Pervasive and Mobile Games

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ABSTRACT

Pervasive and mobile games (PMGs) are a new type of game. They combine physical and virtual world (i.e., they are pervasive), and they exploit mobile devices to enlarge the physical area of gaming action. PMGs are versatilely applied as "serious games" in CSCW, and as casual games in entertainment.

To achieve commercial success with your game, you must fulfil the sine qua non: The game has to be fun! Thus, we try to answer the question, how to develop an enjoyable PMG. We present some example games, compare them concerning different aspects, and give hints on how to approach analysis and design for PMGs.

INTRODUCTION

By requiring a physical gathering of people, traditional board games support social interaction naturally. On the contrary, computer and video games followed another trend for a long time; they only let one person interact with the game system. Only watching another person play such a game was not always satisfying. So game designers addressed the need for collaborative and competitive play. A current trend is pointing towards **M**assive **M**ulti-**P**layer **O**nline **R**ole-playing **G**ames (MMPORGs) like "World of Warcraft" [11]. Still the players sit in front of their desktop PC, immobile and trapped in a room.

Mobile gaming wants to get the players moving. Pervasive gaming wants to get the players interact with the real world again, instead of the purely virtual reality. Offering a similar environment to Collaborative Working, PMGs are also used in research and business. Due to their structured environment, they allow learning collaborative or cooperative behaviours playfully. Thus we also present some "serious games".

EXAMPLE GAMES

Can You See Me Now?

Can You See Me Now? (CYSMN) [5] is a location-based mobile game that mixes a part of a real city with a virtual map. There are two competing groups of players: online players joining over the internet, and so-called *runners* who are equipped with a PDA, a walkie-talkie, WiFi, and a GPS-unit.

The online players have to move their avatars through the virtual game space (at a predetermined maximum speed) and evade the runners who actually run through the real city streets. When a runner comes close enough towards an online player's avatar, the runner catches or "sees" the online player and scores. All players can communicate via text-chat, while the runners also have the ability to talk over the walkie-talkies. All their audio-streams are mixed and made available to the online players.

Figure 1: First equipment for CYSMN *(top)* and Paul playing with the second one *(bottom)*

Uncle Roy All Around You

The successor of CYSMN is called *Uncle Roy All Around You* [1]. It premiered in London. There are street players and online players. Contrary to CYSMN the street players are not professionals. In the beginning an actor shortly instructs the street players, reliefs them of their personal be-

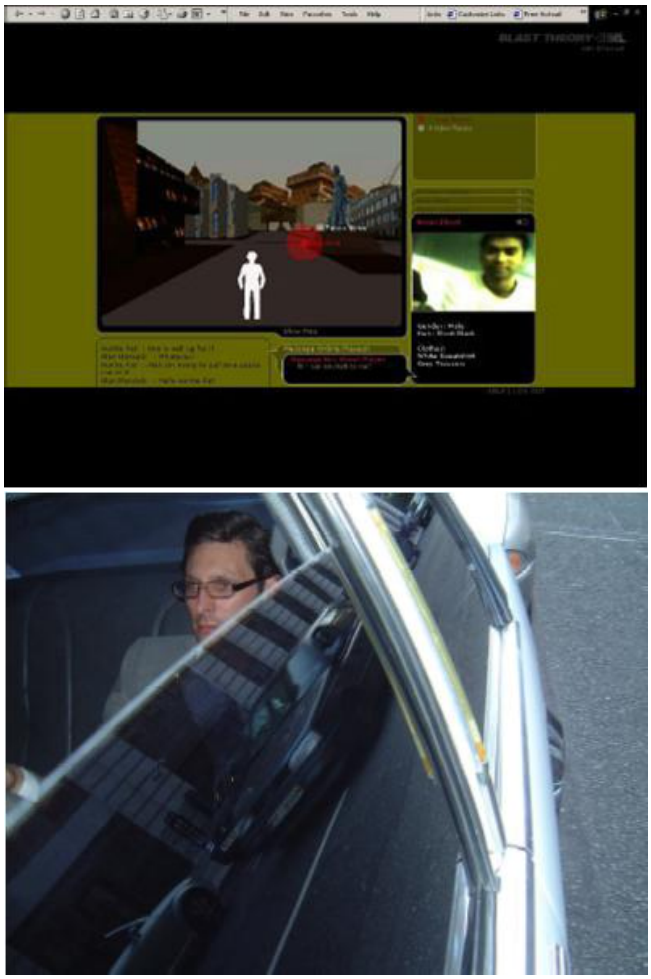

Figure 2: Online Player *(top)* and maybe Uncle Roy!? *(bottom)*

Figure 3: Street player in Uncle Roy's office *(top)* and the mysterious limousine *(bottom)*

longings (i.e., mobile phones, purse, and watch) in exchange for a PDA, and then he leaves the street players to their main task: Search for the mysterious "Uncle Roy"! The PDA contains a city map and instructions, where to go first. Reaching this spot, the street players have to notify the system by self-referencing their position. Then they get further instructions on their PDA, sent by Uncle Roy. In fact this is a scripted event, but the street players do not know.
Now the online players come in. They can see a virtual model of the city, send text messages

to the street players, and freely decide to help these on their way to Uncle Roy, or to distract and mislead them. The game system (alias Uncle Roy) also may lead the street players in a wrong direction by giving instructions like: "Follow the woman that is crossing the bridge!"
The street players do not know that this is a random clue and an arbitrary tourist may be crossing the bridge at that time.
Eventually, most of the street players reach Uncle Roy's office, where they are alone, watched by a camera, and have to fill out an empty postcard that poses the question: "When can you begin to trust a stranger?" Then they are led to a limousine, in which they meet an actor who - during the ride - asks them questions about trust in strangers. The street players are told that some other player is asked the same questions at this very moment. The actor asks if they are willing to enter a year long contract to help this stranger if he will call upon them. If they agree, they are asked to put their filled-out postcard - addressed to Uncle Roy - into a public postbox in order to seal the contract.

Treasure

Treasure [3] is an outdoor mobile multiplayer game. It offers a WiFi network, but makes explicit use of the seams and gaps in the network coverage. The players use a PDA to collect virtual coins that may be scattered inside or outside the network. The collected coins have to be uploaded from within the network coverage to a server. Therefore, the PDA constantly samples the network availability and visualises it in a map. The players, playing in teams of two, may gain double points doing a collaborative upload (i.e., they upload at the same time). Furthermore, there is the possibility of

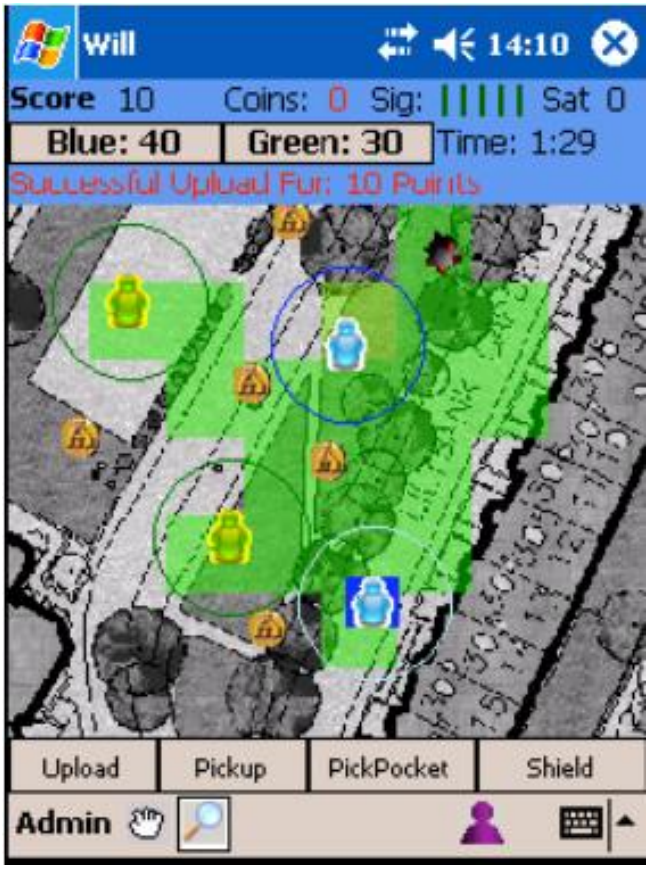

Figure 4: The "*Treasure*-Map"

pickpocketing from other teams, by getting close to the other player, pushing a button, and then running away.

The Lighthouse System

We present an approach to sharing space at a distance, focusing specifically on mobile users and collaboration as part of leisure. The main goal of the presented systems is the support of enjoyable aspects of shared visiting, in particular sociability (i.e., the enjoyment of sharing experiences).

The Lighthouse System [2] supports collaborative museum visiting by connecting on-site visitors with "on-line" visitors. The on-site visitors use a PDA with an ultrasonic tracking system to share their museum visit with online co-visitors who can navigate through a web version of the museum and watch pictures of exhibits. In a trial of this system, users could bring together digital and physical exhibits through their interactions. Despite demonstrating the feasibility of collaborative leisure experiences, this system has a number of limitations, e.g. users are unable to use their own devices, the system's use is fixed to only one location, and the system is hardly scalable beyond the Lighthouse, since this would require different web versions for each new setting.

Figure 5: Screenshot of George Square System

George Square System

The *George Square System* [2] supports collaborative visiting of a city. Through tablet computers sharing photographs, voice recordings, and locations the system allows visitors sharing their experiences with others both far and near.

Each tablet PC tracks the visitor's location using GPS and displays it on the map of the city. Non-mobile users may move an equivalent avatar by clicking on the map (1). Maps are automatically downloaded over the Internet from a map server, allowing the system to run anywhere map data is available for. Since GPS sometimes lacks accuracy, users can specify their position manually by clicking on the map. The visitors can take photographs with an attached camera. These pictures then are referenced to all users' maps at the location where the picture was taken (2). All pictures are shown in temporal order on a shared "filmstrip"-view at the top. The users' behaviour is recorded and compared to the history of others' past behaviour, producing a focused set of recommendations of places, web pages (3) and photos (4) displayed on the map and in a legend below each map (5). The system uses voice-over-IP to support talk between participants.

The *George Square System* is the successor of the *Lighthouse System* and therefore adds some improvements to the limitations mentioned in . Now the system works anywhere a network connection is available. Since maps are available for almost any location, it is not necessary to produce different web versions for different locations. Another point, which turns out to be particularly important for this and the following similar systems, is the use of earlier generated photographs and other logged data for the automatic generation of a web page - a travel weblog - which may be used

both for planning (pre-visit) and for post-visit discussion. Despite of the considerable improvement with that system, one big constraint still remains: the kind of mobile device. Since the display of a mobile phone is to small to present a map with links and pictures, a visitor has to use a tablet PC (see screenshot of the system) which is way less comfortable than the light and already well known mobile phone.

Let us now consider a system which has not such a constrained setting, since a big display is less important and the system is by far less complex.

mGroup: Mobile Media Sharing in Large-Scale Events

The increasing availability of mobile phones equipped with digital cameras calls for investigating mobile media applications beyond current approaches as MMS (multimedia messaging service), mobile instant messaging, and blogging. *mGroup* [6] addresses important issues specific to events: groups and their dynamics, the simultaneous support for immediate sharing (and dialogues), archiving, combining spectators' media for social presence, and real time media services for event engagement. It is based on the following principles:

- **Story based communication spaces:** Users can create "media stories" inviting specific members forming different media spaces to support topical discourses like in chat rooms
- **Threaded replies and presence features:** Each message sent within an mGroup story is delivered instantly to its members, who can reply with a message viewable by all the members. mGroup visualises members' online/offline status and the latest contributors to the stories.
- **Combining spectators' media and real-time event content services:** Spectators are motivated to access mGroup to share media in stories and also to view dedicated stories with real-time event content (by event organisers, competitors, or performers).
- **Automatic album creation for post-event re-experience:** Each media story is also a shared album in an up-to-date web page protected by password (similar to *George Square System*).

Figure 6: **Browsing content in mGroup. From left to right: The media story list from which to join or create a new story; List view of messages in a media story; The message shown in full story after a selection in screen B; The member view available from the Options menu shows the online (green) / offline (red) status of each invited member. The content shown is from a user trial at Neste Rally 2005 in Finland (a part of World Rally Championship competition).**

One user trial took place at the *C/O POP* [4] [8] in Cologne 2005. The advantages of the system are very small limitations, so it can be used by a lot of people without great efforts. Almost all new mobile phones are equipped with digital cameras and support Java (*J2ME, CLDC/MIDP 1.0, 2.0* [14]) allowing the system to run on a large amount of mobile devices, opposite to the systems mentioned above. Since *mGroup* is a client-server application, not only the clients are important, but also the servers. Similar to the *George Square System*, the server does not depend an a certain location and may remain unchanged in other events.

Online Photo Management

"In the era of film, we printed every shot. And filled our closets with photos no one could see. In the digital era, we print fewer than 1 in 10 [...] and fill our computers with photos no one can see" [13] . - Online photo management systems solve these contradictions very successfully, e.g. at youtube.com [15] some videos have over *2 Mio views* [15] - a resonance, never reachable the conventional way. Actually public showrooms for personal pictures and videos just might be the fastest-growing social network on the Web. You can upload images or videos and assign each an identifying tag; these tags help visitors to find things of interest. You may join groups and create new ones, post comments about particular uploads and designate favourites ([7], [13], [15], etc).
Since digital cameras are a de-facto standard for the mobile devices today, it is obvious to combine the two growing sectors. E.g. *Flickr.com* [7], a yahoo company, is a system which supports *uploading photos with a cameraphone* [7], similar to the feature of *George Square System* and *mGroup*, where the logged data was used to generate web-pages which could be used for different purposes.

CLASSIFICATION AND OVERVIEW

The definitions for what a game is, are manifold. Furthermore, there is no "right" classification of the different game genres. Everyone knows categories like "First-Person Shooter", "Role-Playing Game", etc., but those are mostly terms from the discussion in the media, rather than scientific taxonomy. Thus, we created an own classification and custom dimensions to help comparing and discussing PMGs. (See Table 4.1)

Table 1: Classification of PMGs

	CYSMN	**Uncle Roy**	**Treasure**	**George Square**	**mGroup**	**flickr**
Pervasiveness	Strong	Profound	Medium	Strong	Medium	Medium
Mobility	Large area	Large area	Medium area	Medium - Large	Medium area	Worldwide
Commitment	Very Strong (runners) vs. Medium (online players)	Very Strong (street players) vs. Low (online players)	Strong	Medium	Medium	Low
Social Structure	Competitive and Collaborative	Competitive and Collaborative	Competitive and Collaborative	Collaborative	Collaborative	Collaborative
Player Roles	Runners (pro.) vs. Online Players (nonpro.)	Street Players (nonpro.) vs. Online Players (nonpro.)	Team Players (nonpro.)	Outside-visitors with Online-visitors	Outside (event-visitors), post-visitors (created Webpage)	Outside (upload by mobile), inside (upload/watch over Internet)
Technology Level	HiFi	MeFi	HiFi	HiFi	MeFi	MeFi, but HiFi-Tools
Tracking	GPS	Self-Reporting	GPS	GPS, Self-Reporting	not used	not used
Network	WiFi	GPRS	WiFi	WiFi	GPRS	GPRS
Comm-Channels	Text-Chat, Audio (runners), Photo	Text-Chat, Live theatrical performance	Text-Chat	Audio, Photo	Photo, instant messaging	Photo, messages (comments, rating)

THE FUN FACTOR (DESIGN TIPS AND DESIGN PATTERNS)

The presented projects share the approach of user-/player-centered design. It is crucial to tailor your PMG to the needs and wishes of the players. Therefore, it is advisable to use an ethnographic analysis. This means integrating a protocol system into your PMG to record text-chat, audio conversations, player movements, game system failures, videos from the players playing the PMG, etc. Thus, after the game has ended, you can do a comprehensive analysis of the players' interaction with your system. It can be most astonishing to see which mistakes the users make, but also which tactics and strategies they develop.
Your analysis should be integrated into a DIA-Cycle (**D**esign, **I**mplementation, **A**nalysis), which straightens out mistakes and flaws, and introduces new elements that enrich the gaming experience.
We want to give some examples for observations made in the example systems and give tips and design patterns that help designing a PMG which is fun to play.

Dealing with Uncertainty

There are severe problems with the coverage and preciseness of wireless systems like GPS, WiFi and GPRS. As you need at least three GPS-satellites in view to triangulate your position, you may not be able to determine it in the shadow of a house wall or during a certain time of day, where the position of the satellites is improper. Or inside a building you may not get any WiFi signals. Despite continuing efforts to improve location technologies, such as the Galileo satellite system [12], imperfect location awareness and network uncertainties should be assumed for any PMG design.
Generally, the team of *CYSMN* proposes to consider 'four states of being' for a mobile player:

- **connected and tracked**: network and positioning system coverage
- **tracked but not connected**: player can see position updates on local device (PDA), but the position is not transmitted to other players
- **connected but not tracked**: player can communicate and exchange updates with other players, but cannot see his or her position
- **neither connected nor tracked**: player can neither communicate with other players, nor is the own position shown

Instead of seeing the three last states as erroneous, the designer should provide some meaningful and fluent experience for the player who enters these modes. For example there could be a fall-back solution that uses a less sophisticated technology, or the system could provide the player with information where to find better network availability.
The *CYSMN* team worked out five strategies for handling uncertainty that are not mutually exclusive and thus can be combined: Remove it, hide it, manage it, reveal it, exploit it.

Remove Uncertainty

This means improving the technology on the long run, and, for the moment being, choose game areas where you can provide a good network and GPS coverage and avoid blackspots. Also consider playing times, as the GPS availability changes over time.

Hide Uncertainty

Avoid creating wrong expectations (i.e., they cannot be fulfilled by the technology) for the player. If the players build up a conceptual model through the "system image"" you provide (see Norman [9]), and get the impression that the virtual world would be perfectly superimposed to the real world, they will be disappointed when the illusion breaks.
Thus, use simple strategies like those used in *CYSMN*:

- Automatically correct impossible GPS readings, like positions inside building walls or water.
- In *CYSMN* the runner is "seen", not "caught", due to the impreciseness of GPS. So choose your game vocabulary wisely.
- The walkie-talkie audio stream is highly atmospheric and yet not precise enough for the online players to derive the mismatch between the actual runners position and displayed position.

One should add that *Uncle Roy* in a sense broke with this rule. It gave the street players the (wrong) impression that the game system would have great control over the real world. For example, it told the street player something like: "Wait until you are very sure that nobody is watching you, then cross the street and walk down the flight of stairs!" or "Follow the brunette woman!"
Feeling very alone, being taken away all their personal belongings like their watch and mobile phone, the street players almost developed some sort of paranoia, thinking that every stranger was involved in the game. This added very much to the fun of the experience.

Manage Uncertainty

There are two options to manage uncertainty.
First, you can fall back to low-tech solutions. E.g., when your GPS location cannot be determined, you could use self reporting positioning instead.
Secondly, you can do orchestration from behind the scenes. There may be a staff, handling system errors from a control room or maybe also directly interacting with the players. The actors in *Uncle Roy* are also part of the orchestration and provide the player with a continuous gaming experience.

Reveal Uncertainty

This follows the suggestion by Norman: "Make it visible!" You should provide the players with information about the current game state. That information could be the network signal strength, like it is done in mobile phones. You can also give the player information about the current preciseness of GPS, or provide him or her with network availability maps, or maps of probability clouds, representing a prediction of GPS coverage in time.

Exploit Uncertainty

Treasure takes such a "seamful" approach: The players can hide in areas of network loss and then sneak upon the other team in order to pickpocket it. In order to upload their coins, they have to deliberately search for a place with network access. The designers added the features of network availability maps later on, thus revealing the uncertainty and giving the players a tool to make use of the uncertainty.

Tactics and Strategies

When you analyse how the players actually play your PMG, you will find them developing many tactics and strategies, that may help you to make your game more fun. You may add features that support tactical play, or you can fine-tune your game to achieve a better balancing with respect to difficulty or the supremacy of certain strategies.

Tactics

Tactics are game-specific movements and actions, the players use in a short-term perspective in order to win the game. Here are some examples taken from *Treasure*:

- **The 180° Turn:** Players sometimes suddenly did a 180° turn. Asked why they did this, they told they had walked over a coin with their player icon, but due to the lag of GPS, the coin was not collected. Another reason for the turn was a loss of network and trying to regain access to it.
- **Spy Look:** Players often stopped dead in their tracks to look up from their PDA to compare the displayed position of others to their actual position on the game field. It was also a decent way to make sure, no one was sneaking up from behind.
- **Collaborative Network Search:** In order to get double points for a collaborative upload, players outside network coverage met their teammate and did a side-by-side search for the WiFi signal.
- **Hit and run:** When pickpocketing another team, some players ran away very quickly in order not to be pickpocketed back right from the spot.

Some further examples from *CYSMN* taken from the text-chat log:

- **Orienting other players to runners:**
  JOHN DOE: Runner 4 near cafe Rotterdam
  TOBY: Heading up by Las Palmas
  JOHN DOE: Runner 4 headed for Las Palmas
- **Helping other players to avoid runners:**
  DANI: Runner 3 at Las Palmas
  PHIL: Runner 2 is nearby
  CLAUDIA: Shit!!! Runner 3's on our ass
  D.BOT: He's still on us - look out Catherine
  DANI: Watch out Catherine

  SAAB: Mike meet me at cafe Rotterdam
  MIKE: Sorry, stalking Anna
  ANNA: That's okay Mike
  SAAB: Stop stalking her then

Figure 7: A *Treasure* player sneaking up from behind to pickpocket the girl

  MIKE: Anna has a nice butt
  ANNA: How do you know?
  MIKE: Big imagination
  ANNA: Well you're right
  SAAB: Mike watch the runner!
- **Taking evasive action:**
  DAVE: I'm in the south
  ANDREW: Runner 4 is in the hotel car park
  DAVE: Action
  TOMMIE: Christine look right
  ANDREW: Run for your lives! JULES: Run baby run!
  CHRISTINE: Thanks!
  ANDREW: Runner 4 is west of the swings
- **Organising collaborative gameplay:**
  D.BOT: Runner 3 is still by Koolhaas I think
  LANDO: Runner 4
  SAN: Near Phil now
  LANDO: He is heading to the car park
  D.BOT: Bring Runner 3 over this way
  CHRIS: I'm feeling suicidal
- **Finding other players:**
  AMMA: Running around to find Anna. Does anybody see her?
  ROBERT: Anna is moving towards Hotel New York
- **Meeting other players:**
  VESPER: Let's all gather - makes things more exciting
  ANNICK: Where?

Strategies

Strategies are well-considered or planned ways of playing the game. They have a longer perspective and need a longer knowledge and deeper understanding of the game system and the game rules than tactics.
Examples from *Treasure*:

- **Hunters or Gatherers:** Players could be separated using two main strategies. One fraction was *hunters* - people who boldly collected lots of coins over a wide area and uploaded only seldom, but then being very careful not to be pickpocketed during the upload process. The other fraction was *gatherers* - players who uploaded every coin directly, were very worried about being pickpocketed, and left the network coverage seldom. In overall the hunters seemed to be more successful.

DESIGN PATTERNS FOR MOBILE GAMES

In this section we give some examples of existing "Game Design Patterns for Mobile Games", taken from a Project report to Nokia Research Center, Finland [10]. The full report contains 75 patterns.

Hybrid Space

Core Definition: Part of the game state is defined and continuously updated by real world conditions.
General Definition: With modern technology it is fully possible to extend a game beyond its own hardware. With the use of sensors and actuators, the game can have a continuously updated relationship with the real world, in principle making the game state continuously updated by events in the real world.
Example: The game project Human PacMan makes use of the real world. A wall in the real world is a real wall in the game world and cannot be traversed.
Example: The handheld game Boktai uses sunlight as an important input, both to the game world and to the player's resources.
Using the pattern: *Hybrid Space* can be created in three different ways: through *Augmented Reality*, through *Extra-Game Input*, or through *Configurable Gameplay Areas*. In *Augmented Reality* the game state is created by using the real world as a basis and adding information from the abstract game state. *Hybrid Spaces* based on *Extra-Game Input* use a traditional game state presentation style but has the game state updated by input that is not generated by players. *Configurable Gameplay Areas* create *Hybrid Space* by using locations in the real world to define the game world.
Consequences: Games with *Hybrid Spaces* are *Real-Time Games* if the intersection between the real world and the game world is more complex than rather just purely spatial, since they in the case of more complex relations continuously receive *Extra-Game Input*. *Hybrid Spaces* often turn games into *Pervasive Games*, both since non-players may be performing their activities within the space and since players may or must perform non-game related activities.
Relations:
Instantiates: *Pervasive Games, Real-Time Games*
Modulates: -
Instantiated by: *Extra-Game Input, Augmented Reality*
Modulated by: *Configurable Gameplay Area*
Potentially conflicting with: -
Uncharacterized connection to: *Persistent Game Worlds, Real-life Activities Affect Game State*
References: -

Social Skills

Core Definition: The players' actual skills in socializing are vital for gameplay.
General Definition: A players social skills determines how well she interacts with other players and non-players in a social environment.
Example: In the game Crowd Machine players score points by gathering large amounts of people playing the same game. The more people you can gather through social skills, the more points you get.
Example: The game Diplomacy is primarily depending on a player's social skills in creating alliances and deciding when to dishonor agreements.
Using the pattern: The types of *Social Interaction* allowed by a game strongly influences how much impact *Social Skill* has on gameplay. *Unmediated Social Interaction* typically allows *Social Skills* to have a strong impact although this can be affected by the presence of *Symmetric Information* and *Perfect Information* about the game state.
Consequences: In games, *Social Skills* most often affect how well *Team Play* and the creation of *Dynamic Alliances* works, as well as how successful player are at *Negotiation*. Outside actual gameplay, players' *Social Skils* typically affect their roles in *Chat Forums* and affects their *Social Status* and the amount of *Social Interaction* she can perform.
Relations:
Instantiates: -
Modulates: *Chat Forums, Social Statuses, Team Play, Negotiation, Dynamic Alliances*
Instantiated by: -
Modulated by: *Unmediated Social Interaction*
Potentially conflicting with: *Perfect Information, Symmetric Information*
References: -

Figure 8: Hierarchy of the Pattern Language for Mobile Games

Pervasive Games

Core Definition: The play session coexists with other activities, either temporally and spatially.
General Definition: As technology is getting smaller, cheaper and more powerful it can be incorporated into objects traditionally not perceived as technological. This facilitates simultaneous gameplay alongside other everyday activities.
Example: The game Botfighters allows the player to play the game whilst going on with her everyday life by having the bot's position vary with the player's physical position.
Example: In the game project Visby Under, players walk the streets of Visby, interacting with a small creature in a PDA. The creature, which has to be nurtured to some extent, tells them about various sights and assigns different quests to the player.
Using the pattern: As soon as a game has *Real-life Activities Affect Game State* or a game uses *Hybrid Space*, the game is a *Pervasive Game*. How well the game functions with and is affected by the surrounding activities can be controlled through *Extra-Game Input*.
Consequences: *Pervasive Games* by their nature may require *Attention Swapping* between playing the game and performing other activities. Since the game can take place in spaces inhabited by non-players, all actions performed in the game can be considered to have some form of *Extra-Game Consequences* if non-players do not know that a game is being played. If the non-players can recognize the game for what it is, they can be considered *Spectators*.
Relations:
Instantiates: *Attention Swapping, Extra-Game Consequences, Spectators*
Modulates: -
Instantiated by: *Hybrid Space, Real-life Activities Affect Game State*
Modulated by: *Extra-Game Input*
Potentially conflicting with: -
References: -

Gain Ownership

Some mobile games, both pervasive and "traditional", require the players to claim items in order to progress in the game. This is particularly interesting in games which require *Physical Navigation* where player might have to *Race* each other in order to arrive first to an item. *Gain Ownership* may also become a meta-level goal in games that allow *Game Element Trading*.
Instantiates: *Collection, Physical Navigation, Game Element Trading*
Modulates: -
Instantiated by: -
Modulated by: -
Potentially conflicting with: -

Spawning

Spawning the player into the game world might require specific *Spawn Points*. If there is a penalty for needing to respawn the player could suffer *Downtime* before being able to get into the game. Spawning in a mobile game can be different from spawning in a computer game since the player might have to travel large distances in order to get to a viable spawn point. This can be used as an *Individual Penalty* and can increase the *Tension* when being far away from a spawn point. An issue with *Spawning* in mobile games is that it may generate dependencies with *Player-Location Proximity*.
Instantiates: *Spawn Points*
Modulates: *Downtime*
Instantiated by: -
Modulated by: *Player-Location Proximity*
Potentially conflicting with: -

CONCLUSION

Pervasive mobile games are a nowadays developed on a small scale, mostly for scientific research. They provide a good possibility to get an insight on the experience of users with emerging technologies. PMGs offer a flexible design space and allow direct contact to the end-user on festivals and fairs. The main task for the future will be to lift these games out of their children shoes, make them more fun to play, more technically robust, and available to many more players. The development of the games has to follow approved HCI design methods. Then PMGs might become commercially successful.

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