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EXECUTIVE SUMMARY

The purpose of this design kit is to help the design of pervasive live-action role-playing games, both for professional larp organizers and larper communities. After the introduction, it has two main sections: Chapter 2 discusses various pervasive larp design philosophies while Chapter 3 provides design strategies to actualize those philosophies. Thus, the report should provide design advice, both addressing the potential uses and pleasures of pervasive larps and discussing how to reach those goals.

Appendix A collects together our understanding regarding positioning technology. This section is not only valid to pervasive larps, but pervasive games in general. It covers absolute positioning, proximity recognition and wireless connectivity.

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Abstract (for dissemination)	This report describes design principles for various forms of pervasive larps.
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1 INTRODUCTION

The purpose of this document is to support design of pervasive larps. First, we will discuss “pervasive larp” as a form of gaming; how it is positioned as a subgenre of role-playing and pervasive gaming. Second, we will discuss different philosophies of pervasive role-play, looking at desired game experiences and cultural conventions of different forms of pervasive role-play. Third, we present a list of strategies that have been used to realize such games. Essentially, we should first provide a reader with an idea of what pervasive larp is, then we should provide her with understanding of the different variations of the style, and third we should provide her with tools to realize these forms.

This document is a part of the work on pervasive game design done in the Integrated Project on Pervasive Games. Thus, there will be several references to other public project reports, which are all available for download in www.pervasive-gaming.net. This is a practical summary document condensing the pervasive larp design lessons of the project.

This report is largely based on IPerG games such as *Prosopopeia*, *Momentum* and *Epidemic Menace*. However, we also have a considerable background in regular larp, table-top role-playing and online role-played (as played in the Nordic countries during the past two decades). Some of the strategies have earlier been published in Montola 2007.

There are many larps that have been played during the past decade in Nordic countries that have influenced this report. As these larps are generally badly documented and nowadays mostly exist in oral tradition, we do not provide exact references to them.

We used the following pervasive larps as background information: *Det længste dag* (Denmark 2005), *Helsingin Camarilla* (Finland 1995-2004), *Helsinki FTZ* (Finland 1997), *Isle of Saints* (Finland 2001), *Prosopopeia Bardo 1: Där vi föll* (Sweden 2005), *Prosopopeia Bardo 2: Momentum* (Sweden 2006), *Rikos kannattaa* (Finland 2006) *Sanningen om Marika* (Sweden 2007), *The White Road* (Denmark 2007) and *Tre grader av uskyld* (Denmark 2006).

Many non-pervasive larps also provided insight to this report. They include *Amerika* (Norway 2000), *Carolus Rex* (Sweden 1999), *En stilla middag* (Sweden 2007), *Europa* (Norway 2001), *Hamlet* (Sweden 2002), *Mellan himmel och hav* (Sweden 2003), *Panopticon* (Norway 2003), *Pelageya: Clarissie* (Finland 2005), *Pitkä perjantai* (Finland 1997), *Ringblomman* (Sweden 2004), *System Danmarc* (Denmark 2005) and *The Executive Game*–series (Finland 2001-2003).

The both above lists are very incomplete, as they represent a small fraction of the larger Nordic larp culture that in general serves as a background for this report.

1.1 Pervasive Games

Pervasive games are games that break the regular boundaries of games. While regular games are played at a set place and time by certain volunteer participants, pervasive games are different: These games are played out in the open, or they invade players’ everyday lives, or they can involve outsiders and bystanders in play. In our earlier work (Montola, Waern & Nieuwdorp 2006) we have defined a pervasive game as a “game

that has one or more salient features that expand the contractual magic circle of play socially, spatially or temporally”.

This blurring of the traditional boundaries of games usually leads to the point where players are unaware where the game ends and ordinary life begins; they often are unsure whether certain object, place or person is related to the game. This is often a source of pleasurable gameplay, but also occasionally a cause of significant problems in the game.

For a reader unaware of our views on pervasive games in general, we recommend having a look at our work discussing pervasive games in general (Montola 2005, Montola, Waern & Nieuwdorp 2006), ethics of pervasive games (Montola, Waern, Kuittinen & Stenros 2006) and pervasive games in a larger cultural context (Stenros, Montola & Mäyrä 2007).

We have earlier discussed pervasive game design generally (Montola & al. 2006), and there also exist similar design kits for Cross-Media Games (Lindt & al 2007) and Massively Mobile Multiplayer Games (forthcoming in 2008).

1.2 Larps and Role-Playing Games

Role-playing is a form of social gaming, where players perform characters separate from their own personas. In tabletop role-playing games players perform these characters in a verbally expressed (yet imaginary) game world, while in a live action role-playing game (larp) the players act out their characters physically. In tabletop role-playing a word “sword” might represent a *diegetic*¹ sword, while in larp a physical object is needed to represent a diegetic steel sword. (Loponen & Montola 2004.)

While this is by no means a definition of role-playing, it should suffice for the purposes of this report. For purposes of discussing design of pervasive larps, we have the following assumptions regarding the nature of larps:

- Larps are games, at least in the broad sense. Usually you can not explicitly win a role-playing game, but they are a structured form of play like games are.
- Larps are social multi-player games.
- Players have diegetic personas, “characters”, that are separate and different from their ordinary personas.
- Element of make-believe is central for the players. While some players look for physical, even visceral experiences, imagination always plays an important part.
- Role-playing is an expressive form that can be used for entertainment, education, simulation and artistic expression.

There has also been an extensive discussion on *definition*² of role-playing, role-playing games and larps, but for purposes of this document, a summary understanding suffices.

¹ We call something that exists within the game world *diegetic*. A *diegesis* is one player’s understanding of what exists in the game world (see Loponen & Montola 2004).

² See Fatland & Wingård 1999, Mackay 2001, Hakkarainen & Stenros 2002, Juul 2003, Montola 2007a and Montola 2007b for starters.

1.3 Pervasive Larp

Simply put, pervasive larp is a larp played in a pervasive fashion. The majority of standard larps are played either within strictly confined areas (contemporary and futuristic larps) or in the wilderness (fantasy and military larps). Pervasive larps are played on the streets, they invade players' everyday lives or involve outsiders.

Even though this design kit is intended to support the design of pervasive larps, many sections also support closed larps as well. Since not all pervasive larps seek to exploit the pervasivity to the fullest, many design philosophies are common to pervasive and closed larps. Both pervasive and closed larps have their significant advantages and disadvantages in conveying various experiences.

1.4 Legal and Ethical Issues

Both players and designers of pervasive larps should be aware of the legal and ethical issues touching upon their games. However, this design kit does not cover ethical issues in any way, as we have published a separate report on ethics of pervasive gaming (Montola, Waern, Kuittinen & Stenros 2006), which is freely available in the Internet.

We highly advise generous use of common sense in organizing pervasive games. Placing bomb-looking objects or drawing replica weapons in public places is asking for trouble. It should be pointed out that cultural norms and laws vary from county to country as well as change over time. What is acceptable in Sweden might not be acceptable in USA and vice versa. As we write this, the "war on terror" has been going on for six years, and in many places the cultural environment is still extremely hostile towards anything that seems to be out of place or extraordinary.

This document should not be used for legal advice. The authors are not legal experts.

This document is also not a safety manual. Some of the strategies (e.g. urban exploration, indexical propping, doing things for real) may be physically dangerous if used carelessly.

2 PERVERSIVE LARP DESIGN PHILOSOPHIES

Larps can be designed in order to meet a number of goals and purposes. In order to inform design in this report, we first need to create a rudimentary classification of larp design philosophies: These philosophies are holistic approaches to larp organization, considering both the form and function of the game. While the vast majority of larps are created for recreation and entertainment, other uses include education, simulation and artistic expression. These functions can be analyzed further: Recreational larp, for instance, can produce pleasurable play through social play, physical exercise, mental challenges et cetera.

Most of the following larp design philosophies can be applied both on pervasive larps and regular larps. Going pervasive is one way of getting the most out of the game in some cases, but closed larps also have their advantages. For example, the so-called 360° illusion larps (Koljonen 2007) have worked very well in creation of visceral experiences. Then again, some philosophies like hiding in cityscape are very particular to pervasive larp. Also, some of these philosophies can be combined, other are in opposition.

With all philosophies, we also list the design strategies that support and conflict with the philosophy. Such lists can never provide the full truth about the relations of different strategies and philosophies, but should rather be understood as a guide for a reader. While this deliverable can be read either from start to finish in its entirety, we have tried to write it in a fashion where you can also easily browse it, skipping from philosophies to strategies and back again.

2.1 City as Backdrop

Games do not need to have an active attitude towards the city. The city can just be something in the background, not something to avoid, to impress or to change perception of. Games that are not written for the streets, but at some point spill there, usually belong in this category, as do games where the designer simply treats the city as a setting, a backdrop.

City as backdrop is more like a lack of philosophy than a full-blown design attitude. These games are pervasive by accident, not by designer intent. Often the players choose an attitude towards the city from the other philosophies – one that suits their character.

Most of the city games that were played in the Nordic countries in the 1990's belong in this category as the urban environment was considered qualitatively similar to wilderness: The games just happened to take place outside.

Supported By: Coordinated Social Networks, Scene-to-Scene Play, Ludic Markers, Indexical Propping, Sensory Pleasure, Runtime Game Mastering, Ensemble Construction.

Conflicts With: Double Life Roletaking, Reality as a Sourcebook, Social Playground, Play as If It Was Real, Performative Play, Outsiders as Obstacles.

2.2 Hiding in Cityscape

Most pervasive larps aim to hide in cityscape. These games prioritize the way of playing that does not interfere with outside world. Preferably, these games should not cause public disturbance, involve outsiders or reveal that the participants engage in ludic activity in public places.

The definite advantage of this design philosophy is that it allows the excitement of larp in public places, while keeping the social weight of gameplay low. Many people may consider public pretence play embarrassing, or find transgressive public play immoral. Thus, larps that hide in cityspace are also the most casual form of pervasive larp.

Typically the larps hiding in cityspace utilize settings where hiding is an intrinsic part of the play. Wizards of Harry Potter refrain from magic in presence of muggles, vampires of *World of Darkness* hide from mortals, spies and agents hide from everyday people. Thus, bystanders are often an obstructing mechanism: In *Killer* assassination games the referees typically punish killers for having witnesses observe the murders and for causing collateral damage.

Supported By: Coordinated Social Networks, Scene-to-Scene Play, Double Life Roletaking, Ludic Markers, Indexical Propping, Runtime Game Mastering, Unfamiliar Surroundings, Urban Exploration, Play as If It Was Real, Outsiders as Obstacles, Ensemble Construction.

Conflicts With: Social Playground, Pronoia and Exploration, Performative Play.

2.3 Altering Perception

Games can be used to show the environment of the players in a new way. The players become tourists in their own town as they start perceiving the world in a different way. They visit places they would never go to on their own, they are encouraged to have a different type of agency and empowerment in the cityscape and they are trained to look for opening, entrances and exits.

These types of games often draw from urban exploration and other public space movements, but they can also be used to re-enact and teach history. This philosophy is in a way a special case of societal dialogue, but as space and especially city space is such a big part of pervasive larps, it is listed as a separate entity. Also, a game that follows this philosophy need not be political or artistic – it can also aim to teach, to introduce or to simply entertain.

Games that have used this philosophy have included the *Prosopopeia* series (looking behind the scenes of a city) and *The White Road* (hitch-hiking and roads).

Supported By: Chained Tasks, Coordinated Social Networks, Extremely Long Duration, Onion Model of Participation, Indexical Propping, Sensory Pleasure, Reality as a Sourcebook, Runtime Game Mastering, Social Playground, Pronoia and Exploration, Unfamiliar Surroundings, Urban Exploration, Emergent Play, Ensemble Construction.

Conflicts With: Scene-to-Scene Play, Ludic Markers.

2.4 Doing Things For Real

Doing things for real is entertaining, fun and insightful. Many larps look for visceral experiences as their central source of pleasure. In a traditional fantasy larp physical experience is created by simulated combat and playing outdoors in wilderness. *Hamlet* served players with extravagant banquets; *Carolus Rex* was played in a real submarine to create a holistic 360° illusion of *being there*.

Whether it means urban exploration, talking with a homeless person or conducting realistic crime scene investigation, doing things for real creates a pleasurable sense of physical immersion.

Supported By: Chained Tasks, Coordinated Social Networks, Scene-to-Scene Play, Indexical Propping, Sensory Pleasure, Reality as a Sourcebook, Runtime Game Mastering, Social Playground, Pronoia and Exploration, Unfamiliar Surroundings, Urban Exploration, Play as If It Was Real, Ensemble Construction.

Conflicts With: Performative Play.

2.5 Merging Game with Life

Seamlessly merging larp and life, intertwining the players' ordinary lives with content created for the game combining these two into an interesting experience. While it first would appear that merging is only relevant for larp, tabletop role-players have produced similar experiences as well: Players might play a tabletop role-playing game, appearing "as themselves" in the diegetic world, for instance. In pervasive larps this has mostly been explored in the *Prosopopeia* series,

Merging game and life is a hardcore effort. Even though merging larps can try to hide from bystanders to some extent, the players are toying with their real lives when playing the game. If the concept of the game is "play yourselves but you are all highlanders, like in the movie *Highlander*", you may have to prepare to fight a deadly duel at any time. If another highlander attacks you in broad daylight, the hiding phase of the game is over.

In a game that merges game and life, it is central that all the constructed parts of the environment seem perfectly natural. If the scenography, supporting characters and props are not authentic, the players can see the seam between ordinary and ludic. Executing this kind of a game can be a great challenge – and subscribing to this philosophy has a constraining effect on the game fiction.

Supported By: Coordinated Social Networks, Extremely Long Duration, Double Life Roletaking, Onion Model of Participation, Indexical Propping, Sensory Pleasure, Reality as a Sourcebook, Runtime Game Mastering, Social Playground, Pronoia and Exploration, Emergent Play, Play as If It Was Real, Ensemble Construction.

Conflicts With: Scene-to-Scene Play, Ludic Markers, Unfamiliar Surroundings, Performative Play.

2.6 Societal Dialogue

Some pervasive larps seek to engage in active dialogue with their environment. The purpose of such dialogue can be politically or artistically motivated. These games have a message that is aimed either to the players, to the society or to the both.

Pervasive larp is an excellent medium for societal dialogue. It is a very involving and participatory form that allows players to experience the message of the game.

Recently, the politically aware larps have discussed issues such as societal inequality (*System Danmarc, Europa*), gender issues (*Mellan himmel och hav, Ringblomman*), recent history (*Ground Zero, 1942 – Noen å stole på*) and societal control (*PanoptiCorp, .laitos, Momentum*).

Supported By: Extremely Long Duration, Reality as a Sourcebook, Runtime Game Mastering, Social Playground, Unfamiliar Surroundings, Emergent Play, Performative Play, Ensemble Construction

Conflicts With: Outsiders as Obstacles

3 STRATEGIES SUPPORTING THE DESIGN PHILOSOPHIES

A variety of techniques and strategies can be used to produce pervasive larps according to different philosophies. In this chapter, we outline a portfolio of such strategies, focusing especially on innovations and research results of IPerG prototype games.³

The strategies have been divided into four groups: *structure*, *attitude*, *ludic environment* and *ordinary environment*. The aim is not to create a list where a designer should choose one strategy from each group – on the contrary. Many of the strategies can be combined together. Instead the strategies have been grouped in hopes that certain collections, when presented together, communicate more than they would individually.

3.1 Structure

First, we'll look into the strategies addressing structural issues of pervasive larps. There are many ways to serve the content of the game to the players. The game can be designed so that the player characters are strong individuals who either work through their plots alone – or communicate through a network. But just as well a game can be created in a way that plots are given to groups instead of individuals, or the plot can address all players. Often games combine these structures.

These strategies discuss how players are divided into groups, how they work through the plot and how the game is paced.

3.1.1 Chained Tasks

If the game includes tasks or puzzles with a possibility of failure, it is important to communicate the realness of the puzzle and failure in a tangible fashion. The players wanting a real experience have to be forced to solve their problems for real.

An example from *Momentum* illustrates a mechanism providing tangibility to tasks: The players were provided with mathematical data that could be used to triangulate coordinates of a hidden stash of game props and documents necessary for the success in the game. The players did their math wrong, ending up in a wrong Stockholm neighbourhood in a rainy October night. Even though the game master characters later on could help the players to solve the problem, there was a twofold price to the failure: The player group lost time due to their error, and the long night wandering in a wrong area made the miscalculation a strong experience of failure.

In chained and coordinated collaborative tasks the whole becomes larger than the sum of its parts. A boring math exercise of decryption and triangulation is given relevance and context, as failure leads to searching for an envelope in a wrong area. Similarly, the task of searching for an envelope is given relevance as the triangulation allows them to feel that they found the important item in a Stockholm-sized haystack instead of the neighbourhood-sized one.

There are two important considerations to chained tasks. First, a failure in one part of the chain should not entirely stop the game. Also, if the players realize that the game

³ What we call “design strategies” owes more than a little to Staffan Björk’s and Jussi Holopainen’s (2005) work on game design patterns.

will not fall apart if they fail, they will lose faith in making a difference themselves. Second, the way tasks are completed should directly influence the way other tasks are completed: The triangulation task would not have been a chained task if it had been followed by a completely unrelated decryption task. The interrelated and interdependent subtasks contribute to the feeling of tangibility.

Supports: Doing Things For Real, Altering Perception

3.1.2 Coordinated Social Networks

It seems that the pervasive role-players greatly enjoy the feeling of being a inside of a large network of players. As an individual player has a very limited view of the game, it is quite easy to create an illusion where the players imagine that a huge number of people around them are playing. Coordinating social networks in the game is a powerful tool for this: When the petty criminal players realize that both their victims and the policemen are played by other players, their illusion gets deeper. But when they realize that there is also a game-related wedding party going on, with nothing to do with their crimes, their world gets much deeper and all-encompassing: Suddently the players understand that they do not know how large the game is.

Talvitie (2007) discusses methods of constructing social networks in such games. The background philosophy of his approach is based mainly on information flow: If some characters throw a party while others play vampires in the party, the asymmetric information makes dangers and opportunities of vampirism very tangible. Killing a character with actual (role-played) history and existing friends is a deeper experience than preying on a non-player character created for the purpose.

In his design instructions, Talvitie identifies example structures of how to create interaction of player groups within the game in order to create interesting inter-group dynamics through controlling the flow of information and social dynamics. The essential part is designing the ways how players *perceive* the game and environment around them.

In *Prosopopeia* games the players were basically in one a big group, and the illusion of environment was created though game master characters, informed outsiders and characters played through emails and chats. However, *Momentum* split up the group, by assigning four simultaneous tasks to the 30 players. Each task had to be accomplished successfully and in a temporal sequence in order for the whole group to achieve their goal.

The beauty of this example is in the way actual and illusionary was combined. Splitting the players up gave them a tangible impression that the game took place in many places simultaneously, and success of their groups really made a difference. But the players also interacted with many game master characters in the internet, which were illusionary, but the illusion was reinforced through the actual. It was easy to hide the fact that the various non-player characters using different internet messaging systems were played by one person on one computer.

Supports: Doing Things For Real, Merging Game with Life, City as Backdrop, Hiding in Cityscape, Altering Percpetion

3.1.3 Scene-to-Scene Play

Pervasive larps, or larps in general, do not have to be continuous. Though not common, there have been a number of games where the action is broken into scenes or each gaming day takes place a month after the previous. Such temporal pacing, when stretched to scenes, brings larp closer to theatre. Yet what is lost with shorter scenes, can be more than made up with more intensity. The scenes can be design to have little or no empty time, with a continuous emotional and physical engagement.

There are two ways in creating scene-to-scene play; continuous and interrupted. In continuous mode the game is played from start to finish, and players stay in character between scenes as they travel from one place to another. Most pervasive larps that take advantage of the city actually use this mode – the game is in the background when active play is not taking place. Examples of this kind of playing include *Pimeyden maailma*, *Rikos kannattaa* and *Ghost Express*.

In interrupted mode the playing stops between scenes and the players are not in character as they move from setting to setting. This is much rarer. Games that borrow elements from freeform role-play can use these methods; one such game was *En Silla Middag*.

The important aspect of scene-to-scene play is that the players much be willing to adhere to the plot. These games are heavily railroaded and if the players do not play along, the game collapses.

Supports: Hiding in Cityscape, City as Backdrop, Doing Things For Real

Conflicts With: Merging Game with Life, Altering Perception

3.1.4 Extremely Long Duration

Typically, shortest larps run for one evening while long games need a weekend or even a week to play out. With pervasive games, there has been experimentation with very long larps, games than run for more than a week – and possibly indefinitely. Running a game for a very long time imposes several considerations on the game design. Yet temporally expanded role-playing is appealing, as it can create a strong illusion of immersion and produce good play experiences.

The most significant issue with extremely long durations is that players need to be able to fit together the game and their ordinary life. The players need to be able to interrupt the game, to somehow easily navigate between the game and the ordinary. Depending on the double life strategy chosen, outsiders and family members may become a central part of the game.

Other difficulty of this strategy is the huge effort required. The game masters need to produce loads of content for the players to consume, and prepare to be actively involved in game mastering for long periods. The players also need to invest a lot of effort, time and money to participate the game: Something not many people want to do, unless the experience is truly excellent. Creating enough game content for the whole duration of the game is hard – especially as it shouldn't be too repetitive. If the players feel that they could have received the same game experience in a shorter time their motivation to play will decrease. Player investment in general is a challenge – the game needs to be interesting enough for the players to sacrifice such a large part of their life to it. Finally, the game masters – if they are running the game in real time – need to be on call almost

around the clock. The workforce required to do that, not to mention the information system that ensures that whoever is on duty knows all the plot threads, requires a lot of dedication.

In practice long duration larps should be segmented into high and low intensity periods, in order to reduce stress they impose in both players and game masters. If participants knows that weekends are the most active times and that nothing much happens on Wednesdays, they can plan their time use – both in order to avoid stress and in order to be present when the game is most intense.

Supports: Societal Dialogue, Merging Game with Life, Altering Perception

3.1.5 Double Life Roletaking

When playing an extremely long game or merging life with game, the game needs to address the issue of two conflicting worlds: The game world is in conflict with the real world, and this conflict needs to be mitigated both to sustain the enjoyable game and to not disturb the ordinary life excessively.

Double life roletaking is one solution: In the games utilizing this strategy the players role-play the diegetic duplicates of themselves that are altered in some way. For instance, a spy game could start by an email where a diegetic intelligence agency recruits the player as an agent, thus commencing the differentiation of the diegetic and the ordinary personas.

Prosopopeia-series used a Possession Model to create double lives (see Stenros, Montola & Waern 2007). In that game, the diegetic duplicates were possessed by ghosts of the long-dead people. This allowed the game to hide while still merging game with life: When a player went to work, she could just suppress the spirit for the time being. When the player focused on playing, the possessing spirit gave her goals, motivations and character to be role-played. Players could address situations and challenges in game both in through the possessor and possessed: In the benevolent possession one persona never entirely suppressed the other.

Many pervasive larps are played with vampire characters, as inspired by White Wolf's *World of Darkness*. Contrary to the first impression, these characters are always based on a very different philosophy: If your diegetic duplicate is turned into a vampire, the change restricts your everyday life so much that the benefits of the double lives are lost: Especially a lethal allergy to sunlight makes hiding in plain sight very difficult.

Supports: Hiding in Cityscape, Merging Life with Game

Conflicts With: City as Backdrop

3.1.6 Onion Model of Participation

Larp is a demanding form of play and expression, and it may be a problem to involve new players in larp. Onion model of participation is one solution for the problem: In this structure the pervasive larp is surrounded by games and mass media allowing different play modes.

For instance the outer layer of *Sanningen om Marika* was a television series shown nationally in Sweden. A small fraction of watchers also participated an alternate reality game played in the Internet. A small fraction of alternate reality gamers also participated in the larplike live events.

This allows the organizer to easily reduce the number of larp participants even when aiming the game at a broad audience. It also allows the prospective participants to choose whether they want to enter the larped part of the game.

Supports: Hiding in Cityscape, Societal Dialogue, Altering Perception

3.2 Ludic Environment

Strategies relating to ludic environment explicate different design approaches to the diegetic game world. How is this world built? What is the driving idea behind it? How is it separated from the ordinary world, or is the line invisible? How to ensure that the game world stays coherent? Or does that matter? As these games take place in the ordinary world, the game world bubbles built inside require constant work and maintenance.

3.2.1 Ludic Markers

One of the central decisions of pervasive larp organizing is whether to use ludic markers or not. Ludic markers are symbols that explicitly denote that some object, person or place is a part of the game. For instance, *Rikos kannattaa* required all players to constantly show a badge, making sure that players would always know who the players were and who the outsiders were.

Symbols can be also used to designate certain areas as particular gaming zones: While players of a typical street larp can venture to any restaurant to have a lunch, they should be considerate of other people in public and semi-public places. Usually the players would not even want to play in an overtly extrovert manner in a space where that is frowned upon; it can be personally embarrassing for the player and most players (even if not all characters) want to be considerate. Thus symbols are often used to designate secluded or more permissive areas as game zones, spaces where characters can more liberally act out scenes that would attract attention in other public places. Often these areas are secluded, but in large cities there are also squares, parks or market places where attitudes are more permissive. These are the areas where there are street artists, beggars, people giving flyers and religious fanatics. Adding a few pervasive players into the mix will not surprise or shock anyone.

Carefully placed symbols can also serve as game clues. If players are supposed to break down a door or open up a computer to succeed in the game, ludic markers can be used to guide them to correct direction. Perhaps the game can use a rule saying that anything with a ludic marker can be broken down, while non-marked objects should not be touched.

It is usually advisable to design the markers to fit the game. *Prosopopeia* series used the stickers of a fictitious guard company as ludic markers. As players knew that Kerberos Bevakning did not really exist, they could tell that anything with a sticker was a part of the game.

The main danger of ludic markers is careless use. Game masters should be extremely careful to remove unnecessary markers and to not put them into inappropriate places. If players falsely “know” that a place or a person belongs to the game, they are likely to take liberties in their behaviour: For example, if players think that game masters expect

them to break down a door, they probably will do so. And ludic markers are a strong way of pointing to such directions, correctly and incorrectly.

Supports: Hiding in Cityscape, City as Backdrop

Conflicts With: Merging Game with Life, Altering Perception.

3.2.2 Indexical Propping

Props can be categorized into symbolic, iconic and indexical categories, depending on how an object in the real world refers to an object in the diegesis. A symbolic prop represents something through a convention, like when a game rule states that a paper slip with the word “gun” represents a diegetic gun. An iconic prop represents something through similarity, like if a pair of Finnish army boots represents a pair of German army boots. Indexical prop is the third class, where the prop represents *itself* directly in the diegesis. A plastic gun represents a plastic gun.

If indexicality goes far enough in both props and scenography, this creates a feeling where everything feels like a prop and thus nothing feels like a prop. A great upside of the method is that it allows the players to solve puzzles in a real and tangible way. Players can freely toy with anything they encounter: In *Prosopopeia* the players used a reel-to-reel recorder with only earphones attached. Due to the strong indexicality of the game, they could have acquired, and were even expected to acquire, loudspeakers in order to make the using of the device easier.

In games that merge life and game indexicality can go even further. Even though in a regular urban larp a jacket may signify a perfectly identical jacket, in *Prosopopeia* the jacket signified the exact same jacket owned by the exact same person: The indexicality included the social and historical context of the “prop”.

Supports: Doing Things for Real, Merging Game with Life, Hiding in Cityscape, City as Backdrop, Altering Perception.

3.2.3 Sensory Pleasure

Computer and console games have long strived to produce maximal audiovisual enjoyment for players. Pervasive games should not forget this strategy – actually, a pervasive larp can expand it to all five senses. Sensory enjoyment comes in many shapes and sizes, ranging from a good dinner to a moonlit lake and beyond. Creating sensory pleasures requires considerable effort and resources, but it enhances the experience considerably.

One way to achieve this is by creating an overall aesthetic for the game. This would mean that locations would be chosen with the aesthetic in mind and props, scenographed locations and character costumes would be designed so that they all reflect the vision. The game website and other material should introduce the theme to the players. It should be remembered that emphasizing a genre might conflict with a realistic playing style; if everything looks and feels like 1980’s cyberpunk, then the players are prone to act as the stereotypical cyberpunk fiction stipulates.

Depending on the design philosophy, unpleasant experiences can also be utilized. Finding a game artefact from an actual junkyard or walking through the town in a rainstorm are also enjoyable, if physically unpleasant experiences.

Sensory pleasure is a good choice especially to commercial larp makers creating events for non-hobbyists. An inviting aesthetic or promises of a cinematic experience can soften the possibly stressful experience, and lure hesitant, inexperienced players into play.

Supports: Doing Things For Real, Merging Game with Life, Altering Perception, City as Backdrop.

3.2.4 Reality as a Sourcebook

Pervasive games can use their environment as an endless source of game content. A clever design allows players to use reality as the all-encompassing sourcebook for the game world, thus requiring the players to spend time in the internet, libraries or other sources.

A simple form of reality as a sourcebook takes place with puzzle games. Perhaps the characters need to learn Morse code or read up on local history to solve problems. If the game story is interwoven with real people or history, success may require real-world knowledge.

One way of using reality as a sourcebook is by making an explicit change into what is true in the diegetic world. For instance, in the world of *Momentum*, Enochian occultism was real. Thus, game masters had to read up on the subject and include pointers to that material in the game. During the game, the players could explore an endless amount of weird books and internet sites for game information.

Reality as a sourcebook can powerfully support various forms of fabrication. *Momentum* organizers cloned an entire website, in order to be able to add character names and game information into the material. Using both fabricated websites and the unedited reality to create diegetical background can really make players unable to find the borders of diegetic and ordinary reality.

Supports: Merging Game with Life, Doing Things for Real, Altering Perception, Societal Dialogue.

Conflicts With: City as Backdrop.

3.2.5 Runtime Game Mastering

Runtime game mastering is the process of influencing the flow of a game in real time.⁴ In order to successfully game master a larp, three things are needed:

- Sensory system, to acquire information about the state of the game
- Actuation system, to change the state of the game
- Decision-making system, to use information to determine preferred changes
- Communication system, to connect the other three systems

In a classic tabletop role-playing game, all three functions are embodied in the game master. This can also be done in a very simple way by a game master who participates

⁴ Runtime game mastering is also known as puppetmastering in the alternate reality game culture.

in the larp as one of the characters, even though such techniques are often resented by players.

In complicated pervasive larps, technology is needed at least for communication. In *Isle of Saints* the players were expected to independently report their activities (extradiegetically) to game masters with cellular phones, both revealing their plans and describing the past events.

Surveillance technology can be somewhat useful for game mastering. Hidden microphones can provide accurate information on the game, if players happen to have their most important discussions within the hearing distance. Video feeds are less useful, as they can mainly reveal which players are in a certain location or when a player arrives or departs. Surveillance, be it video or audio, also always requires a human game master to view it and interpret it. Finally, a big limitation for all surveillance technology is that it can only be mounted in places that are only visited by (consenting) players.

As self-reporting can distract the game experience, *Momentum*⁵ selected four players as undercover *controllers* that both spied for game masters and actuated changes by secretly guiding the players. It is very difficult to understand a larp situation through sensory equipment, but an on-site person can analyze it much better. The controllers were also a feedback system telling how players liked different game elements during the game that could be used in further runtime game mastering.

Internet characters are an immensely valuable way of both sensing and actuation. *Momentum* game masters could have several simultaneous discussions with players via instant messaging, chats and emails, without the players ever realizing that all the communications came from the game master room. Some characters helped players while others tried to coax information out of them.

Supports: Hiding in Cityscape, Societal Dialogue, Doing Things For Real, Merging Game With Life, Altering Perception, City as Backdrop.

3.3 Ordinary Environment

Pervasive larps, though always use public space, have different attitudes towards the common ground. The ordinary environment that envelopes the play can be approached in many ways, as a background, a playground, a feedback machine, an obstacle.

3.3.1 Social Playground

Larps that treat their environment as a social playground take a very active stance towards bystanders. These games require players to talk with outsiders, intentionally creating a conflict between the diegetic worldview of the player with the ordinary worldview of the outsiders. If the character is a detective, she might ask people near a murder site whether they saw something strange an hour ago, if the character is an animal-rights activist, she might engage in a provocative discussion with a bystander in a fur coat.

⁵ Jonsson & al 2007b provide a full description of *Momentum* game mastering.

Creating an impression that it is necessary for the success in the game fosters this kind of play. If the game masters have the habit of planting fake outsiders (non-player characters with no ludic markers) near crime scenes, the detective has no option but to talk with all the bystanders just in order to find whether one of them was a plant. Even better, the game masters can plant the information on real outsiders, by actually acting out the ‘crime’ in advance.

Acting like a vampire or a madman in an urban environment serves as an excuse for social experimentation and breaking of conventions. While stressful, social play with outsiders can reward the player with feelings of fun and insight about the social conventions. Jane McGonigal (2006) states that if people are given specific instructions to act in a certain way in public environment, they will surprise themselves with their own daring and ingenuity, and also find that the environment is surprisingly receptive to these advances.

In other words, socially expanded role-playing provides *empowerment* to act against social constraints. While an ordinary person is bound to follow cultural conventions, a directly instructed player or carefully designed role-playing character can differ from them. After the game the player is left with *insight* on the strength of such conventions and how they operate.

Social playground approach is especially valuable tool for a designer wishing to use game as a political or artistic tool: For example, Augusto Boal’s (2002) group did *invisible theatre*⁶ with the theme of sexual harassment by having actors harass each other in public, trying to find out if the outsiders would intervene. When they did, other actors joined in, provoking further discussions.

Supports: Merging Game with Life, Societal Dialogue, Doing Things For Real, Altering Perception.

Conflicts With: Hiding in Cityscape, City as Backdrop.

3.3.2 Pronoia and Exploration

Games where the player can never be certain who is part of the game and who is not, and where the game actively engages the player where ever she goes, create a sense of positive paranoia, pronoia (McGonigal 2006). It is the feeling that the universe is plotting behind your back to make life/game better for you.

When players learn to understand that their game is situated in the social, historical and physical context of a real, living urban environment, they seem to love exploring both content and context to the fullest, curiously looking beyond boundaries to find how far they can push and still find recognizable parts of the game. The fun of exploration lies in the feeling that the entire world is part of the play and wherever the player goes, more content turns up.

The totality of the surrounding world needs to be demonstrated in order to create a good illusion. As Koljonen (2007) point out, a plausible universe should deliver surprises: “To make the player accept the border of the game as something else than the border of the fiction, it is the duty of the truly illusionist game master to demonstrate that

⁶ Invisible theatre is drama staged in public space, without denoting it as a performance. In a sense it is “socially expanded theatre”.

characters, plots and information could, and sometimes will, cross them". As the players learn to look and even expect this, pronoia emerges.

Supports: Merging Game with Life, Doing Things for Real, Altering Perception.

Conflicts With: Hiding in Cityscape.

3.3.3 Unfamiliar Surroundings

People have clear ideas as to what is the correct kind of behaviour in a certain public space. Breaking these societal norms can be difficult for some players. If the game design is supposed to support these kinds of departures from norms, then it helps if the players are in unfamiliar surrounds (with people they trust, see *ensemble building*). A player is more prone to act in a weird way in a city that she is not familiar with – and more importantly where the bystanders are not familiar with her. Large cities provide certain anonymity, and that anonymity awards a wider range of agency.

It is also possible to use the unfamiliar surroundings as a starting point; to stage a game first in a strange setting, creating the conventions and style of play there, and then move the game to an area that players are more familiar with. Thus players would be disposed to routines that they would never have established in the familiar settings.

Supports: Hiding in Cityscape, Societal Dialogue, Doing Things For Real, Altering Perception.

Conflicts With: Merging Game with Life.

3.3.4 Urban Exploration

Urban exploration as a term covers all the activities where the participant examines the normally unseen parts of human civilization. Usually this activity takes the form of infiltrating abandoned structures, off-limits areas, catacombs, sewers and other tunnel systems. The rule, usually, is to "*take nothing but pictures, leave nothing but footprints*" (Ninjalicious 2005).

Urban exploration and pervasive larp can easily be combined. The thrill of going to places that usually are unseen translates to the game. The problem is that going to many of these places is either illegal, dangerous, or both. If such activities are encouraged, the players need to know what they are signing for – and they need to be properly equipped. Urban explorer should always have a flashlight, clothes that can get dirty and gloves. A compass may come in handy in tunnels.

Urban exploration can be hazardous: Explorers may get minor bruises in almost all interesting environments. The major hazards include risk of falling from high places or getting exposed to hazardous chemicals in sewers. Consulting experts, safety guides and local authorities is highly advised.

Supports: Hiding in Cityscape, Doing Things For Real, Altering Perception.

3.3.5 Emergent Play

No-one can anticipate what will transpire during a pervasive larp. Emergent play happens when players take the game to unexpected and unplanned directions. In tabletop role-playing games and non-pervasive larps this happen as players/characters

have an unforeseen idea and attempt to carry it out. In pervasive games the environment and especially non-player participants drive emergence.

From the game master perspective, emergence is a free and inexhaustible source of game content, but it also needs to be designed for. The game designer can try to either curb or encourage the emergence by either driving the players to think and act outside the box (in *The White Road* the players were encouraged to hitch-hike with non-players), or by trying to contain the game as much as possible (in *Rikos kannattaa* the players were forbidden from disrupting non-players and thus had limited interaction with them).

Especially social play with non-players seems to have considerable authenticity and realness to it, and many players have considered it highly pleasurable and thrilling (e.g. Montola & Jonsson 2006, McGonigal 2003).

Supports: Societal Dialogue, Merging Game with Life, Altering Perception.

3.4 Play Attitude

The player can adopt a number of different attitudes towards herself and the unaware participant. The choice of approach has a major influence on the game. For example, is the outsider an obstacle or a spectator?

3.4.1 Play as If It Was Real

This strategy is both an instruction to players and a serious consideration for game masters. When a pervasive larp is played in public, play as if it was real is a good guideline for players. The gist of the strategy is that the larp is not a Hollywood action movie but a down-to-earth event: As the players have (probably) never been engaged in a car chase or a shootout, the characters probably would not do so either: Not diegetically, and especially not physically.

Pervasive larps sometimes involve outsiders, and plant game organizers in outsider roles. Thus it is sometimes impossible to determine whether a given bartender or librarian is a part of the game or not. Playing as if it was real solves the conflict of diegetic and ordinary worlds: The player should treat the person as an outsider even if she supposes that he's a part of the game.

This strategy works well together with indexical propping. Its main drawbacks are the heavy constraints to game fiction and the limits it places to performative character play. In art, realism is just another aesthetic choice. In a film noir setting it might make sense to beat up a bartender to get him snitch about someone you consider a spy, but a game that strives for realism that is often out of the question. If the game wants to incorporate elements from genre fiction, surrealism, absurdism or any other unrealistic style, it must be done with care.

Supports: Hiding in Cityscape, Doing Things for Real

Conflicts With: City as Backdrop.

3.4.2 Performative Play

Many pervasive games incorporate performative play, playing *for* an audience, e.g. in a fashion explored by street theatre and invisible theatre. In these games the bystanders

are not unaware players, but spectators. These performative games run the gamut from paideic zombie walks and flash mobs to invisible theatre and the ludic *Pac-Manhattan*.⁷ The strategy is rarely applied to pervasive larp as in role-playing games the focus is usually on playing a character truthfully than in performing the character for an audience. Yet there are times when pervasive larps also adopt a more performative attitude, by having the characters perform instead of the players. In *Momentum* the players conducted elaborate and theatrical rituals as well as a fully fledged demonstration, which bystanders could witness.

Turning the whole game into a performance (or an installation) instead of simply treating a single player as a performer is another way to introduce a performative element. *Amerika* and to a certain extent also *System Danmarc* were games that were also art pieces staged in the streets of the cities, Oslo and Copenhagen. The trick here is to assign a clear role for the spectators so that the players will be able to relate to them. Experiences in simply staging a larp so that the players must ignore the spectators have not been encouraging.

Supports: Societal Dialogue.

Conflicts With: Hiding in Cityscape, Merging Game with Life, Doing Things for Real, City as Backdrop.

3.4.3 Outsiders as Obstacles

Using outsiders as obstacles is one of the most basic strategies in street larp. It suits into fiction featuring agents, supernatural elements, spies et cetera. The basic idea is that characters want to stay in urban areas, but they want to hide themselves. Cold war agents would not start a shootout in broad daylight even if it was important for national security.

There are two ways of using this strategy. The soft one is used in *Killer* assassination games. If a player conducts a murder with outsider presence, she is punished by the referees. For example, the referees form a detective squad that tries to arrest the player, using the basic rules of *Killer*.

The hard way is to create a game rule that absolutely forbids risking any action that would risk being seen by witnesses. If this rule is still broken – accidents do happen – the sanctions can be diegetic or extradiegetic. *Vampire* games usually go here: Revealing ones presence to mortals is punishable by death in game, and unless character has extraordinary motivations, it is often also considered bad playing by other players.

In order to enforce this strategy, game masters need a way of obtaining information of transgressions. Most of the time, game masters can trust larpers to provide information themselves. *Killer* games usually require all encounters to be reported by both initiator and target.

Supports: Hiding in Cityspace.

Conflicts With: Societal Dialogue, City as Backdrop.

⁷ *Paidia* and *ludus* are Roger Caillois' (1958) words for free play and formal play. Zombie walks are close to childrens' free play, while *Pac-Manhattan* is closer to the ludic sports.

3.4.4 Ensemble Construction

Playing in public requires more courage than playing in private. It is also easier to step out of the game when faced with the numerous distraction of a busy street than in an area specifically reserved for playing. When playing in public the only support that a player gets is from the game masters – and the fellow players. Turning the players into an ensemble that trusts each others and actively supports each others' play is a common strategy in encouraging more liberated play.

A common way of doing this is by having workshops prior to starting to play where the players meet each other. In addition to introducing the players to each other and the world and rules of the game, these meeting can take advantage of various trust exercises (as borrowed from theatre, see for example Boal 2002), discussions, shared character building exercises and other such methods. Playing a game always creates a 'secret society' of players (Huizinga 1938), but that doesn't mean that the emergence of such a feeling of camaraderie couldn't be fostered along.

Ensemble construction techniques may conflict slightly with coordinated social network strategies, since trust and familiarity are central building blocks of a good ensemble. Many social network strategies exploit the fact that players have a very limited perspective on the game: Organizing ensemble construction workshops before the game would reveal such secrets to all participants.

Supports: Hiding in Cityscape, Societal Dialogue, Doing Things For Real, Altering Perception, City as Backdrop.

4 CONCLUSION

Pervasive larp is a diverse and powerful form of expression that can be used for various purposes ranging from entertainment to artistic expression and from education to societal exploration. A large repertoire of design patterns has been used in such games, allowing a wide variety of different games to be created. We have here presented several design philosophies of larps that treat their environment in several ways, range from indifferent (City as a Backdrop) and secretive (Hiding in Cityscape) to embracing (Doing Things for Real) and involving (Societal Dialogue). We can even argue that there is a certain philosophical progression in the design philosophies that grows from City as Backdrop and Hiding in Cityscape towards Societal Dialogue: The larp communities wanting to proceed toward the rarer forms of pervasive larps need to both learn new strategies and to unlearn others.

While some of the philosophies and strategies presented above were plucked from professionally created research prototypes (*Prosopopeia* and *Momentum*), we want to also draw the attention to the incredible amount of valuable work that has been done by the larp communities around the world. These cultures produce hundreds of games every year, serving as think tanks and developers for interesting design strategies. Strategies that can be often brought to mass market in formats such as digital games and alternate reality games.

The business opportunities of pure pervasive larps are still narrow, even though their immersive and entertaining potential appears to be considerable. Currently the vast majority of these games are organizers by player communities, but especially the strategies such as the Onion Model of Participation may help wider commercial distribution in the future.

One model of monetization could be adopted from the field of alternate reality games. If we look at the success of *The Beast* (see e.g. McGonigal 2006), often hailed as the genre-spawning original alternate reality game, it is obvious that its designers drew heavily upon the accumulated design knowledge of various treasure hunt, puzzle hunt, scavenger hunt and assassin cultures. The innovation of *The Beast* was to create a format that took all the tricks of the trade but scaled the participation massively upwards. The challenge of monetizing pervasive larp is in understanding which strategies need to be developed and which unlearned in order to create a success format for mainstream audiences.

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APPENDIX A:

INFORMATION TECHNOLOGIES FOR PERSVASIVE LARPS

This appendix provides a brief overview on positioning, proximity recognition and communication technologies useful in staging pervasive larps. While a larp can be staged with no technology at all, especially the game mastered games need to utilize some technologies.

Pervasive games actually rely on a very large set of technologies and media that are not considered information technologies. While pervasive larps and their players use all sorts of technologies in staging the play, this appendix focuses on the use of information technologies, only bringing in other technologies peripherally. This restriction is a bit arbitrary, but stems from the close relationship between pervasive games and pervasive technologies. It is also motivated by the fact that these media support interaction in much richer ways than more traditional technologies. This makes information technologies a great platform for gaming (which is demonstrated well by computer games).

This appendix is intended to be a brief primer, quickly going through the most relevant technologies and their essential strengths and weaknesses. The IPerG website at www.pervasive-gaming.org provides further information and research on many of the following technologies.

Absolute Positioning

GPS The Global Positioning System is the dominant technology for positioning. Being a satellite navigation system, the GPS system works only when the device is under open skies. Under good circumstances, the technology can pinpoint you with the accuracy of a few meters and it can be combined with different types of dead reckoning to provide positioning in areas not under GPS coverage. In addition, GPS is free to use once the user has access to a GPS device (map services, however, are usually subscription-based).

GPS is designed to position people who make an effort to be positioned, and it is not such a good technology for tracing players who e.g. try to hide. Physical obstacles and bad weather can stop GPS from working. Narrow streets and high buildings are especially problematic, but even one small wall can stop it from working if the player is standing right next to it. The further you go from the equator, the harder it is to position efficiently, as the satellites fly closer to the horizon. GPS is a global standard, but the systems are run by United States government, and using GPS means that you become dependent on US foreign policy. Finally, GPS can become a power sink, draining the batteries fairly quickly.

The European Union is building another satellite system, *Galileo*, which is a serious candidate for becoming the definitive positioning system for pervasive gamers. It will be similar to GPS in that it will require special hardware to receive the positions, but it is intended to be more precise than GPS and it will also be regulated by a pan-European policy. Unfortunately the satellites are not up there just yet.

Cell Positioning Cell positioning is a form of global positioning which relies on the fact that the mobile phone operator knows exactly where the base stations for the mobile phone system are located. The phone operator knows always which base station a phone is connected to, and can either relay that information directly or use lower-level information (e.g. about the direction and distance of the phone to the base station) to approximate a more precise position of the phone.

Cell positioning is typically made available as an internet based server-side service. A game server can contact the positioning service and ask about the position of a specific phone (with a phone number). Privacy protection is an issue for such services (as basically, any service could track any phone), so the user/player must set different types of permissions with the phone operator to allow the game service to use positioning.

The quality of the positioning is highly variable dependent both on the position of the player and the technology the operator is using for calculating positions. It can range from just giving the position or name of the base station to which the player is connected, to a very precise position within meters. It is not available from all operators. Service side cell positioning can also be very expensive, and are typically charged for per request. If you want to position a player once per minute, prepare to pay the bill 1440 times every day. The major advantages of (server-side) cell positioning are that when the operator supplies it, it is always available and works indoors as well as outdoors, and that it does not require any special hardware or even software running on the phone.

An interesting fact is that the cell information actually is generated at the phone. A mobile phone always knows it's own cell ID, and some phones are able to display this information. To our knowledge, only the Nokia series 60 phones make this information available for other programs installed on the phone. When accessible, this information is free of charge (which probably is the major reason why it is not accessible on most phones). The problem with using this information 'raw' is that mobile phones can switch base stations rapidly and unpredictably. Depending on the station, the base station radius can be anything from a few dozen meters to several kilometres, and the players will experience random teleportation from time to time. This is especially problematic if the game features a static virtual world that should be overlapping with physical world.

WLAN Positioning Wireless local-area network positioning works in a way that is very similar to cell-based positioning. It relies on knowing where the WLAN base station is located. Again, using triangulation algorithms and the signal strength of the WLAN station, the players position can be calculated quite precisely as long as the WLAN base stations are positioned. There exists both commercial and open source software for WLAN positioning.

WLAN positioning is a clear alternative for games where the game area is well known and not too large. It is possible (though not completely easy) to map out such a game area by putting up WLAN stations and positioning them. The advantage of this approach is that at the same time as the area is being mapped, you are providing WLAN access over the same area.

As a global positioning technique, WLAN positioning is much less reliable. There exists online web services that aim to provide WLAN connectivity as well as WLAN positioning as community service; anyone who sets up a WLAN station is encouraged

to report it to the service to pool resources. The reliability and coverage of such services should not be trusted.

Self-Reported Positioning For many pervasive games, it is a clear alternative to ask mobile players to report their current position through clicking on a map on the device they are carrying. It is also possible to track the position of a player through monitoring how he or she selects to view an online map. Benford et al (REF) have reported on their experiences of using self-reported positioning in Uncle Roy all Around You, where the positioning method proved quite reliable.

Proximity Recognition

In many cases, games don't need to know exactly where a player is. It is sufficient to know that he or she is close to something, is picking up a particular object, or meeting another player. There exist a host of technologies that can be used for this purpose. All of these technologies have limited uses also for global positioning – if the thing the player is close to is globally located.

Infrared Communication Infrared is a communication technology that relies on invisible light signals sent between in line of sight. The requirement on line of sight makes it useful as a proximity technology, and since it also requires a straight line between the communicating sensors it is direction-dependent. Laser games use infrared communication to establish who takes a shoot by whom, a usage that readily transfers to pervasive games. There is no specific communication standard used in infrared systems, but as discussed previously the communication protocols typically employ no system for secure identification.

RFID Radio Frequency Identification is becoming the most widespread technology for proximity detection. There exist several competing standards for RFID, so here we will only describe the major divide into *active* and *passive* RFID.

All RFID technologies consist of a large number of small and fairly cheap *tags* that can be put on objects or hidden in the real world, and a smaller set of electricity-powered *readers* which are larger and more expensive. The reader must be held in the vicinity of a tag to read or change its content. Line of sight is not necessary; on many occasions a reader will read a tag e.g. through a paper or even a table surface. Tags can take different forms and the smallest ones can be inserted under the skin (as is often done with pets) or even eaten. The determining factor for tag size is the size of the antenna; with a small antenna a tag can only be read at very close range (centimetres) whereas with larger antennas and large reader antennas, the reading distance can be several meters. The reader and the tag antenna must be somewhat lined up for the reading to work.

The smallest RFID tags are typically *read-only passive* RFID tags. Passive RFID tags are not powered by any power source of their own. Instead, they take the energy needed to read or write them from the energy field generated by the RFID reader when it is being read. A read-only tag only contains one single piece of information that cannot be changed: a unique ID that is not shared with any other tag (in the same standard) in the whole world. There also exist passive RFID tags that can store information that's written into the tag from a reader. Passive RFID tags are very cheap to buy, in a price range from a few cents to one Euro each. The readers are more expensive, especially if

they are to be able to write as well as read, or to communicate their data wirelessly e.g. to a computer program or a mobile phone.

An active RFID system has an energy source (typically a battery) connected to the RFID tag itself. This means that the tags can do things even when not read or written by a reader. Such tags are sometimes packaged together with sensors, so that they can track some information about their surroundings (e.g. temperature changes). The active RFID standards have primarily been developed by the transportation industry to track e.g. that things that are supposed to be transported chilled have not been subjected to heat during transportation. Active RFID typically supports larger reading distances than passive RFID.

The main hindrance of RFID tags is the need for a tag reader. There are affordable readers which you can plug directly into a mobile phone, but chances are none of your players have ever used such a device before the game, let alone own one. Passive tags are cheap to buy, so once you have the readers you can flood your game with tags. In contrast to Bluetooth, locating and reading a tag is very fast with RFID technology. Since the antennas must line up, the relative orientation of the tag and the reader is important for a successful read.

Bluetooth also has a use as a proximity technology. A device with Bluetooth can scan for other Bluetooth devices in its vicinity. As in RFID, each Bluetooth device has a *unique* ID that is immediately available from such a scan. Bluetooth scanning can be used for proximity detection without invoking any kind of communication between the two devices; hence the approval protocol for connecting the two devices does not come into play.

The good thing about Bluetooth is that most mobile phones and a large range of portable devices support Bluetooth, making it a technology that is readily at hand. The drawback is that scans are slow, unreliable, and draw quite a lot of battery power. The Bluetooth protocol supports two kinds of scans: open scans, and scans for devices that are already known. The latter is faster and slightly more reliable, and draws less battery.

The Bluetooth standard is under rapid development and the proximity range is increasing. Recent devices are said to have a proximity range to up to one hundred meters. This development actually renders the technology less and less suitable for proximity detection. If you decide to use it in your game, you should check the scan range of your game devices first.

Wireless Connectivity

WLAN Wireless local-area networks are a mobile version of a standard internet access point. They only work in the vicinity of a base station. The advantage is that these are cheap and that you can set them up for your game. Access to the WLAN base station does not automatically mean that you have Internet access, which requires that the WLAN base station in turn is connected to a computer that has Internet access – and that you have access to that network.

In urban areas, there are typically many WLAN base stations available from any position, but many of these are not open for connection to the Internet, or require a paid account. The scarcity of WLAN base stations with Internet access makes WLAN more of a hotspot connectivity space than a continuous connectivity space.

GPRS and 3G General packet radio service and third generation mobile phone standards are access technologies used in the mobile telephone networks. Unlike WLAN, the telecom operators deliberately seek to achieve continuous coverage. There are two modes of data communication on mobile phones; GPRS runs over the GSM network, whereas 3G is an integrated standard for mobile phone and data communication. With the right subscription, GPRS and 3G always provide internet access but it is typically still very expensive (charged by communicated bit). GPRS offers low bandwidth, which means slow downloads, and has a built in delay in response times that sometimes can be in the range of 20-30 seconds.

Although both provide continuous access, it is in practice not uncommon to get disconnected from the network at times, or to get very large variations in response times. Another problem is that not all operators (access providers) handle data communication the same way – some will always prioritise voice communication.

A particular problem with GPRS and 3G is that you almost exclusively must use mobile phones to access them. It is difficult to develop a mobile phone application that runs on more than one phone due to the different interfaces, the different ways of integrating third party programs with main phone functionalities, and so on.

Infrared communication Wireless communication can also be achieved through infrared. It enables close range (maximum ten meters apart) connections where the two senders/receivers are in direct line of sight of each other. The connection protocol usually does not require identification (the complex procedure of getting things in line of sight is seen as enough).

Bluetooth As a close range communication protocol, Bluetooth is designed to support ad-hoc data transfer between devices, for example looking up the printers and moving documents from a laptop to the printer. It is used in mobile phones to support wireless earphones. Nowadays Bluetooth is available on most portable PCs and mobile phones, whereas game consoles more often support WLAN. The range of Bluetooth is typically around seven meters, but this is expected to increase in future phones to up to a hundred meters.

Establishing a connection requires identification. The protocol in the Bluetooth standard requires that one of the devices asks to connect to the other, setting a secret password, and then the other accepts by entering the same password. Typically this only needs to be done once for any pair of devices. In the future the two devices know about each other and can connect automatically.

The communication protocol prioritises data transfer, which is pretty high bandwidth – illustrated by the fact that you can use wireless earphones to listen to music. The lookup process (noticing other Bluetooth enabled devices in the area) is by contrast rather slow and somewhat erratic. This means that games that use look-up as a game mechanic need to allow this search to take some time (up to 20 seconds).