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A Pattern Language for Designing Location-based Games

Diploma Thesis at the
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by
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I hereby declare that I have created this work completely on my own and used no other sources or tools than the ones listed, and that I have marked any citations accordingly.

Hiermit versichere ich, dass ich die vorliegende Arbeit selbständig verfasst und keine anderen als die angegebenen Quellen und Hilfsmittel benutzt sowie Zitate kenntlich gemacht habe.

Aachen, April 29th, 2013
Christoph Will

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Abstract

Over the last two decades, video games became increasingly mobile. However, so far very few of those mobile games use the full advantages of being "pervasive", i.e. played in the physical world. Almost none use the GPS-receiver present in many mobile devices to incorporate the location they are being played at into their gameplay.

While commercial video game developers so far have shown little interest in such location-based games, there is a wealth of location-based games created for research purposes. The case studies of these games provide insights into what technological challenges await developers in this area, but also contain information about the game design process and the decisions made by the designers behind the games. Additionally, the live-action role-playing community and researchers studying such pervasive role-playing games provide many insights into their design decisions.

The long established tool of design patterns has already been adopted for the field of game design in the form of game design patterns. These game design patterns are primarily discovered through the process of "harvesting" them, i.e. by analyzing existing games in order to identify recurring design elements.

In this thesis, we used the approach of harvesting game design patterns to identify recurring design challenges and decisions in the process of creating location-based games. By collecting feedback from researchers with experience in the field of location-based games, we identified a key problem creating misunderstandings when talking about location-based games. Furthermore, we collected feedback for our design patterns in order to improve them iteratively.

By compiling the existing knowledge about the design of location-based games in the established format of game design patterns, we aim to provide potential developers of such games with an overview over this knowledge. Additionally, the patterns in this thesis can ease communication problems in teams designing location-based games.

In the future, we want to collaborate with developers of location-based games to increase the validity and precision of our pattern language.

Überblick

Im Verlauf der letzen zwei Jahrzente sind Videospiele zunehmend mobil geworden. Aber bis heute benutzen nur sehr wenige dieser mobilen Spiele die Vorteile davon in der physischen Welt gespielt zu werden. Fast keine benutzen den GPS-Empfänger, der heutzutage in vielen mobilen Geräten zu finden ist, um den Ort an dem gespielt wird in das Spiel einzubinden.

Während kommerzielle Entwickler von Videospielen bis heute eher wenig Interesse an ortsbasierten Spielen zeigen wurden sehr viele solcher Spiele für wissenschaftliche Zwecke entwickelt. Die Fallstudien dieser Spiele zeigen auf welche technologischen Herausforderung Entwickler in diesem Bereich erwarten, aber auch welche Entscheidungen über den Spielablauf die Designer hinter diesen Spielen treffen mussten. Darüber hinaus geben Spieler und Forscher die sich mit Liverollenspielen beschäftigen einen Einblick in die Entscheidungen hinter der Gestaltung ihrer Rollenspiele.

Entwurfsmuster (engl. design patterns) sind ein Werkzeug, das lange etabliert ist und bereits in der Gestaltung von Spielen eingesetzt wurde in der Form von sogenannten game design patterns. Diese Entwurfsmuster werden hauptsächlich durch "ernten" gefunden, d.h. indem man existierende Spiele analysiert um wiederholt auftretende Elemente zu identifizieren.

In dieser Diplomarbeit benutzen wir die Idee des ernten von Spieleentwurfsmustern um wiederkehrende Entscheidungen und Herausforderungen im Gestaltungsprozess von ortsbasierten Spielen zu finden. Durch das Sammeln von Kritik von anderen Forschern mit Erfahrung im Bereich orstbasierter Spiele gelang es uns, ein zentrales Problem zu identifizieren, dass für Missverständnisse in Diskussionen über orstbasierte Spiele führen kann. Weiterhin sammelten wir von diesen Forschern Kritik an unseren Entwurfsmustern um diese iterativ zu verbessern.

Indem wir das existierende Wissen über die Gestaltung von ortsbasierten Spielen in dem etablierten Format von Entwurfsmustern kompilieren, versuchen wir potentiellen Entwicklern von ortsbasierten Spielen einen Überblick über dieses Wissen zu verschaffen. Zusätzlich können die Entwurfsmuster in dieser Arbeit helfen, Kommunikationsprobleme in Teams zu reduzieren die an solchen Spielen arbeiten. In der Zukunft möchten wir mit Entwicklern ortsbasierter Spiele zusammenarbeiten um die Präzision und Validität unserer Entwurfsmuster zu erhöhen.

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Thank you!

Conventions

Throughout this thesis we use the following conventions.

Text conventions

All names of games (including interactive performances and live-action role-playing games) are written in typewriter-style text, such as `GroupAixplorer`.

All names of design patterns, whether from our pattern language or others, are writting in small capitals, for example: POSITION VS. LOCATION.

Important terms are written in *emphasized* typeset.

The whole thesis is written in American English.

Chapter 1

Introduction

"Men grow old because they stop playing, and
not conversely."

—G. Stanley Hall

Playing Games has been a central part of human social life, especially in childhood, for all of recorded history. The rise of digital technology in the 21st century has had a major impact on everything we do in our daily lives, and playing games is certainly no exception.

In the beginning of what one might call "the age of video games", video games were played in arcades, with an arcade game called `Pong` probably being the most influential game of all time, kicking off what is now a multi-billion dollar industry. Soon, with both the PC and video game consoles such as the Nintendo Entertainment System, digital games moved into private homes, where they are still played predominantly today. While arcades never had any major impact in markets such as Germany, playing video games at home became an activity that permeated the (first) world.

Early video games: played in arcades or at home

But in 1989, something happened: suddenly, video gaming was no longer restricted to a fixed location. While the Nintendo Game Boy was not the first handheld video game console, it is certainly the first one to have an major im-

Video gaming became mobile with handheld consoles

pact. Playing video games was now possible while on the subway, commuting to work, while laying in the grass of a park on a sunny day or while sitting in the bathroom. And since the success of the Game Boy spawned a multitude of similar devices, game designers and developers adapted to this new technology and created games specifically for these devices. One of these games, originally released for the Game Boy, was a Japanese role-playing video game called Pokémon - which is now one of the most successful and lucrative video-game based media franchises in the world. Since then, one handheld video game device after the other was released, some were flops, some were successes, and it took almost exactly 20 years from the release of the Game Boy to the next major paradigm shift.

Video games very successful on mobile phones

This shift occurred in late 2009 with the release of a game called Angry Birds for the Apple iPhone. Released a year earlier, the iPhone was a commercial success for Apple and can arguably be called the first device what we today call "smart phones". These phones have significantly higher computing power and better display quality than the previous generation of mobile phones - and continually increase their capabilities. Additionally, the iPhone and many of its "brethren" rely on touch-based input instead of buttons - which is part of the success of Angry Birds: players seem to love the way they launch the birds towards their targets using a touch-based interaction. And again, a new technology changed the way game designers and developers create their products. One of the more unexpected results is the creation of new business models: it seems the era of simply buying a mobile video game, installing it on your device and playing it is almost over. Two major new models have emerged: releasing an application for free and relying solely on advertisements (often in the actual game) as revenue or so-called micro-transactions, which means paying small amounts for things such as better items for your in-game character.

Advances in technology create new markets for games

Summarizing these developments, we can see that major technical advances can create new kinds of games, opening up new markets for which game developers might not be sufficiently prepared for - after all, it took approximately one and a half years from the release of the iPhone to the release of Angry Birds. Now, as an interesting side-note: the

creation of a new video game market does not mean other, older markets are now obsolete and no longer interesting, on the contrary - it is not uncommon today for people to own video games for their PC, own a console systems such as a SONY PlayStation and carry a modern phone with a few games installed on it in their pocket. But still, the question hanging in boardrooms and development studios all over the world is - and will always will be "What is the next big thing?". In this work, we will not even attempt to answer that question, nobody truly can. However, we think we have successfully identified a candidate for the spot of "the next big thing": location-based games. The reasoning behind this is based on technology: the Game Boy was the first video game device to combine longer battery life, better display technologies and the general trend of miniaturization, resulting in an attractive platform for game developers of that era. The iPhone combined display quality, computing power and especially the intuitive touch-based interaction into one visually appealing device. Looking at the current generation of mobile phones, almost all of them have the ability to sense where they are in the world: mostly through GPS receivers, but often assisted by Wi-Fi-based or cellular-based location technology. There are however, so far, very few games that both fully utilize this capability and achieve commercial success. The most notable ones are `Zombies, Run!` and `Ingress`, both of which are covered in a later part of this work.

As we can see, location-based games might play an important role in the future of mobile games. In order to prepare developers and designers for this very new market, this thesis presents a pattern language of game design patterns, which, in conjunction with other such languages, should help the potential creators of such games. The main goal of our work is to capture the knowledge that exists (for now) predominantly in the research community for pervasive games. Distributing this knowledge through the established format of design patterns should ideally enable Game Designers and Developers in their design process by equipping them with a vocabulary of game design problems and solutions.

Goal: help future designers of location-based games by capturing existing knowledge

In order to achieve this goal, we have structured this thesis in the following way:

Chapter 2—"Design Patterns" In this chapter, we will explain how Design Patterns made their way from architecture into game design. The main part of this chapter is on the book "Patterns in Game Design", which was the biggest influence on our work.

Chapter 3—"The Pattern Writing Process" While unique, the process we used to arrive at our Pattern Language is based on established tools. A description of this process is necessary before introducing the related games. Additionally, this chapter includes a description of our pattern format and our thought process behind it.

Chapter 4—"Related Work" In this chapter, we will introduce both research publications and commercial products that provide examples of location-based gaming. These publications and products serve as the basis for the patterns in our language.

Chapter 5—"The Pattern Language" This chapter, as the main part of this thesis, contains the pattern language and a pattern graph.

Chapter 6—"Summary and future work" Finally, we will summarize our work and provide an outlook for the next steps to improve our pattern language through further evaluation and addition of patterns.

Chapter 2

Design Patterns

"... in a healthy society there will be as many pattern languages as there are people-even though less languages are shared and similar"

—*Christopher Alexander*

2.1 From Architecture to HCI

2.1.1 Origins in Architecture

In 1977, an architect called Christopher Alexander and his co-authors published a book called "A Pattern Language". Their dissatisfaction with the state of modern architecture at that time fueled their desire to capture existing design knowledge into a format that allowed this knowledge to be understood by every reader, including laymen. Their definition of a design pattern is a perfect statement of their intentions:

First design pattern language created by architects

> "Each pattern describes a problem which occurs over and over again in our environment, and then describes the core solution to that problem, in such a way that you can use this solution a million times over, without ever doing

it the same way twice." [Alexander et al., 1977]

"Good" design hard
to capture - unless
you break it down
into small decisions

When Alexander and his co-workers actually tried to find
the core of *good* design, i.e. the unique qualities that sep-
arates well-designed buildings from badly designed ones,
they came to the realization: it is very difficult to capture
this quality, especially in written form. In fact, they ended
up calling it - in their publication "The Timeless Way of
Building"[Alexander, 1979] - a *Quality Without a Name* or
QWAN. However, in breaking down the design process
into a series of recurring problems, they were able to cap-
ture at least glimpses of this QWAN. By including the con-
flicting forces at work in such a problem and imposing
value and context on the solution they made sure that de-
signers, be they laymen or professionals, could implement
the solution in a fitting and unique way every time they
would encounter this problem. It is therefore not surpris-
ing that, although it took several decades, design patterns
have become an effective tool in many design-centered dis-
ciplines.

2.1.2   Software Engineering

Influential pattern
language only aimed
at experts

The first discipline to adopt the idea of the pattern format
was the field of Software Engineering. In [1995], the so-
called "Gang of Four" Gamma, Helm, Johnson, and Vlis-
sides published a book of 23 patterns. These patterns pro-
pose solutions to central problems programmers encounter
very often, across different programming languages and
environments. This book has had considerable impact in-
side the software engineering community which has not di-
minished over the years. However, it is clearly aimed at do-
main experts, which is something Christopher Alexander
clearly disagreed with in his keynote speech at the OOP-
SLA conference in [1996].

2.1.3   Human-Computer Interaction

HCI design patterns:
closer to Alexander's
original intentions

The true success story of design patterns as Alexander

intended them however might be the field of Human-Computer Interaction. The field was introduced to the concept of HCI Design Patterns by Jennifer Tidwell, who proposed a pattern collection about user interface design called *Common Ground* at the PLoP conference in 1998 (an extended version was published in [2005]). The first book on HCI Design Patterns was published in [2001], in which Borchers introduces the idea to use interdisciplinary pattern languages to complement each other. The three pattern languages he includes serve as an example from the field of interactive music exhibits: one musical pattern language (for the application domain), one HCI pattern language focused on the user interaction and one Software Pattern Language focused on problem the software developer may encounter. Starting from these works, HCI Pattern Languages have spread through many aspects of HCI design, and since they are (in most cases) understandable by laymen and try to improve the user-experience, they are much closer the Alexander's original intentions than the pattern languages in software engineering.

2.2   Patterns in Game Design

2.2.1   The Book

While game design certainly is related to the field of human-computer interaction, most of the recurring problems, solutions and goals are very unique and not covered by HCI design patterns, design guidelines or even HCI research. It is therefore imperative to have a close look at Staffan Björk and Jussi Holopainen's book "Patterns in Game Design"[Björk and Holopainen, 2004]. It is in many ways an outstanding work, not simply because it was the first language of game design patterns or out of its sheer size - it contains 200 patterns. No, in addition the authors provide an activity-based framework for describing games and provide a clear and usable definition for the term "gameplay". They use this definition to focus their patterns on the design of exactly this gameplay, which seems very much in line with Alexander's original intentions

"Patterns in Game Design": first and extensive collection of game design patterns

- using design patterns to make buildings better for the
people living in them and using them. And, maybe most
importantly for the scope of this work, they introduce
game design patterns as a tool: they define them, show
how to identify them and finally how game designers can
use them. We will now provide a structured overview of
their work, which includes remarks on where we agree or
differ with their views.

2.2.2   Gameplay

Definition of
gameplay

Björk and Holopainen start by defining gameplay, which
they consider to be the essential part of a game. Their defi-
nition is:

> "[...] we define gameplay simply as the
> structures of player interaction with the game
> system and with the other players in the game.
> Thus, gameplay includes the possibilities, re-
> sults, and the reasons for the players to interact
> within the game."

[Björk and Holopainen, 2004, page 3]

We find this definition ideal and whenever we are going to
use the term gameplay in the rest of this work, especially
our game design patterns, it should be understood as in
this interaction-centered point of view.

Motivation for game
design patterns:
support design and
communication

Next, the two authors provide a motivation for game de-
sign patterns. While they elaborate more on this later in the
book, these first few paragraphs are very good at convey-
ing their central ideas. First of all, in order to communicate
about games and more specifically about their gameplay,
whether to compare multiple games, analyze an existing
one or create a new one, terminology is needed. The aim of
design patterns is to provide essentially a vocabulary, mak-
ing them the perfect tool for this purpose of communica-
tion. Additionally, Björk and his co-author stress the dif-

ference between gameplay patterns and game design patterns: they specifically chose the latter, since it includes one of the main goals of their work: to support the design process. This is something we absolutely support and tried to achieve in our work, too. The idea of each pattern containing "descriptions of choices one has to make when designing a game that uses the pattern" [Björk and Holopainen, 2004, page 4] is partly why we chose a slightly different pattern format, for our full reasoning on this see our chapter 3.

Björk and Holopainen include "words of warning", stating that they "do not attempt to define good gameplay or good games through our game design patterns" (same page as the last quote). We agree with their reasoning behind this: obviously this is very much a matter of personal preference and taste and as such essentially impossible to capture. However, as we describe in more detail later, we think that Alexander's idea of a pattern includes values and context to guide the decision-making process of a designer in his particular situation. In our eyes, this can work in game design patterns by including specific examples and clearly stating trade-offs, so that designers using the pattern can at least estimate if it will provide a positive or negative experience for the players of their game.

Not an attempt at defining good *gameplay*

The authors explicitly avoid including a definition of what a game or playing actually is, since they think their pattern collection can be indifferent to this. In their eyes, defining game has a place, which is "when we encounter people doing an activity, we can determine if they are playing a game or doing something else altogether" [Björk and Holopainen, 2004, page 7]. We however, do not have this luxury: location-based games are in most cases played in public spaces, creating exactly the social situation where bystanders or even the players themselves have to determine if a game is being played or not.

How to separate location-based games from ordinary life?

2.2.3 Activity-Based Framework for Describing Games

Björk and Holopainen now introduce their framework for

Framework for describing components of games

describing games. In this framework, they describe components common to games that are needed or at the very least helpful for writing game design patterns. One example would be the two components "Game Session" and "Play Session": the first is the complete activity of one player playing a game, the second is the different occasions she is actively playing the game. To illustrate, think of a massively multiplayer online role-playing game (or MMORPG): every time the player logs in an plays until logout, he is in a play sessions. The sum of all his play sessions is his game session in the game. It is obvious that these components need to be defined in order to write unambiguous game design patterns.

Components separated into four categories

The authors separate these components into four categories: holistic components, boundary components, temporal components and structural components. Their underlying assumption for this framework is the existence of a quantitative game state, a collection of all values of all the game elements and the relationships between them. This assumption holds obviously true for almost all digital games.

Holistic components: relation between game and other activities

The holistic components, defined on page 9 of "Patterns in Game Design" [2004] are quite important for location-based games, as they help describe the relation between a game and other activities. The aforementioned "Game Session" and "Play Session" are in this category. Additionally, a "Game Instance" is the complete collection of components, actions and events that take place during the playing of a single game. These three sessions can have a setup and a set-down (sub-)session, which would be the administrative actions of a player before or after the actual gameplay. The last component in this category are all "Extra-Game Activities", which in the case of a location-based game played in a public space, are almost always present.

Boundary components limit and define player actions

The boundary components, defined on page 14, limit the activities of a player in the game, they are "Rules, "Goals", "Subgoals" and "Modes of Play". While the first three are obvious, "Modes of Play" requires some explanation: it refers to how players can perform a different set of actions in different modes of play. One very common example

from modern games would a class-based system: each class is a separate mode of play since it usually allows for different action, i.e. a "medic" can heal, while an "engineer" can repair.

The temporal components, defined on page 19, describe the flow of the game, the first two of these are "actions", describing ways the player can affect the game state and "events", the state changes perceivable by the player. Additionally, "closures" are somehow quantifiable and meaningful changes in the game state that progress gameplay. "End conditions" define the requirements on the game state needed for a switch in the mode of play or the completion of a closure. Finally, "evaluating functions" determine the outcome of an end condition.

Temporal components describe how a game "flows"

Structural components, defined on page 23, are the basic parts of the game which are manipulated both by the player and the system. The first of these is the "game facilitator", responsible for maintaining and synchronizing the game state. "Players" are all the entities in the game trying to achieve a goal by performing actions through an "interface". The game state is contained in all the "game elements", while the "game time" describes how the changes in the game state relate to real time.

Structural components: basic parts of the game

This framework provides some terminology that is very helpful in describing games, especially the parts of games that are not strictly part of the gameplay. There might be some problems with it - we consider it for example quite confusing to use the term "player" in such a way that it includes non-human agents, however this does not take away from the general idea of this framework. While we do not use these terms very often in the current version of the pattern language, knowing this framework is helpful when discussing location-based games or games in general.

Rarely used in this version of our pattern language

2.2.4   Game Design Patterns

In the next chapter, the authors provide two important things: a definition of what they consider to be a game design pattern and their reasoning behind this. The definition

Definition of game design patterns

is as follows:

> "game design patterns are semiformal interdependent descriptions of commonly reocurring parts of the design of a game that concern gameplay".

[Björk and Holopainen, 2004, page 34]

Different from
previous design
pattern languages:
Not based on
problem-solution
pairs

This description-based approach differs fundamentally from the more "classic" approach of construction design patterns as problem-solution pairs. The authors name three observations they made that lead to this decision. The first observation was that defining patterns based on problems does not necessarily support creative design work well, but is geared more towards removing unwanted elements of a design. The second observation is based on the fact that game design elements often automatically guarantee the presence of specific other elements, which leads to: a problem described in one pattern might easily be solved by applying a more specific pattern. The third and last observation, related to the second, is the difficulty of breaking down game design into isolated problems: Adding, changing or removing a single element of a game can have wide-ranging effects on the whole game, preventing game design patterns from being used as precise problem-solving tools.

Game design
patterns can
structure knowledge

As we will describe in more detail later, we made very similar observations in our first approach, however we decided upon trying a slightly different solution to this. We do however completely agree with Björk's and Holopainen's conclusion that game design patterns can be used to "structure knowledge about gameplay that could be used both for design and analysis of games"[Björk and Holopainen, 2004, page 34]. After this, they introduce the format and characteristics of their patterns, which we will skip here. Instead, in Chapter 3, where we describe our format and our thought process behind it, we compare our format to the one chosen by Björk and Holopainen in a detailed fashion in order to illustrate differences and similarities.

2.2.5   Using Design Patterns

Their next chapter is essential to both their and our pattern language, as it describes how design patterns can be used. These two categories are called "analysis" and "design" by the authors: Analysis being the study of an existing game to find what design patterns exist in it and design can refer to both the creation of an idea as well as the formalizing an idea into a more structured description.

Two ways to use game design patterns: Analysis and Design

First, Analysis: the authors describe two ways to find existing design patterns in existing games: *play testing* and *structural analysis*. It seems Björk and Holopainen deem structural analysis superior, as they consider it faster and more ordered than play testing. Especially since by studying the design documents of a game, one avoids the conflict of interest that can happen in play testing: studying a game while playing it and enjoying it while playing it are very different mind-sets which could influence each other negatively.

Play testing and structural analysis to find existing design patterns in games

Secondly, Design: the authors identify four key aspects of the design process in which game design patterns can be used. These aspects are idea generation, development of game concepts, problem solving and communication.

Four ways to use patterns in game design

In the case of *idea generation*, they consider game design patterns important for their ability to show, in a structured way, how gameplay changes dependent on the game environment. This is important for new game mediums and new types of games - such as location-based games.

Idea Generation

Development of game concepts means fleshing out rough game ideas by using the structure of a pattern language to follow a path from initial design choices to very specific ones. While this is a very important goal for pattern languages - only the relations between patterns turn a collection of patterns into a pattern language, this was not a primary goal in our work: as an initial version of this language and within the scope of a diploma thesis, there is a limit to the level of detail we can achieve.

Development of game concepts

While the next aspect is called *problem solving*, game de-

Problem solving

sign patterns are not problem-solution pairs as other design patterns. Rather, the authors argue, since they contain information on how other games achieved a certain interaction within gameplay, designer can use them to achieve the same kind of interaction. Additionally, by identifying which pattern causes an interaction and removing it from their design, game designers can remove unwanted interactions from the gameplay. Since most of our patterns describe interactions in the gameplay of existing games, they should theoretically be able to fulfill this role in a design process.

Communication

The last aspect is *communication*, arguably the key goal of every pattern language. Ideally, the names of each pattern become a vocabulary, to be used as a form of shorthand communication, preventing misunderstandings even in multi-disciplinary teams. As this was one of our key goals (and biggest challenges), we will revisit this when describing our process.

2.2.6   Harvesting Patterns

How to find and create game design patterns

The last part before the actual pattern collection is used by Björk and Holopainen to describe the process of finding and writing design patterns. This process consists of a theoretical foundation, transforming game mechanics into game design patterns, harvesting patterns and interviews.

The *theoretical foundation* is their focus on interaction, i.e. on gameplay - in contrast to most game research up to this point, which they think was focused on narration.

The first candidates for patterns were then created by *finding existing game mechanics and converting them into design patterns*, sometimes merging multiple mechanics into one pattern, and use these candidates as starting points to find more specific or abstract patterns.

Havest patterns from existing games

The next approach, *harvesting patterns*, is arguably the most important one and is essentially our approach, too. They describe harvesting patterns as a brute force analysis of existing games, design concepts from other fields (such as

architecture) and extrapolation of possible interactions be-
tween persons and their environments from sociology and
similar fields. While they started with a structured, iter-
ative five-step process for this harvesting (recognize, ana-
lyze, describe, test, evaluate), during their work this pro-
cess devolved to a point where it became a lot more dy-
namic so that creation and mutation of patterns was possi-
ble during every step and the steps were no longer used in
sequence.

The last part of their overall process were *interviews* with
professional game designers in order to gain insight how
game concepts are described and used in game develop-
ment. In next chapter, we will describe our own process
and especially the difference and similarities to the process
used by Björk and Holopainen.

Interviews with
professional game
designers

Chapter 3

The Pattern Writing Process

3.1 Overview

In this chapter, we will show how we arrived at the version of our pattern language included in this thesis. The first step in this process was an extensive literature review, which was not only necessary to find pattern candidates but more importantly to gain general insights into the field of pervasive games, to which location-based games belong. After this, the combination of our own attempts at writing game design patterns and the experiences of Björk and Holopainen led to our pattern format. We followed up on this by discussing our format and initial patterns with other researchers in a workshop. This helped us identify one of the key challenges we needed to address, leading to the evolution of our patterns described in the corresponding section of this chapter.

3.2   Initial Approach

3.2.1   The Search for Location-based Games

Main problem:
limited availability of
commercial
location-based
games

From the beginning, we encountered problems with the
classic problem-solution approach of design patterns as
proposed by Christopher Alexander. First of all, it quickly
became evident that there are very few commercial games
which can truly be considered location-based games, which
would be needed to identify recurring problems in the de-
sign of location-based games. In [2010], Coulton et al. came
to the same conclusion: "Despite being the subject of con-
siderable research effort location based games in general
have failed to attain the popularity and longevity of similar
activities such as geo-caching or orienteering." Since then,
not much has changed, although during the months work-
ing on this thesis, `Ingress` [2013] entered the closed-beta
stage, which might be the starting signal for the first real
wave of location-based games. This limited availability of
games makes it near impossible to harvest patterns from
commercial games in the way Björk and Holopainen did
for their collection.

However: many
location-based
games in research

There are however many research publications introducing
location-based games and it was often possible to identify
a clear candidate for a pattern from such research. For ex-
ample, the idea to DESIGN FOR COINCIDENCE is based on
Josephine Reid's [2008] paper of the same name. All the
publications that had major impact on our work by not only
inspiring the creation of a pattern, but which also can pro-
vide arguments or context for why a certain design might
be appealing to players, are included in the next chapter on
related work.

Research not ideal
for identifying game
design patterns

But still, some inherent properties of research prevented us
from finding patterns related to social interaction and play-
ing in public spaces, which is something we considered im-
portant based on our own experiences with research games
such as `GroupAixplorer` [2011]. One property is the fo-
cus on technical challenges, which is naturally an impor-
tant component of most research related to computer sci-

ence. While some technical aspects such as the NETWORK
INFRASTRUCTURE can have major impact on the player's
interaction with the game, a game design pattern has to
deal with this challenge through the means of game de-
sign rather than through technical solutions. Additionally,
while the existing research on location-based games covers
a wide array of different problems, we found it difficult to
find *recurring* design problems and therefore patterns.

3.2.2   Location-based Games as Pervasive Games

In our literature review, we came across multiple terms
similar to "location-based", such as "locative" or "location-
aware". Additionally, there is a lot of research from the field
of "pervasive Live-Action Role-Playing Games" or simply
"pervasive games", mainly the work of Markus Montola.
He has co-authored and published a lot of research, mostly
in the form of case studies, such as a book called "Pervasive
Games: Theory and Design"[Montola et al., 2009]. How-
ever, more importantly, roughly at the time we started our
work on this pattern language, he published his disserta-
tion "On the Edge of the Magic Circle: Understanding Per-
vasive Games and Role-Playing" [2012].

Expanding search
into field of pervasive
role-playing games

3.2.3   Markus Montola's On the Edge of the Magic Circle

The stated goal of his thesis is "to establish a basic concep-
tual framework for discussing pervasive games and role-
playing in games." For this, he re-iterates a definition of
pervasive games from his book, which is as follows:

Definition of
pervasive games

> "A pervasive game is a game that has one or
> more salient features that expand the contrac-
> tual magic circle of play spatially, temporally or
> socially."

[Montola et al., 2009, page 12]

Definition of the
magic circle

The contractual magic circle has many definitions and descriptions, but none of them short or precise, which is not surprising - after all, "playing" is a very abstract and complex human behavior. The definition used in the first chapter of his book on pervasive games, which is also included in his thesis, is as follows:

> "[...]we understand the magic circle as a metaphor and a ritualistic contract. [...]While all human activities are equally real, the events taking place within the contract are given special social meanings."

> [Montola et al., 2009, page 11]

Magic circle can take
many forms

It is important to realize how many different forms this "contract" can take and how visible or invisible the magic circle can be, a few examples should illustrate this. First of all, think of a boxing ring: The clearly visible outline of the circle (or square, in this case) transforms socially unacceptable physical violence into a sport. The players entering the fight have agreed on a set of strict rules to fight under, with a referee to supervise the fight. On the other hand of the spectrum, imagine a few kids running around in their neighborhood with water pistols, shooting at each other. They have accepted, in an often very implicit contract, getting wet as a possible effect of their game, bystanders have not (although some might still be willing to forgive getting accidentally hit). While the social boundary is somewhat precise, the magic circle in this case has no clear spatial or temporal boundaries, it is quite literally "all over the place". We use the term "magic circle" in our pattern EPHEMERAL MAGIC CIRCLE since it allows us to describe, in one expression, both the physical circle formed by a group standing together as well as the signal "this group

Pervasiveness as
central property of
location-based
games

is playing a game" it sends out to bystanders. It should be clear how Montola's publications have impacted our work: all location-based games should fall under this definition of pervasive games, making it possible to use research from this field in our patterns. There are of course gray areas, for example some players of `Feeding Yoshi` continued playing the game from home, as one would play a game bound

to a PC and not a pervasive game, but this does not detract from a key insight: location-based games are predominantly played in a pervasive manner, which results in the players interacting with the social environment surrounding them. This lead us to the conclusion that many of the design challenges and decisions for location-based games will arise from their *pervasiveness*, allowing us to identify a few pattern candidates, namely MINIMIZE SOCIAL AWKWARDNESS and ETHICAL AND LEGAL PROBLEMS.

3.2.4 Pattern Candidates and the Problem-Solution Approach

At this point, we had identified a few pattern candidates: MINIMIZE SOCIAL AWKWARDNESS, ETHICAL AND LEGAL PROBLEMS, DESIGN FOR COINCIDENCE. Additionally, from our own experiences, mainly the work on `GroupAixplorer` [2011] and `iCatch` [2011], we knew there was some fundamental difference between using a LOCATION AS INPUT in a game or using a LOCATION AS CONTENT.

First pattern
candidates

Using these ideas and the core parts of Alexander's pattern format, we tried formulating our first design patterns. The core parts we used were: Name, Problem Statement, Explanation with Examples and a Solution Statement. We quickly realized just how difficult it was to formulate the idea of DESIGN FOR COINCIDENCE into a problem-solution pair.

Problem-solution
approach not suited
for game design

After identifying another pattern candidate called REACHABLE LOCATIONS, in which we tried to capture the necessity of tourist-oriented games such as `GroupAixplorer` to be accessible to all people, we realized something else: game design largely depends on the intended target audience of a game and what kind of gameplay the game designer wants to create for this audience. For example, while REACHABLE LOCATIONS is certainly a very good idea if a designer wants to reach a wide audience and in the case of public buildings, accessibility might even be required by law - a game

Game design full of
exceptions and
specific to target
audience

like `Geocaching` [2000] actually draws its appeal from hard-to-find and hard-to-reach locations. These kind of decisions have to be made by game designers all through their design process, starting with the very basic idea behind their game.

Fundamental
decision: How to use
location?

For example, one of the most fundamental decisions in the beginning is the one we tried capturing with the patterns LOCATION AS INPUT and LOCATION AS CONTENT: does the proposed game actively use the location it is being played at as part of the gameplay? In the case of an interactive tourist game such as `GroupAixplorer`, this is clearly the case: it relies on the players solving quests, which often can only be done by having a close look at the room they are in. A big consequence of this is the game being tied to the location: it is impossible to play `GroupAixplorer` anywhere but in the town hall of Aachen. `Ingress` [2013], on the other hand, can be played more or less all over the world. It uses the information about where the player is to show her virtual game elements such as "portals" in her proximity. Since these game elements are *virtual* and can be placed by players (pending approval by game administrators), they are practically independent of the real-world location. Clearly, this is a fundamental design decision which has a big impact on all following decisions and the whole design of a game, however it is difficult to consider it a design *problem*.

Describing gameplay
or guiding designer?

As mentioned in the chapter about their book, Holopainen and Björk made similar observations and ultimately, combined with their intentions of supporting a creative design process, decided on a very *descriptive* pattern format for their collection. Applying this to our candidates, such as LOCATION AS CONTENT and LOCATION AS INPUT worked quite well. We however feel that due to this focus on *describing* gameplay, they can not *guide* the designer through a design process. It is clearly impossible to provide an empiric analysis for every part of gameplay, with results that indicate what kind of player finds which kind of interaction appealing, so we do not attempt to do this. Instead, we use a slightly different format for our patterns which we think results in them putting more value on gameplay being appealing for players.

We completely agree with Björk and Holopainen: for their collection, which is very extensive, covers many aspects of gameplay and includes very abstract patterns such as "Combat", their approach was and still is the only possible way. However, for a pattern language such as ours, which is focused on a very small part of the design space containing all games, we think that the format we created might be better suited. We especially like the thought Björk and his co-author have in the beginning of their book, on page 5: much like a spoken language, game design pattern languages should have dialects and slang. So, consider our language a local dialect of theirs: it has slightly different spelling (the pattern format), a simpler grammar (only one kind of relation between patterns) and its own vocabulary (the patterns themselves). In any way, we suggest that any future designer who wants to design a location-based game should start with their pattern collection before delving into ours: after all, location-based games are still games and as such, everything in "Patterns in Game Design" [Björk and Holopainen, 2004] is applicable - and helpful.

Our pattern language: a dialect of "Patterns in Game Design"

3.3 Resulting Format

Thinking about the kind of decisions game designers have to make, we came to the conclusion: these are artistic decisions. Video games are an interactive medium and at their very core is always some artistic idea. This is why we looked at publications with a focus on this artistic aspect of games. In [2009] Staffan Björk, together with Sus Lundgren and Karl J. Bergström published a paper with the title "Exploring Aesthethic Ideals of Gameplay"[Lundgren et al.]. The ideals they mention in this, such as "*Tempting Challenge*" or "*Simplicity*", while not captured in a strict pattern format, reminded us very much of the original design patterns by Alexander. He put great effort into describing the conflicting forces at work in architectural problems, which we can immediately see in "*Tempting Challenge*": if a challenge is impossible to overcome, players will not bother trying, if the challenge is too easy, players will not feel satisfaction in overcoming it.

At the core of game design: artistic decisions

Patterns built around
ideal

This is why we decided to essentially build our whole patterns around an *ideal*, which the pattern tries to reach. We think the concept fits in well with the process of game design and that most people would agree that an ideal is something that is actively pursued, very hard to reach, can be compared to other ideals, and there are many possible ways to pursue it.

3.3.1   Name

Name represents
pattern in
communication

The name of design pattern has to be carefully constructed, as it will be the one part explicitly used in communication. Consider a group of architects who all have read Alexander's [1977] pattern language - one of them suggests framing an area with a SITTING WALL. She does not have to describe what a sitting wall is in general and she does not have to describe the specific elements in the pattern, just the name is sufficient to evoke the same kind of concept, image or design in the minds of all present - as long as they all have read the pattern. In many ways, the name "becomes" the pattern, or the pattern is equal to the name, representing all the concepts and ideas captured in the pattern in a few words or half a sentence. For ordering purposes, this element of design patterns often contains an unique identifier, such as a number. However, like Björk and Holopainen, we have decided not to use such an identifier: Alexander's language has a (mostly) clear spatial ordering, while we could not identify any obvious ordering in our language apart from bi-directional relations between patterns. Additionally, the limited extent of our language (compared to Alexander's) makes such an identifier unnecessary.

3.3.2   Design Ideal

What the pattern *and*
the designer are
trying to achieve

This part is a short description of what this pattern is trying to achieve. In many ways, it can also be considered a description of what the game's designer is trying to achieve: this should make it possible to "browse" through our patterns and find the one needed by skimming the top part of the pattern, much like one would look for the problem

statement in a problem-solution based pattern language. If the designer knows what he is trying to achieve, the pattern with the same goal should offer him ways to do so.

In our experience, this can be as hard to find and to capture in written form as the problem statement in Alexander's format and we certainly do think that our patterns need more feedback and iteration especially on this part.

We chose to call this part "Design Ideal" and not "aesthetic Ideal" or just "Ideal" because while we like the artistic connotation of the term "ideal", many other factors influence the design process, removing the "aesthetics" from focus. In our search for design challenges specific to location-based games, we encountered many that were related to the technical side of these games, such as COPING WITH UNCERTAINTY, which resulted in the term *Design* being much more fitting than *Aesthetic*.

Focus on design process

3.3.3 Design Solutions

This is the main part of the pattern, offering ways towards the ideal. It should start out with a short description offering more insight into the ideal and illustrate it further through examples, either from hypothetical games or real ones. In this version of the language, we tried to only include examples that we cover in our chapter on related work in order to avoid lengthy descriptions of games in each pattern.

Ways towards the ideal

This part should be clearly focused on being a *guide* through a design decision: not only should it offer descriptions of the ways towards the ideal, but it should also show which way is better suited for a given situation. As a rule of thumb, this requires at least one example for each introduced design solution and an explanation of why a solution is a good idea. The trade-offs between different solutions towards the ideal need to be made clear, for example between ease of implementation and appeal to players.

Guide through design decisions

Obviously, links and references to other patterns should be used whenever possible to guide the design process not only within one pattern, but through the pattern language.

Connections to other patterns

These links should be used to help with the decision about which design solution is most appropriate in a given situation, and should also make it clear what consequences might arise from using this solution. It should be especially stressed if a solution absolutely necessitates a follow-up decision described in another pattern.

3.3.4   Trade-Offs

Gameplay is
interconnected

Trying to achieve the ideal in a pattern by implementing one (or more) of the design solutions will have impact on the gameplay of the whole game. We use the part "Trade-Offs" to clarify the most important consequences that would follow out of the "use" of one of the solutions offered in this pattern. As we described above, game design is a process that is very much a balancing act between conflicting forces, for example between the desire to reach a wide audience and gameplay that is very appealing to only a small number of players, such as in REACHABLE LOCATIONS.

3.3.5   Inspiration

Insight into thought
process

By providing a concrete overview over the publications and games that inspired us to capture this ideal in a pattern, we hope to provide an additional insight into our thought process. Since pattern languages are supposed to be evolving constantly, we hope that in the case of patterns where we have not yet succeeded in explaining the ideal and/or solutions to the reader, the material mentioned in this part might help readers to provide us with better feedback. Additionally, this allows readers interested in a specific pattern to find both more games that use the pattern as well as the scientific publications that offer a better explanation for their use of this design.

3.3.6 Related To

This part simply serves as an at-a-glance reference to all patterns "related" to this one. In our language, relations are simple bidirectional links between patterns, we consider collecting them at the end of the pattern helpful because, depending on the format (e.g. online or print), references to other patterns might be hard to spot when used in "Design Solutions".

Overview over relationships

3.4 Comparison to "Patterns in Game Design"

3.4.1 Semiformal Descriptions

In their definition of game design patterns, Björk and Holopainen explicitly call them "semiformal". Obviously, design patterns are always formal to a certain extent since they have a strict format, which all patterns in a language adhere to. By "semiformal", the authors mean that game design patterns should describe gameplay in a general way and not rely on quantifiable measures. They think that the design process is full of ill-defined problems, which results in the fact that "any specification of gameplay that relies on measures would be too precise to be of practical use" [Björk and Holopainen, 2004, page 35]. We fully agree with this, as it matches our own experiences with game design as described in our initial approach.

Game design full of ill-defined problems

3.4.2 No Illustrations

Visual aids are central to both Alexander's original pattern language as well as many HCI design pattern languages. The two most prevalent visual aids used are a "sensitizing image", which should give a reader an immediate idea of the conflicting forces at work in a given situation, sensitizing him for the problem in the pattern. Additionally, the solution should not only be described in text-form, but

Visual aids not fitting for game design

captured in a hand-drawn sketch as additional help. While these two work well in the field of architecture and HCI design, Björk and Holopainen's language contains no illustrations or photos - and neither does our language. Game design is a very abstract process and does not lend itself to static illustrations or pictures.

3.4.3   Relationships

Five types of
relationships

Maybe the most striking difference between "Patterns in Game Design" and our pattern language is the five different kind of relations between patterns in the book, while we use only one kind of relation. The relationships used in the book are: "instantiates", "modulates", "instantiated by", "modulated by" and "potentially conflicting with". We decided not to differentiate the connections between our patterns in such a detailed manner for two reasons, the first of which simply is the size of our pattern language. While Björk and Holopainen provide 200 patterns, we provide just over 20, with a lot less connections per pattern. Simplifying the relationships would be a disadvantage for their collection, reducing the detailed insights into the interconnectedness of game design they provide. And as a second reason, their language is a lot further along in the general evolution of a pattern language: a lot more time, work and feedback went into their patterns, making it possible to find distinctions between modulation and instantiation.

Too early in our
process for more
than one type

In our language, we are not yet sure about some of the patterns we present and are most certainly not classifying any pattern as "finished", therefore we consider it premature to go looking for more kinds of relationships between our patterns. Additionally, we feel that the subtle differences between modulation, instantiation and conflicts can also be expressed through a description in the texts of "Design Solutions" and "Trade-Offs".

3.4.4   Name

No change needed

It should not come as a surprise that we did not change

this part of a game design pattern: It is the most constant part, present in most if not all design pattern languages, for its function is to make patterns identifiable. Changing this part could only be detrimental to the ability of a pattern language to serve as a tool for communication.

3.4.5   Core Definition

This is a significant change between Björk and Holopainen's language and ours, as we changed this definition into our "Design Ideal". All the main reasons for why we did this were mentioned already but can be summarized by this: we think our patterns are better summarized in one line through *what they can achieve*, not through *what they are*.

Changed into Design Ideal

3.4.6   General Description and Using the Pattern

These two points obviously converged into our part "Design Solutions", as they have the same intention. Since the authors have different kinds of relations, they chose a more separated format: "General Description" contains no links to other patterns while "Using the Pattern" contains references to patterns through the "instantiated by" and "modulated by" relations.

Only separated due to multiple types of relations

3.4.7   Consequences

The intention of this part is quite close to what we try to accomplish with "Trade-Offs", but, again, this part contains mostly certain types of related patterns, namely those it "instantiates", "modulates" and "potentially conflicting with".

Only changed in name

3.4.8   Relations and References

We use these parts practically in the same way as Björk and

Only stylistic changes

Holopainen, but switched the order of these two points and renamed them slightly - which was mostly a stylistic choice.

3.5   Workshop

Identified key issue
in discussion

In this section, we will explain what kind of feedback we collected during the creation of this pattern language. Our primary goal was to implement a writer's workshop as used in the design patterns community and improve our pattern language based on feedback given by domain experts. However, instead of sticking to the strict format of the writer's workshop, we let it devolve into a free-form group discussion. In the end, this was a very good decision, as it allowed us to identify a key issue of location-based games. We think this ultimately improved our design patterns much more than a strict following of the established protocol would have. In the next part, we are going to give an overview of our plan for the workshop - followed by a description of how the group discussion helped us identify this key challenge.

3.5.1   The Plan

Writer's workshop:
established tool

The Writer's Workshop [Gabriel, 2002] is an established tool in the design patterns community to provide structured feedback to pattern authors. Pattern authors send their pattern languages to a group of participants so these can prepare for the workshop. During the workshop, feedback is given to the authors in a very structured and precise procedure, which is as follows:

1. The author welcomes the participants, cites a sample sentence of his or her pattern to remind of its core idea, and steps back to become a silent listener to the discussion.

2. One moderator summarizes the pattern.

3. Suggestions for things to keep (form and content).

4. Discussion about improvements (form and content).

5. Sandwich: summarize positive points.

6. Author joins the discussion and asks clarifying questions in a non-defending manner.

7. Before moving to the next pattern, talk about something unrelated.

This strict format has been proven to produce very valuable feedback for the pattern author, for example at the PLoP (Pattern Languages of Programming) conference series. It is however a very time intensive tool and therefore difficult to implement, at least in its envisioned format.

A further established tool of the community is to have a domain expert (from the domain targeted by the pattern language), who has experience with design patterns, to *shepherd* a pattern author, providing him with initial feedback. This is used for example in the submission process of the PLoP conferences in order to help pattern authors improve their submissions before a writer's workshop.

Shepherding: another tool of the pattern community

Since both the writer's workshop as well as shepherding require a considerable investment of time and effort of the shepherd and other participants, we tried to trim the format a little bit. From our own experience with writer's workshops (and software user tests), one of the truly eye-opening feedbacks is seeing your own work described from another person's perspective. This is included in the writer's workshop in point 2 and the fact that the author is a silent listener for most of the process. Our goal was to achieve this by:

Both tools: very time-intensive

1. Split participants into pairs.

2. Give each pair 1 pattern and 10 minutes to read and discuss it with each other

3. Have each pair summarize the pattern to the other participants.

4. Have each pair give their feedback for the pattern they read.

5. Have the other participants give spontaneous feedback for the patterns they did not read.

6. Author joins the discussion and asks clarifying questions in a non-defending manner.

Workshop
participants

Additionally, instead of providing the patterns to the participants before the workshop, this was the first time reading the patterns for most of them. Carl Huch, a diploma thesis student at the Media Computing Group who, at the time, was working on a location-based quest game (for his own thesis), had already read most of the candidate patterns and provided some initial feedback. The other participants were Gero Herkenrath, supervisor of this thesis, Joachim Kurz, a master thesis student at the Media Computing Group and Mostafa Akbari. Joachim is not primarily involved with any projects related to location-based gaming, which we considered essential, since such an outside perspective can only be helpful to identify passages in the patterns that can not yet be understood by people who are not experienced in the target domain. Gero can be considered an expert in the domain of location-based games as he has been involved in numerous research projects from this field, namely `GroupAixplorer` [2011], `iCatch` [2011] and `Aachen Horror` [2012]. Mostafa was not only involved in research on mobile applications, especially location-based services, but is also a co-founder of the start-up Bitstars[1] which focuses on augmented reality projects, including games using augmented reality. All of these participants were familiar with the concept of design patterns.

3.5.2   A Start according to Plan

Helpful feedback
collected

The first round of patterns went more or less exactly according to the plan described above. All participants agreed that the format we chose was viable and showed promise, however they also agreed that we did not always succeed in using the format to its full potential. This was

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[1]www.bitstars.com

made especially clear for the "Design Ideal" part of the pattern: while all liked the idea of expressing the core idea of a pattern this way, in all patterns the stated ideal was considered to be too descriptive and not really capturing the goal towards which the game designer should strive. This ultimately lead to a complete re-writing of all ideals for the current version of this language, which we have not yet evaluated in a second workshop. Additionally, all participants suggested to keep the part "Inspiration" in the format but to ensure a reader can clearly identify what games were the primary source of inspiration and not just to repeat all the examples mentioned in the pattern already.

3.5.3 Discussion: What is a Location?

Beginning with the second round of patterns read and evaluated by the two pairs of participants, a general discussion started to evolve. Since those two patterns were LOCATION AS CONTENT and LOCATION AS INPUT, participants started talking about the different kind of locations one can imagine. When we revealed a pattern candidate concerning this called THE ROLE OF LOCATION, the discussion started to focus on communicating about locations.

Location can for example mean the GPS coordinates of a point on the earth's surface. A location can also be a building such as the Aachen Cathedral. But it can also refer to something very small-scale, such as the statement "I'm sitting at the head of the table" - the head of the table is most definitely a location. And it can also refer to something more abstract and fluid such as the region around Aachen - there might be a formal definition for this, but in most cases, people will form a consensus among themselves about what they still consider close enough to Aachen to be in its region while on the other hand something slightly more to the east will be in the region of Düren. In other cases, there might not be such a consensus: let's assume you give someone the instruction to meet you *in front of* a certain building. This building has multiple entrances, none of which is clearly labeled as a main entrance, and the friend you want to meet is from out of town. It is highly likely that further clarifying questions need to be asked or

Discussion: What is a location?

Examples for ambiguity of term "location"

you might miss each other, since *in front of* this building might have different meanings for you and your friend.

Pattern language needs to address communication issues

This ambiguity is not surprising (obviously not every word in a spoken language has one and only one meaning) and in many cases, the context will give a clear indication of what kind of location people are talking about. However, during this group discussion, we agreed that for effective communication in a team designing a location-based game, a more clear-cut distinction would be needed. And since pattern languages in general are very much focused on helping with this communication, we strongly felt that providing some solution to this was essential for this pattern language.

3.5.4 Proposed Solution

Difference between how humans and machines perceive locations

During the discussion, one suggestion was discussed and accepted as probably the best way to reduce the chance of misunderstandings occurring. It is based on the difference between how a machine, such as a mobile phone, and a human being perceive "locations". For now, machines see this information as a set of data, such as a set of GPS-coordinates or a collection of signal strengths received from surrounding Wi-Fi networks. The proposal was to call this kind of information a *position*. On the other hand, we would use the term *location* every time this position would have some kind of *meaning*, derived from its context.

Example: Aachen Cathedral

While this might sound arbitrary, an example should help illustrate our idea behind it. Think of a big church such as the Aachen Cathedral. If people talk about it, they can use this location for navigation ("When you see the cathedral, just go towards it") or as a meeting point ("Let's meet in front of the cathedral") or in many other ways. Most of these references even work for people who have never seen the cathedral before, since contextual clues (tourist gatherings, size, architecture etc.) quite clearly identify the cathedral. However, a digital device has no such implicit understanding of it: all GPS-coordinates are just a set of numbers in the same format. Only if and when a human being tells the device to distinguish a set of coordinates from the rest

and to call this set "Aachen Cathedral" will it be able to tell the difference.

We decided to capture this idea in the first pattern of our language, POSITION VS. LOCATION, which we also consider the best starting point for new readers, since this difference between *position* and *location* is essential to better understand patterns deeper in the pattern graph (see figure 5.1). While this could just as well be a definition outside of the pattern language (perhaps like the theoretical framework in "Patterns in Game Design"), especially since it not necessarily affects gameplay directly, we however feel it should be a central part of it. This allows for the collection of patterns to be used on its own, outside of this thesis. Additionally, it clarifies our intention to enhance the communication of teams designing location-based games: This is not an attempt at re-defining the words "position" and "location", we simply propose to use them in a certain way for the context of discussing location-based games.

Capture solution in central pattern

In summary, we encountered many communication problems when talking about "locations". Our proposal to reduce misunderstandings in discussions about location-based games is to refer to data such as GPS-coordinates as *positions* while every position with a meaning derived from its (human) context should be refered to as a *location*.

Summary: communication problems identified

3.6 Evolution of Patterns

From the initial few pattern candidates to the version of the pattern language included in this thesis, many aspects of it were changed. Some patterns only received minor changes such as the addition of examples, others were created and added to the language. One was dropped completely, while a few were drastically changed and barely resemble their initial form. Since this process was mostly a very fluid one and not captured in clear, iterative steps, there is little sense in comparing initial and final versions of patterns in detail. Instead, in this section we will give an overview over the major changes to patterns and the language itself that happened during the time spent working on it.

Documentation of how patterns changed

3.6.1   Impact of the Workshop

Consistency of
position and *location*

In the section above, we describe how the workshop we held helped us identify a key issue that could hinder communication about location-based games. Our solution to this was to create a pattern we call POSITION VS. LOCATION that can serve as a starting point in the language. This pattern should help alleviate potential communication problems and ideally help readers to better understand the other patterns we wrote. This had severe impact on the patterns that already existed at that point and required us to ensure the use of the terms *position* and *location* was consistent throughout our collection. While in many cases this only required simply replacing location with position, the impact on the pattern candidates LOCATION AS INPUT and LOCATION AS CONTENT was much bigger. In the end, based on the feedback given in the workshop about our "Design Ideal" and this new approach to communicating about location in location-based games, we decided to completely re-write both candidates. We think that the current versions (after some additional small stylistic changes and addition of examples) of POSITION AS INPUT and LOCATION AS CONTENT, combined with the pattern POSITION VS. LOCATION, serve as a much better description and explanation of what we consider to be one of the central design decisions faced by designers of location-based games.

One position, many
locations

Additionally, during this discussion, we realized something that follows the decision to use the terms *position* and *location* in the proposed way: One position can belong to multiple locations. This was the motivation behind the creation of the pattern LOCATION GRANULARITY, in which we try to illustrate how this can have severe effects on gameplay.

Feedback collected
on several patterns

Before the workshop turned into a (fruitful) discussion about locations, it actually provided some very useful feedback for several other pattern candidates, namely DESIGN FOR COINCIDENCE, PROVIDE COMMUNICATION CHANNEL, and USE LANDMARKS FOR NAVIGATION.

More examples for
achieving
coincidence

The feedback for DESIGN FOR COINCIDENCE was generally

very positive, however people stressed how difficult it was to actually achieve this use of coincidence. The lack of examples was especially criticized as they might help a reader to better understand how to include real or fabricated coincidences in a location-based game. The version included in this thesis contains not only more references to APPARENT FRAME - a pattern created after the workshop describing how players perceive events in a location-based game, but we also added two explicit examples from two of the publications that served as the inspiration for the DESIGN FOR COINCIDENCE pattern.

The biggest criticism for PROVIDE COMMUNICATION CHANNEL was the limited number of channels actually mentioned in the pattern. The workshop participants suggested several more, non-traditional channels such as visual "breadcrumbs" through which players can leave clues for other players. Additionally, it was pointed out that communication about a game can happen outside of the game, for example in online forums. In the current version, the pattern COMMUNICATION CHANNELS contains more examples of channels, points out the possibility of outside communication and contains a much larger Trade-Offs part, which was expanded to stress the problems arising from playing a game in public spaces.

Communication can happen outside of game

Concerning USE LANDMARKS FOR NAVIGATION, the participants pointed out that using landmarks only for navigation would mean ignoring the many other ways they can be used in location-based games. While some of these uses are covered in LOCATION AS CONTENT, too, the consensus was to include all these possibilities in one pattern simply called LANDMARKS. This pattern is included in this thesis and barely resembles its original version since we completely re-wrote it, pointing out several ways other than navigation in which landmarks can be used in the gameplay of a location-based game. Furthermore, we expanded on the properties of landmarks to help illustrate why we consider them ideal both for navigation as well as gameplay. And lastly, after the previously mentioned creation of the LOCATION GRANULARITY pattern, we also added how LANDMARKS can help avoid misunderstandings caused by this granularity.

Use of landmarks not limited to navigation

3.6.2   Technical   Challenges   in   Location-based Games

Addressing technological challenges through game design

Several of the publications in our literature review deal with the technology behind location-based games, most importantly "Coping with uncertainty in a location-based game" by Benford et al.. At times, we were not sure if these technological challenges truly belong in a pattern language focused on gameplay, but after realizing just how severe the impact of technology can be on the player's experience of a game, we decided on including them. Additionally, in these cases the technological challenges could be addressed through gameplay design. The two closely related patterns dealing with these challenges are COPING WITH UNCERTAINTY, named after the paper, and NETWORK INFRASTRUCTURE. These serve to illustrate the problems arising from the technologies used in mobile games in general, but we can only offer very general ideas to solve such problems. Since the underlying technologies are constantly evolving and problems are very context-specific (for example, some areas have perfect cell reception, others do not), we simply can not offer any better, more specific solutions. This goes back to the earlier thoughts of us - and of course Björk and Holopainen - on why the problem-solution approach does not work well for game design patterns.

3.6.3   Patterns in Game Design

More specific versions of existing patterns

While the book by Björk and Holopainen is of course a major influence behind this thesis for many reasons, there are two patterns specifically created due to their work: CO-LOCATED MULTIPLAYER and CHANGE PERCEPTION OF REAL WORLD PHENOMENA.

Since, we consider our pattern language a dialect of theirs, we did not write and include patterns their collection already features in sufficient detail, such as MULTIPLAYER. However, we consider *co-located* Multiplayer to be an interesting property of many location-based games and decided to include it.

Since the original publication of their pattern collection, Björk and Holopainen have created a wiki in which they not only included all patterns from "Patterns in Game Design" but many more, often as a work in progress. When browsing through it, we came across the pattern CHANGES IN PERCEPTION OF REAL WORLD PHENOMENA DUE TO GAMEPLAY [Björk, 2012]. This inspired us to write a similar pattern, which has a more narrow focus on the changed perception of the locations and environment a location-based game is being played at. We also included a paragraph about how players might change their perception of their own physical prowess since location-based games can require much more physical activity than a game played at home.

3.6.4 Immersion in Location-based Games

As we explained earlier, after coming across Markus Montola's thesis we started looking more and more at other research from the field of pervasive games or, to be more specific, the field of pervasive Live-Action Role-Playing Games. Initially, we did not include patterns related to role-playing in our preliminary drafts of the pattern language, our reason being: most location-based games might not be role-playing games, therefore patterns related to role-playing should not be a priority. This might have been a bias from our own research on interactive tourist systems such as the `GroupAixplorer`, but in the end, we reversed our decision and included the patterns IMMERSION and AUTHENTIC ACTIVITY in the collection. We think the unique possibilities for role-playing and deep immersion into a narrative or a fictional world that are created by playing a game in a pervasive manner are too important to be left out of this version of our pattern collection.

Pervasiveness allows for immersion

3.6.5 Games in Public Spaces

While the pervasiveness of location-based games certainly allows for very unique and appealing gameplay to be created, we are quite sure that many challenges arise from this.

Challenges from playing in a public space

Unfortunately, feelings such as the feeling of awkwardness are very hard to quantify and therefore, it is impossible to propose any real solutions as to how to minimize it. However, we think the pattern MINIMIZE SOCIAL AWKWARDNESS is one of the most essential patterns in our collection, if only to alert game designers to the social context their game will be played in. We can not predict how much impact the social environment will have on a player and we can offer few concrete solutions to reduce this impact (mostly the EPHEMERAL MAGIC CIRCLE to provide safety in numbers), but we are certain that this is something designers should pay attention to.

3.6.6   Not included: Seamful Design

Over the time spent working on these patterns, the collection either stayed the same size between two iterations or grew because we added one or more patterns. Only one pattern that made if further than the very initial stage of just a few words scribbled down on paper did not make it in any form into the collection in this thesis: SEAMFUL DESIGN.

Could not capture idea in a satisfying manner

The inspiration for this pattern was, among other publications, "Interweaving mobile games with everyday life" by Bell et al. in which the authors introduce a game called `Feeding Yoshi`. They consider this game an example of seamful design, which means to expose the seams in technology instead of hiding them. The seams are the technical limitations that usually impede users or are hidden from them, in the case of `Feeding Yoshi` this refers to the difference between encrypted and not encrypted WiFi networks. While teaching players through such a game how these seams and the technology behind them work might be an excellent idea, we could not find a way to capture this in a pattern that was satisfactory.

3.7   Comments On Using a Wiki to Write Design Patterns

After we saw that Staffan Björk had created a Wiki[2] to collect his existing game design patterns and to work on new ones, we decided to try this approach for our own process. We found that this has several advantages, the first one being asymmetric communication. This allows people to use the built-in option to write and publish a comment on the website containing the pattern, providing feedback that can be accessed by the original pattern author at a later date. Since most wiki systems in use today contain version control, the pattern author can easily revert the pattern to an earlier version, for example when a specific change receives mostly negative feedback.

> Wiki: great for feedback

Additionally, having this digital archive of different versions of patterns and the corresponding feedback should give a good overview of the long-term evolution of a pattern language. However, it is important to note that digital feedback should never replace feedback collected through writer's workshops or similar events, it can only augment this. For example, we identified the communication problems when talking about "locations" through a discussion in our workshop, not through feedback given online.

> Longterm archive of changes

However, we did not yet fully use the potential we see in wiki-systems for pattern languages: we only used it for "internal" communication, i.e. for people of the media computing group providing feedback. We can absolutely imagine that in the near future, collaborators from research institutes and game studios spread over the globe could help provide feedback through such a website. Of course, the competitive nature of game studios trying to sell location-based games could actually hinder such a development since sharing their knowledge about game design might be conflicting with their business interests.

> Could be used for collaboration on patterns

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[2]https://amedeo.informatik.rwth-aachen.de/groups/designpatternsforlocationbasedgames/

Chapter 4

Related Work

"If I have seen further it is by standing on the shoulders of giants."

—*Isaac Newton*

In this chapter, we will show work by other authors that has had major influence on our design patterns. Since many of the games that we use as examples in our patterns are taken from research papers, we introduce these papers and games in quite detailed fashion. We have to rely mostly on examples taken from research instead of commercial products because there are (so far) very few commercial location-based games available. This approach of basing our design patterns on existing games is based on the idea to "harvest patterns" by Björk and Holopainen.

4.1 REXplorer and GroupAixplorer

`REXplorer` [2007] and `GroupAixplorer` [2011] are interactive tourist guides developed by the media computing group and therefore driving forces behind the creation of this pattern language.

4.1.1   REXplorer

Goal: make learning fun

`REXplorer` is, at its core, a game designed to make learning history fun for tourists in Regensburg. It allows players to "cast spells" by waving a mobile phone like a magic wand in order to communicate with "spirits". These spirits are historical figures, associated with specific historical buildings.

Influence on several patterns

Of course, since the game has the primary goal of educating players about the history of Regensburg, it is a clear inspiration and example for CHANGE PERCEPTION OF REAL WORLD PHENOMENA. And, since it was the first location-based game we had a look at, it was of course the basic idea behind the very first pattern candidates, most notably LOCATION AS CONTENT. Lastly, the pattern LANDMARKS was also strongly influenced by this game (and `GroupAiplorer`, too) being played at historical sites.

4.1.2   GroupAixplorer

Focus on communication and collaboration

Since museum audio guides tend to isolate visitors from each other, the aim of the `GroupAixplorer` was to alleviate this problem through a collaborative quest game. These quests require a group of up to five people to find specific exhibits in the museum and solve a question related to the exhibit. Additionally, historical facts and anecdotes are mediated audio-visually by the devices during the game. The game is built using an existing museum guide called Aixplorer[1] . Two things are noteworthy: the headphones are monaural and a function was implemented that allows a single player to send a predefined text message to the group members, asking them to come to her location. These two decision influenced our pattern COMMUNICATION CHANNELS, where we consider it especially noteworthy to support natural communication (mentioned in the Trade-offs part of that pattern). The monaural headphones allow players to talk to each other without missing parts of the audio, while stereo headphones would hinder communication in the group.

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[1]www.aixplorer.de

Of course, since the players solve quests together, the `GroupAixplorer` is one of the inspirations behind CO-LOCATED MULTIPLAYER as well. Finally, the user study and evaluation show examples of PLAYER CONFUSION: For one quest, the players were tasked with finding a certain painting in the Town Hall of Aachen. Due to ambiguity in the description, one group of players "found" the wrong painting, which led to them listening to an audio segment about Francis II while standing in front of a painting of Napoleon Bonaparte.

4.2   Design for Coincidence

"Design for coincidence: Incorporating real world artifacts in location based games" by Josephine Reid, published in [2008], is one of the key works our pattern language is based on.

The main influence Reid had on our work is the fact that she encountered the same problem we did: the central question of what *role* locations can play in games. She calls this the "relevance of place" and illustrates this with figure 4.1, placing example games along this dimension. Her descrip-
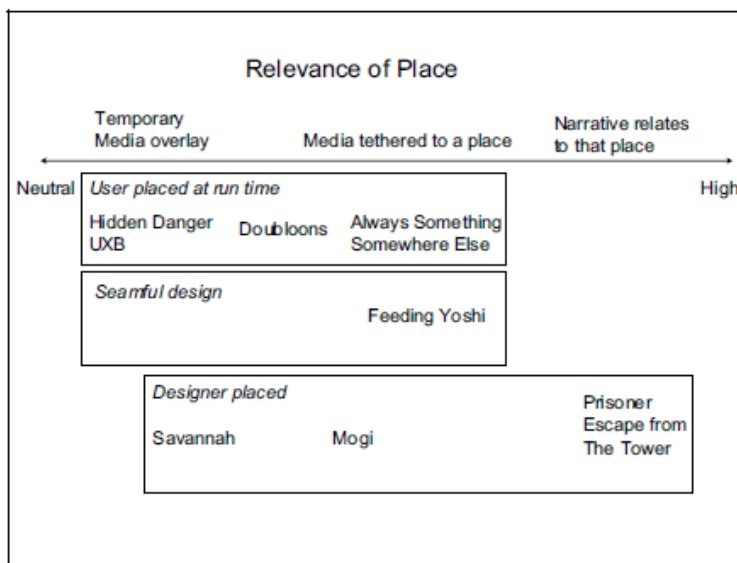
Encountered same problem we did

Figure 4.1: Figure 1 from "Design for Coincidence" [2008]

tion of the difference between "place" and "space" and our own communication problems caused by the ambiguity of the term "location" lead directly to the decision to create and include the pattern POSITION VS. LOCATION. As a top-level pattern, our goal is to remove this ambiguity, at least for the context of our pattern language.

Provides overview over several location-based games

Furthermore, she gives an overview over several location-based games that we use as examples in our pattern language. Most of them are covered in other sections of this chapter, one however should be introduced in detail here: `Prisoner Escape from the Tower of London`. In this game, players receive a GPS-enabled PDA with an Active RF receiver. The players' goal is to help virtual historical figures to escape from the Tower. Activating and progressing missions was triggered by reaching certain locations in or outside of the Tower - GPS was used outside to determine if the player reached a game location, RF transmitters were used inside. The crucial aspect of the game that resulted in the creation of the pattern DESIGN FOR CO-INCIDENCE are the two ways the game combined virtual and real world artifacts.

Make virtual action more relevant

The first way was by having the players look for a virtual guard (he was part of a mission) at a part of the Tower were the "Beefeaters" are often found. The design goal was to increase the player's chance of seeing a real guard while looking for a virtual one to make the virtual action seem more relevant.

Social and feigned coincidence

The second way had an even more profound impact on player behavior: some of the "Yeoman Wardens" (the guards) were carrying active RF transmitters. When a player helping a prisoner came close to such a transmitter, they would be "caught", receiving an audio message telling them of this. Even though not every guard was carrying such a transmitter, once players knew that some were included in the game in this way, they treated all the guards as "threats". Players were observed running away from guards (which would sometimes chase them in a playful manner), and carefully checking around corners, since the layout of the tower makes it impossible to know beforehand whether you are running into a guard or not. Because the guards continued with their every-day duties, the en-

counters between players and guards are non-predictable - Reid calls this *social coincidence*. The difference between this and *feigned coincidence*, which Reid introduces next, is the fact that guards were part of the game while continuing with their everyday duties. Once a designer, for example, hires an actor for nothing but the role he plays in a game, Reid calls it feigned coincidence. However, we do not consider this distinction to be as important in our pattern DESIGN FOR COINCIDENCE: The most important part is the excitement and engagement coincidence creates for the players of location-based games.

This excitement is clearly documented not only in Reid's paper, but also in case studies done by Montola (for example in Montola [2007]) and other researchers of pervasive games such as LARPs and Alternate Reality Games. So, whether the coincidence a game designer achieves is natural, social or feigned (the three categories defined by Reid) is not as important as increasing the player's experience by whatever form of coincidence is appropriate and achievable.

Excitement about coincidence evident in other research

4.3 Interweaving Mobile Games with Everyday Life

In "Interweaving Mobile Games With Everyday Life", Bell et al. introduce a location-based game called `Feeding Yoshi`. Not only is the idea behind the game very creative and a great display of what the authors call "Seamful Design", but their insights into how people actually play location-based games are very helpful. Consequently, their insights have influenced almost all of our patterns and `Feeding Yoshi` serves as a great example of the unique properties and challenges of location-based games.

`Feeding Yoshi` is a mobile multiplayer game, which lasted a week and was played in three locations by three teams. This allowed the researchers to gain insights into how the players try to combine the game and their everyday activities while also gaging the impact of different locations on game-play. The goal of the players was to achieve
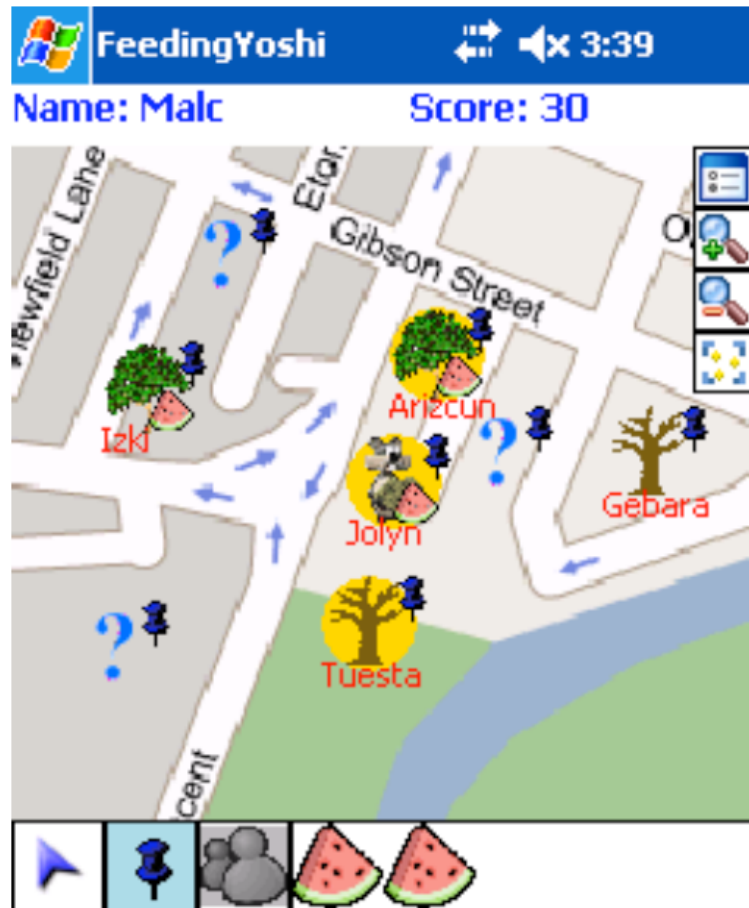
Description of gameplay

Figure 4.2: Figure 1 from "Interweaving mobile games with everyday life" [2006]

a high score by feeding creatures called Yoshis the fruits they desire. Yoshis will always desire 5 out of 7 fruits, and feeding them all 5 at once will score more points than only satisfying one desire, while feeding it a fruit it does not want will cause the player to lose points. Fruits come from plantations, and each Yoshi always carries a seed for the fruit it most often wants. Players can take these seeds and plant them at plantations, causing these to generate the fruit. Players move through a city and will be alerted of nearby Yoshis and plantations through audio and visual alerts. Neither Yoshis nor plantations are randomly placed but rather determined by the local wireless network infrastructure: secured wireless access points become Yoshis and

unsecured ones turn into plantations. Additionally, other player PDAs will be detected and displayed, since players are allowed to trade fruits and seeds. For an example of how the interface of `Feeding Yoshi` looks like, see figure 4.2.

For their main trial, four teams played in three locations in the UK. The locations were chosen for their difference in population density: from Derby, a small suburban city, via Nottingham, a medium-sized city to Glasgow. The players in each team knew each other before the game in order to have a guarantee for them to meet at least once during the game and to encourage playing collaboratively.

Trial in different types of cities

The authors' insights from this trial start with the the fact that, in general, the game was considered to be appealing by the players, especially the aspects of exploration, i.e. searching for Yoshis and plantations. However, there was considerable variety in players' opinion, which the authors attribute to three key factors: the fit of the game with everyday life, friendship and collaboration, and the impact of location. Of these three, the impact of location is the key factor that had the most severe impact on our work.

Three factors influence player feedback

The impact of location in `Feeding Yoshi` was mostly felt by the players through the availability of wireless networks. One of the insights the authors provide is that players start to associate Yoshis and plantations with features of their environment. This would often be a very fine-grained association, such as "Kelly lives by the door of the block" (Kelly being a Yoshi), although the underlying network could be detected elsewhere, too. This is one of the reasons behind our ground-level distinction between *position* and *location* in our first pattern, but also is a major reason for the creation of LOCATION GRANULARITY.

The impact of location

Additionally, the paper provides examples of how the social environment can shape the experience of playing a location-based game. Some players reported walking into other pedestrians, one was even asked if she was lost due to the repetitive nature of the movements required for the game. Even more critical would be feeling uncomfortable or even afraid to play the game: this would happen for example for one player in an area where he would fear the

Impact of social environment

PDA would be stolen. Others reported feeling uneasy playing in areas with security cameras and guards, such as an industrial area. On the other hand, players really enjoyed playing from work, at home or during their commute. All this clearly leads to the conclusion that not only the physical and electronic properties of the location of a game are important for the player experience, but the social features are maybe even more critical to the "feel" of the game. We tried to capture this idea in our pattern MINIMIZE SOCIAL AWKWARDNESS since we are sure that almost all future location-based games will have to consider the social setting as a central part of the player experience.

4.4 The Frame of the Game

Excitement through
implication of
bystanders

"The Frame of the Game: Blurring the Boundary between Fiction and Reality in Mobile Experiences" by Benford et al. is a study of a touring performance called `Uncle Roy All Around You` or URAY which, as noted in their abstract, "reveals how designers generated excitement and dramatic tension by implicating bystanders and encouraging the (apparent) crossing of normal boundaries of behaviour".

Summarized in one
pattern

Our pattern APPARENT FRAME is essentially the summary of their ideas and work in form of a design pattern. Since, additionally, URAY is used in several patterns as an example, we want to give a short overview over this game and the authors' results.

Description of game

Part performance, part game, URAY is a game played by street players and online players - the latter however are not relevant for our work. For the street players, the experience starts with a briefing, performed by actors, during which players receive a PDA but have to hand in personal items such as money, mobile phones, identification and similar items of their daily life. During the next few hours, a series of clues, received via Text Message (mostly sent by the online players) leads them through a limited area (about one square kilometer) of the city. These clues are often ambiguous and require an increased breaking of

social conventions, from "stealing" something off a chained up bicycle to the finale during which they have to get into the car of a "stranger". A key idea of their game is to often implicate bystanders in their game while also having actors behave as bystanders, blurring the boundary between game and reality for the street players.

The paper contains several quotes from player interviews as well as excerpts from the communication between "control" and actors of the game. These two techniques are great for two kinds of insights: Player interviews are great for identifying appealing game-play and the communication of the performers helps in identifying possible challenges and problems for future designers.

Player interviews: very insightful

The primary impact on our work is the creation of the pattern APPARENT FRAME: the player interviews seem to indicate quite clearly that players really appreciate being unsure about who is part of the game and who is just a regular passerby. Of course, this requires a certain willingness of the players to suspend their disbelief and to interact with people in the street who might not be hired actors, but for those who are willing to do so, the pay-off is great. The technique to blur the boundary between gameplay and real life is what Benford et al. call "manipulating the apparent frame", which is the source for our pattern. See figure 4.3 for an overview of the two manipulation techniques, shrinking and extending the apparent frame.

One pattern to summarize core idea

Further impact of their paper extends to our patterns PLAYER CONFUSION, DESIGN FOR COINCIDENCE, MINIMIZE SOCIAL AWKWARDNESS and ETHICAL AND LEGAL PROBLEMS.
Some of the communication excerpts they show are great examples of the difficulty of recognizing when a player is confused and needs help.

Influences felt in multiple patterns

The ambiguity of the text messages, for example to "follow a person in a white t-shirt", is an application of DESIGN FOR COINCIDENCE.

The player interviews show in several instances how the players trust the game designers and are therefore willing to get into the car of a stranger or willing to "steal" some-
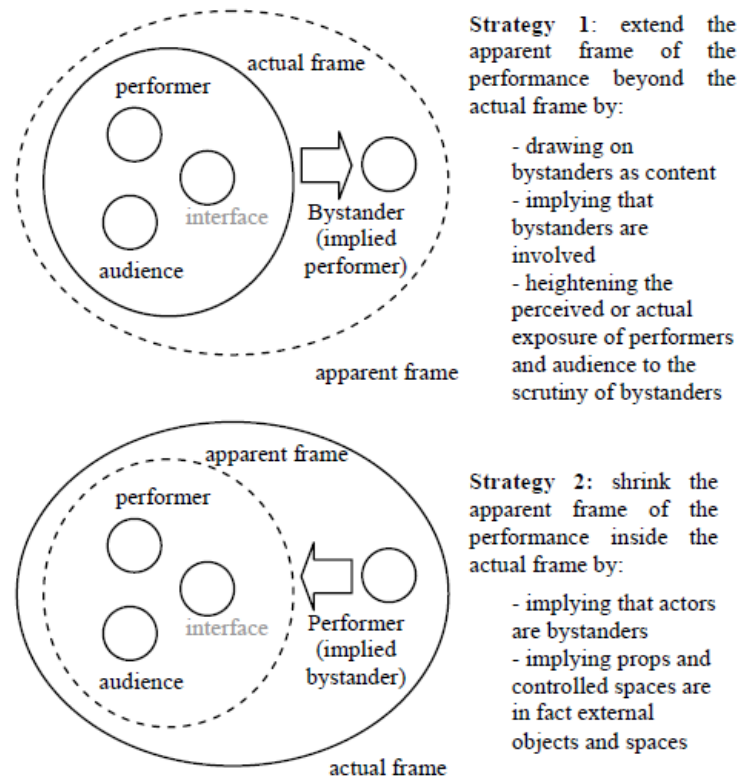
Figure 4.3: Figure 5 from "The Frame of the Game" [2006]

thing. This clearly can lead to ETHICAL AND LEGAL PROB-
LEMS, were designers need to make sure players do not
steal something that is not a prop in the game.

While not a straight-forward example of how to MINIMIZE
SOCIAL AWKWARDNESS - after all, many of the interactions
the game requires are actually quite against social conven-
tions, it shows how trust in the game organizers and the
willing participation in a performance/game can have a
"soothing" effect, actually helping players to break those
conventions.

In conclusion, "The Frame of the Game" is a landmark pub-
lication, with URAY being probably one of the most dar-
ing and inspiring location-based games so far, providing
great insights into the appeal of a blurred boundary be-
tween game world an real world.

4.5   Coping with Uncertainty in a Location-Based Game

"Coping with Uncertainty in a Location-Based Game" by Benford et al. is an article in which the authors describe their "experiences, focusing on uncertainty, in publicly deploying an experimental, mobile mixed-reality game called `Can You See Me Now?`".

Staged at two new-media festivals, 2001 in Sheffield and 2003 in Rotterdam `CYSMN` was created with two purposes in mind: create an engaging experience while testing location-based gaming technology under realistic conditions. At its core, `CYSMN` is a chase game: three professional performers, equipped with hand-held computers, serve as "runners", navigating an actual city. They chase up to 15 online players through the virtual model of a city, where these online players can move at a fixed maximum speed, access a map, see positions of other players and runners and exchange text messages. The goal of the online players is simply to run away from the street players for as long as possible. Scoring is based on the time elapsed since joining the game and a player is considered caught or "seen" when a runner gets within five virtual meters of an online player. The hand-held computers of the runners contained GPS receivers, a screen displaying a map (including positions of virtual players) and a 802.11b wireless connection (see figure 4.4). We will forgo a more detailed description of the game's user interface here.

Chase game: online players versus runners

As is rather obvious from the name, our pattern COPING WITH UNCERTAINTY is based mostly on this article. The researchers show very well how uncertainty, stemming from both the GPS system as well as the network connection has major impact on the game. They use both captured data to gage the actual uncertainty they encountered as well as player comments to illustrate the impact on player experience. Additionally, the researchers suggest two approaches to deal with these problems (*hide* or *reveal* the uncertainty), providing a great basis for our pattern.

Core insights turned into one pattern

Since the uncertainty is caused by the technology behind

Influences in two other patterns

Figure 4.4: Figure 2 from "Coping with Uncertainty in a Location-based Game"[Benford et al., 2003]

location-based games, it is no surprise that the pattern NETWORK INFRASTRUCTURE is strongly related to COPING WITH UNCERTAINTY and therefore influenced by this article, too. Some additional impact can be seen in PLAYER CONFUSION, as one of the major problems that could be game breaking in CYSMN was when players did not understand how they were caught - the runners simply were not always showing up correctly due to signal loss and similar problems.

In summary, "Coping with Uncertainty" is a great article showing some of the key problems developers of location-based games will encounter due to the limitations of technology. By suggesting and explaining two strategies to deal with this, the article is in itself almost a design pattern. While one might argue that it is out-dated since mobile devices and network technology are now considerably better than in 2003, all these problems still exist, as almost every mobile user can attest to. Furthermore, since more and more games are now also using new mobile devices for indoor-navigation and -tracking, the article provides a preview for what kind of problems designers will encounter with these new technologies.

4.6   The three-sixty illusion: designing for immersion in pervasive games

"The Three-Sixty Illusion: Designing For Immersion in Pervasive Games" by Waern et al. is one of the big influences behind our pattern IMMERSION. As stated in their abstract, they present how to "effectively realize an immersive game world through a combination of physical play and technology-supported play". The main idea of the authors is to look at game practices where the real world is already used as the stage, which they find in Nordic style live action role-playing (LARP for short), alternate reality games (ARG for short) and pervasive games. They consider LARP to be the practice that is closest to realizing full immersion, since the approach encompasses "confinement of the players to a carefully staged environment, educating them (in advance) to play their character roles, and leave them to interact with each other and the environment, fully in character, for the duration of the game".

Combination of physical and technology-supported play to realize immersion

The paper mentions three design aspects that together create the 360° illusion in LARPs: *environment perceived as authentic*, *authentic activity* and *immersive role-play*. Our pattern AUTHENTIC ACTIVITY was created based on the second of these aspects, which suited itself very well as a design pattern for location-based games. We are very confident in this pattern since the authors provide several examples from successful LARPs for the use of it. The two other design aspects however were not as easy to transform, however they influenced our IMMERSION pattern.

Design aspects in LARPs

The authors continue by showing how the three-sixty illusion is achieved in ARGs, which is arguably more difficult than in LARPs - LARPs are, in general, staged in closed environments whereas ARGs are often played worldwide and over longer periods of time. They again show how three aspects come together in this case: *online authenticity*, *authentic activity through infinite affordances* and *immersion as performing belief*. For our patterns, it was again the second point that was most influential: by infinite affordances, the authors mean "In an ARG, the scene is unrestricted and the players can travel anywhere, pick up any clues, and impro-

Design aspects in ARGs

vise any action to address a game challenge" [2009]. This results in AUTHENTIC ACTIVITY as it allows players to use the same problem-solving tools for challenges in the game as they would use in their real lives. We also think that these infinite affordances can help if a designer wants to achieve EXPLORATION CENTRAL TO GAMEPLAY.

Design aspects in physical pervasive games

In the next part, Waern et al. describe the three-sixty illusion in what they call "physical pervasive games". We consider this especially important for our work because, as they point out: "The central attraction of pervasive games lies thus not only in their ability to create an illusion of a game world, but that this illusion' spills over' into real life, enchanting everyday places and activities." Since location-based games are often played in the ordinary world, techniques such as the fully crafted environments from LARPs are hard to use to create IMMERSION. The authors write, and we fully agree with them: "The key feature of location-based technology is that it enables the creation of a game world through overlaying virtual content on a physical landscape." This is a core idea behind several of our patterns, from the more general LOCATION AS CONTENT to the specific AUGMENTED REALITY. This is also something we can identify in many other example games in this chapter, such as `Feeding Yoshi` or `Ingress`. Additionally, and maybe even more important, they show the limitations of AUTHENTIC ACTIVITY in pervasive games: the authentic physical actions are severely constrained by ETHICAL AND LEGAL PROBLEMS.

Examples: already covered by other games

The rest of their publication is focused on example games, two of which have their own sections in this chapter: `Interference` and `Uncle Roy All Around You`. The last example, `Prosopopeia Bardo II: Momentum`, aimed at creating and maintaining a full three-sixty illusion for over 30 days for its 30 players. We will forgo a detailed description of this game here, since it offers no examples or insights into IMMERSION not already covered by other games. Additionally, it was focused very much on role-playing aspects, which were not a priority in this version of our pattern language. However, we consider these aspects clear candidates for future patterns and `Momentum` could be a wealth of design ideas and examples for gameplay focused on role-playing.

4.7   Narrative Friction in Alternate Reality Games

"Narrative Friction in Alternate Reality Games: Design Insights from Conspiracy For Good" by Stenros et al. is a study of an Alternate Reality Game (ARG) called `Conspiracy for Good` (CFG). The authors explain that alternate reality games are primarily designed as storytelling vehicles, with their main appeal being the ability to transport player to a fictional world superimposed on everyday life. While `Conspiracy for Good` was, like most ARGs, a combination of online game and live event, for our work the online part was less relevant. We will therefore give a short overview over the problems and design insights the authors uncover for what they call "pervasive, participatory storytelling".

Combination of online game and live event

One of the first insights is how players perceived the grand narrative of CFG, on which their actions had only little influence. In player interviews, completely opposite opinions could be found: some described it as an interactive experience, especially compared to other ARGs they attended, while there were also players who felt like a "follower" of a story, and not as a player in a game. According to the researchers, some players complained about all important choices being made by actors - while actually mistaking other players for actors. This serves as a great example of the APPARENT FRAME from `Uncle Roy All Around You` in action.

Mistaking players for actors

They also provide great examples for when CO-LOCATED MULTIPLAYER can actually be detrimental to a game, explaining how some players felt there was no point in trying to solve puzzles since there were many other players in the group who would solve them faster. These insights combined with "the friction between genre expectations and actual play" the researchers describe next illustrate how designers of a novel genre such as location-based games need to pay close attention to PLAYER CONFUSION. The survey response the authors quote from players describing the "most boring or bad moment of the game" all contain expressions of player confusion, showing how problematic

Bad moments trace back to players experiencing confusion

this can be for pervasive games.

Playing in groups
highly appreciated

One of the positive points (except for the above mentioned problems it could cause) was however the CO-LOCATED MULTIPLAYER because in general, playing in teams was highly appreciated. Especially noteworthy is how multiple players expressed happiness about not having to carry out "awkward" social tasks as others in their team loved doing them. We consider this a very good argument for our patterns MINIMIZE SOCIAL AWKWARDNESS and also the EPHEMERAL MAGIC CIRCLE. Lastly, the study provides, again through player statements, some insights into IMMERSION and AUTHENTIC ACTIVITY. While the authors agree with previous results (from Waern et al. [2009]) in that full immersion is not required for a great experience and players do not expect it, severely immersion-breaking elements need to be avoided. As examples the authors mention "hacking" a security camera by scanning barcodes, which is the opposite of AUTHENTIC ACTIVITY and the game feeling "too safe", when at one event running on grass was prohibited, which did not fit with the general theme of an evil conspiracy hunting the players.

4.8   Pervasive Play, Immersion and Story: designing Interference

Location-based
games should use
the real world

"Pervasive Play, Immersion and Story: designing Interference" by Bichard and Waern, published in [2008] describes the design, staging and evaluation of a pervasive game called `Interference`. One of the first sentences in their abstract has not only influenced our patterns, but is actually quoted in LOCATION AS CONTENT: "The world is a vast and infinitely changing resource of content for pervasive games." While position-based games (see POSITION AS INPUT) such as `Zombies, Run!` can certainly be attractive, we consider this statement of Bichard and Waern to be a perfect explanation of the unique advantage of location-based games over other video games.

Therefore, this idea is central to our whole pattern language

and has had major influence in the patterns LOCATION AS CONTENT, OTHER CONTEXT OF PLAYER, DESIGN FOR CO-INCIDENCE, CHANGE PERCEPTION OF REAL WORLD PHENOMENA and EXPLORATION CENTRAL TO GAMEPLAY.

However, `Interference` does not provide examples not covered in other games - which is why we chose not to include a description of it here. Instead, this quote from the paper warrants a closer look - since it describes a design decision made by the creators of the game:

> "The public performative aspects introduce social tension into the game, intended to make players both more engaged as well as slightly uncertain. Walking around in the (high-tech) city mall carrying a large red doll with a blinking eye was meant to be slightly uncomfortable - perhaps in particular for the male participants. We decided that the players should not need to split up during the course of the game, but always play as a group, to encourage them both to dare to perform strange things in public and increase their engagement in publicly visible activities. Most likely, spectators interpreted Interference as some kind of treasure hunt game."

[Bichard and Waern, 2008, page 5]

This offers a very valuable insight, without knowing the details of `Interference`: Even when attempting to create a feeling of social awkwardness in players, the designers tried to minimize it as much as possible by having the players stick together as a group. This paragraph was the first inspiration for our patterns MINIMIZE SOCIAL AWK-WARDNESS and EPHEMERAL MAGIC CIRCLE since it clearly shows the thought process of game designers creating a pervasive game.

Insight into design decisions and process

4.9   Tangible Pleasures of Pervasive Role-Playing

The paper "Tangible Pleasures of Pervasive Role-Playing" by Montola was published in [2007] and is an overview over the central pleasures of pervasive role-playing. While we focused this version of our pattern language on design challenges other than role-playing, Montola's paper served as a source of inspiration for several of our patterns. The reason for this is the fact that location-based games are played in a pervasive manner and therefore have strong similarities to pervasive role-playing games.

Use insights into pervasive role-playing for location-based games

The first point we consider important is his summary of multiple case studies: "one of the strongest appeals of pervasive gaming is the uncertainty of gameness" [2007]. This is of course central to games such as `Uncle Roy All Around You` and an argument for manipulating the APPARENT FRAME.

Playing in public spaces

To illustrate the problems faced by players playing a pervasive game, Montola translates and quotes a rule from an urban live action role-playing game called `Rikos kannattaa`:

> "When playing in an area with lots of people not participating the game or knowing about it's existence, players must play pretty carefully and with respect towards their environment. Even though every heavy immersionist opposes external restrictions, we must accept them because of the play area." Montola [2007]

This is a clear indicator of the potential problems caused by playing in a social environment, which we address in our patterns ETHICAL AND LEGAL PROBLEMS and MINIMIZE SOCIAL AWKWARDNESS. Later, he quotes a player of a game called `Där vi föll` saying "We were always moving as a group, which created a zone for playing" which we consider an example of the EPHEMERAL MAGIC CIRLE in action.

We found examples of players exploring the real world while playing a location-based games in several games, for example `Feeding Yoshi`. Montola delivers a concise argument for why pervasive games can encourage this exploration: "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." This is a good argument for why location-based games should strive to have EXPLORATION CENTRAL TO GAMEPLAY.

Exploration is fun

And finally, while the tangibility of accomplishments in pervasive games can increase their enjoyment for the player, the author also explains how the player failing has more tangible consequences. Montola mentions players miscalculating coordinates of a hidden stash needed to progress in a game, resulting in players spending multiple hours in "a wrong neighborhood in a rainy October night". We try to address this issue in our pattern PLAYER CONFUSION.

Player confusion has severe consquences

4.10   Life on the Edge

"Life on the Edge: Supporting Collaboration in Location-Based Experiences" by Benford et al. is the study of a location-based educational game called `Savannah`. The authors combined their video recordings of the children playing the game with the recorded data from the GPS-enabled PDAs in order to identify the interactions between player behavior and the technology behind the game. For our patterns, the paper serves as a second source for these issues, the primary being "Coping with Uncertainty in a Location-Based Game" by Benford et al. [2003]. The players in the game were "lions" hunting in a virtual Savannah. Each player had a handheld, GPS-enabled PDA which displayed information, for example a nearby presence of prey, according to the position of the player in the Savannah. The "lions" needed to collaborate, for example to take down a certain prey, but no groups were assigned. Collaboration was therefore highly dynamic and group membership fluid. The game was designed to be portable and can be

Educational game for children

set up on any open space, and as such uses POSITION AS INPUT, not LOCATION AS CONTENT. The insights into how the technology has a severe impact on the collaboration of players are however valid in both cases.

Locale boundaries and player behavior

The first issue the authors identify is the problem of "locale boundaries", with a locale being the zone of GPS-coordinates in which a specific game event is triggered, for example the presence of an animal the lions could hunt down. In their video observations, they noticed that sometimes the child walking in front of a group of other children would stop as soon as they saw the information about nearby prey on their display. The other kids would then also stop, often still outside of the boundary of the locale and could not see the same prey. Additionally, some locales were too small, so that groups of certain size could not actually fit inside them completely. Combined with the general uncertainty inherent in the GPS system, this lead to behavior such as sweeping movements with the PDA or forming very tight inwards circles in order to receive the same information. The authors propose a solution to this: the combination of "two level locales" and "personal auras". We included both these solutions in our pattern NETWORK INFRASTRUCTURE since we think they should help alleviate many of the problems inherent to using technology such as GPS as a basis for a location-based game.

Groups formed by humans in a very fluid manner

The second issue is the difference between how humans organize themselves in groups and how the system perceives this organization - which is of course reminiscent of our problem identified in the workshop. For example, in some of the bigger locales, players would be grouped together by the system although they were not actually collaborating. This happened for example when a group was coordinating an attack on a prey and another player, not working with the group but entering the game locale, started the attack prematurely. This issue show how the fluid self-organization of players in groups and rigid system interpretations do not mix well. However, in contrast to the first issue, the researchers could not suggest very specific solution to this and as such this has not impacted our patterns. However, in the future, we would like to expand our pattern language with more patterns dealing with CO-LOCATED MULTIPLAYER and especially cooperation in

games and would certainly revisit this publication for this.

4.11 Zombies, Run!

`Zombies, Run!` and its successor `Zombies, Run! 2` [2013] are games available in the iOS App Store and the Google Play Store for phones running the iOS or Android operating systems. The game is described as a combination of fitness application and survival game, where the real-life running of a player is accompanied by a story narrated in his headphones. During his runs, the player automatically collects supplies such as ammunition for his base, which he can build up through completing missions. Players can track their running stats such as distance covered, time and pace and share these and their base with other players. The game's story of surviving in an apocalyptic world full of Zombies is told through audio clips written by professional authors and recorded by professional voice actors. We consider `Zombies, Run!` important enough to mention here for two reasons: it is highly successful and a great example of a *position-based* game.

Combination of fitness app and game

First of all, the commercial success of `Zombies, Run!` is undeniable, with more than 450 000 players worldwide according to the official [website](2) of the game. Together with `Ingress`, this might be part of the first wave of successful mobile games that use technology such as GPS as a key part in their gameplay.

Highly successfull

However, we use `Zombies, Run!` not as an example for location-based gaming, but rather for position-based gaming. We have shown in the previous chapter how we arrived at the distinction between *position* and *location*, which lead to the creation of our central pattern POSITION VS. LO-CATION. This running game is clearly only relying on information about the player's position and change thereof for its gameplay, the locations through which she is running are not part of the game - except for when she imagines them to be. The gameplay depends on how fast the player moves, how much she moves and for how long she moves,

Example for position-based game

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[2]www.zombiesrungame.com

but there is little difference in running through an inner city block, a forest or on a treadmill (in which case the game can use the accelerometer instead of GPS to determine player movement) - in many ways the archetype of POSITION AS INPUT.

4.12   Geocaching

Find caches hidden
in the real world

While `Geocaching` can refer to a range of activities, at the core they all are based around finding hidden caches. The information leading to these caches is publicly available on message boards and similar online communities, for example the one run by Groundspeak. In many cases, the person hiding a cache encrypts its GPS-coordinates, so that players who want to find a cache need to solve a riddle first which essentially turns the game into a modern-day version of classic outdoor activities such as paper chase (also known as Hare and Hounds). While in the early days of `Geocaching` it could effectively be played only by people who owned an expensive GPS-receiver, today most modern mobile phones can track their position with a built-in GPS-antenna, making partaking in `Geocaching` possible for a much wider audience. Many of the `Geocaching` communities provide information about the degree of difficulty of a cache, with regard to both the difficulty of the riddles as well as the difficulty of physically reaching the cache and spotting it.

Illustrates the
difficulty of game
design

Since it is one of the oldest and longest-running location-based games, `Geocaching` provided us some valuable insights. It serves as the best example of why game design is full of trade-offs and exceptions and of how, in many cases, there is no obvious best decision to be made by a game designer. As mentioned before, we consider REACHABLE LOCATIONS to be not only a game design pattern that can be found in many games, but sometimes can actually be a necessity in a location-based game. Additionally, PLAYER CONFUSION can leave players stranded and lost, which is a core problem, for example, in designing games for tourists. `Geocaching` however draws much of its appeal from the fact that caches are hidden and hard to reach, with players

sometimes spending hours in a city or even in a forest trying to find them. This is why we use `Geocaching` as an example in several patterns, especially in their Trade-Offs part. We thought about writing design patterns about different player types, what kind of location-based games they like and why - but this would be far outside of the scope of this work. Additionally, so far there has not been a lot of research directed toward player types and their preferences. Furthermore, examples such as `Geocaching` can illustrate the challenge that is the context-dependency of game design well enough for our purposes, making design patterns for player types a lower priority. By context-dependency we mean how the game design is influenced by the answers to a series of questions every game designer needs to think about, such as:

- What is the purpose of this game? Entertainment, Education, a mix of both?

- What is the intended audience for this game?

- What kind of gameplay does the target audience prefer?

- What is the artistic vision in the mind of the game designers?

4.13   Ingress

`Ingress`, developed by NianticLabs@Google, is an augmented reality massively multiplayer online video game. Players are split into two factions, with the ultimate goal being the faction controlling the largest amount of "Mind Units", the estimated number of humans within the territory controlled by the faction.

As the game is currently in Closed Beta Testing, it has little influence on our design patterns, however we consider it a possibly huge step forward for location-based games in general. So far, location-based games have mostly been research projects, e.g. `Feeding Yoshi` and `Can You`

Could be a breakthrough success

`See Me Now?`, live action role-playing games, or very limited (both spatially and temporally) alternate reality games, such as `Conspiracy for Good`. Seeing an influential company such as Google create a location-based game (which `Ingress` undoubtedly is, since you have to be physically close to the virtual game objects in order to interact with them), especially while also developing an augmented reality device called Google Glass, might be the first indicator of the future of location-based gaming. Even though it is only in Closed Beta, `Ingress` has most certainly already created significant attention among Android users. We think that if `Ingress` has at least some success, be it through critical acclaim, financial success or simply through sheer number of players, it might signal the kick-off for the first wave of commercially available location-based games.

Chapter 5

The Pattern Language

> *"Each solution is stated in such a way that it*
> *gives the essential field of relationships needed to*
> *solve the problem, but in a very general and abstract*
> *way - so that you can solve the problem for yourself,*
> *in your own way, by adapting it to your preferences,*
> *and the local conditions at the place where you are*
> *making it."*
>
> —*Christopher Alexander*

This chapter contains our final version of a pattern language for designing location-based games. To provide an overview over the language, we have included a "pattern graph" (Figure 5.1), i.e. a graphical overview over the patterns and how they are related to each other.

The colors are used to indicate which patterns deal with design challenges and design decisions that are closely related:

- Orange: Core patterns for using *location* and *position*

- Green: Patterns related to playing in a public space

- Light Blue: Patterns for immersive gameplay

- Yellow: Technology in location-based games

- Dark Blue: Patterns for multiplayer games

- No Color: Patterns related to the physical world

Of course, several patterns are in grey areas and could be considered part of multiple categories, such as EPHEMERAL MAGIC CIRCLE. While only possible in multiplayer games, the circle helps to MINIMIZE SOCIAL AWKWARDNESS and could therefore just as easily be in the green category of patterns related to playing in a public space. We see these categories mostly helpful in "excluding" patterns: if a game designer has decided on creating a singleplayer game, he can choose to "ignore" the dark blue part of this language.

The connections indicated in the graph are only what we consider to be the strongest bi-directional association between two patterns. Including *all* relations we mention in a pattern would only clutter the graph and disallow it from providing an overview. The connections also do not indicate any specific kind of relation. Rather, we see the pattern graph to be used by designers to navigate the language in the style of this example: "If I use LOCATIONS AS CONTENT in my game, it seems I should have a look at the OTHER CONTEXT OF PLAYER."

Additionally, the graph in Figure 5.1 is roughly structured from top to bottom in the way most designers should encounter the patterns: the core decisions and most prevalent problems are at the top, while the lowest patterns can only be found or implemented in very specific kinds of games. And almost all paths through the graph lead past the green patterns dealing with playing in a public space, which we consider very important for most if not all location-based games.
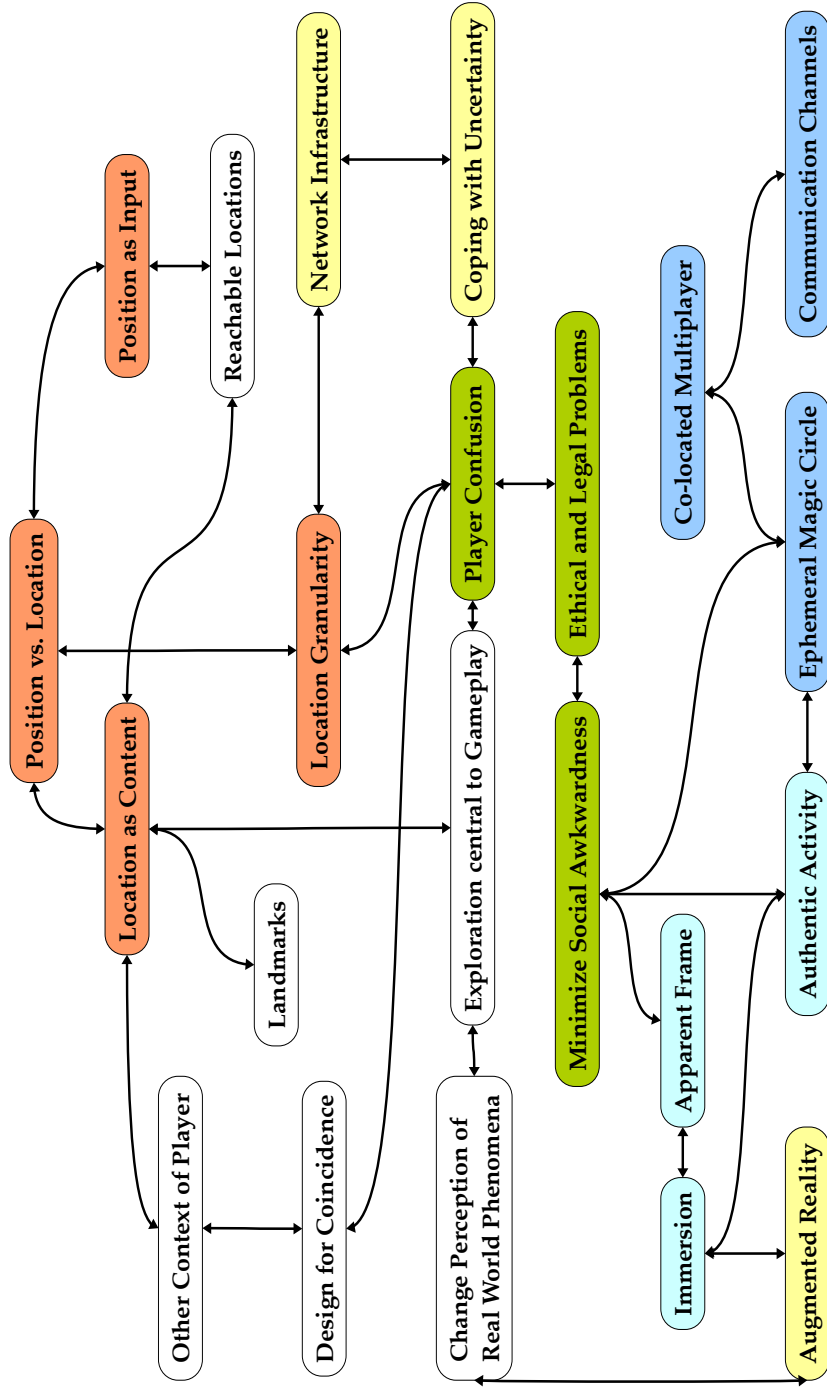
Figure 5.1: The Pattern Graph

POSITION VS. LOCATION

Design Ideal:

Since the terms *location* and *position* can both have multiple meanings, there is a need to clearly define them for the context of location-based games and especially for this pattern language.

If we want to describe where a player is in terms of a data set, we are going to use the term *position*.

If we want to describe where a player is in a context, therefore giving meaning to his position, we are going to call it a *location*.

Design Solutions:

Determining a player's position and the change thereof can already be the basis for creating game-play mechanics. The game `Feeding Yoshi` for example turned unsecured wireless networks into plantations and secure ones into Yoshis. While more ideas and examples to use POSITION AS INPUT can be found in that pattern, the most important use of the player's position is to determine her location.

Observations from games such as `Feeding Yoshi` indicate that players tend to turn non-descriptive positions into meaningful (as in: having a meaning for the player) locations anyway: players would for example say a Yoshi "lived down the block".

There is obviously a possible mis-match between position and location: One position (e.g. a set of GPS-coordinates) can belong to a multitude of locations since the shape and size of what constitutes a location is variable. These variables are determined by context and meaning, which can be influenced both by the player and the game. For more information on how to deal with this mis-match and what kinds of locations one can differentiate, consult the pattern LOCATION GRANULARITY.

There are many ways to use location in games, some basic ideas for this are explained in LOCATION AS CONTENT, more specific solutions can be found in DESIGN FOR COINCIDENCE and OTHER CONTEXT OF PLAYER.

Trade-offs:

There are definitely ways to create interesting games using POSITION AS INPUT and resulting games often can be played anywhere, which is a great advantage.

However, this pattern language will focus on games that use more than just position to create a game experience, hence the name "location-based games".

We think the disadvantage of being "tied" to locations is far outweighed by the variability of gameplay mechanics, the depth of IMMERSION and the player's experience in general (e.g. through CHANGE PERCEPTION OF REAL WORLD PHENOMENA) that is offered by using LOCATION AS CONTENT in a game.

Add to this the rise of AUGMENTED REALITY technologies, which allow a great degree of interaction between virtual game worlds and real locations, and the result is a complex design space. One of the goals of this language is to help navigate this space and help with the unique challenges created by the pervasiveness of location-based games.

Inspiration:

- Feeding Yoshi

- REXplorer

Related to:

- POSITION AS INPUT

- LOCATION AS CONTENT

- IMMERSION

- DESIGN FOR COINCIDENCE

- OTHER CONTEXT OF PLAYER

- CHANGE PERCEPTION OF REAL WORLD PHENOMENA

POSITION AS INPUT

Design Ideal:

Information about the player's position and change thereof can be used in gameplay.

Design Solutions:

There are three basic possibilities to use the player's position as input:

- use mainly the change of position as a basis for gameplay (and not the absolute start/end position)

- with minimal setup, the game can create a game field in any suitable place

- use OTHER CONTEXT OF PLAYER to determine his position in a way that works in a multitude of places

Using one of these or a combination of them provides a good basis for interesting gameplay while not anchoring the game to a specific location such as a specific city or building. Some examples to further illustrate these possibilities:

- `Zombies, Run!` uses audio to give a runner the feeling of being chased by zombies. This simple idea turns a physical excercise into an immersive, story-driven experience by using distance traveled and speed of the runner as input.

- `Savannah` can be set up on on any suitable open space.

- `Feeding Yoshi` uses encryption of WiFi-networks to create plantations (not encrypted) and Yoshis (encrypted), a great example of using the NETWORK INFRASTRUCTURE to create a very diverse game experience based on where in the world the game is being played.

Trade-offs:

Since you can no longer effectively predict where the game will be played, choosing to use position this way in a game makes it difficult to use LOCATION AS CONTENT. It is certainly more difficult in these kind of games to DESIGN FOR COINCIDENCE since it is practically impossible to scout locations for natural coincidences or fabricate coincidence using hired actors.

However, with the rise of AUGMENTED REALITY technologies it is certainly becoming feasible to provide players with a seemingly "localized" experience, even in games played all over the world (see `Ingress`).

Inspiration:

- `Zombies, Run!`

- `Savannah`

- `Feeding Yoshi`

Related to:

- POSITION VS. LOCATION

- OTHER CONTEXT OF PLAYER

- NETWORK INFRASTRUCTURE

- LOCATION AS CONTENT

- AUGMENTED REALITY

LOCATION AS CONTENT

Design Ideal:

Location-based games are played in the real world and should use it as a resource.

Design Solutions:

To quote Bichard and Waern: "The world is a vast and infinitely changing resource of content for pervasive games".
Games that use LOCATION AS CONTENT should incorporate real-world artifacts unique to those locations into the game.
The ability to merge the real world into a game world is essential in differentiating location-based games from "classic" games on PC, consoles or mobile devices. The goal in this case is to use things that are unique about a location to create an equally unique game experience which can not be replicated elsewhere.

Real-world artifacts include for example all kinds of sensory information:

- visuals: what kind of buildings, colors, lighting...

- sounds: streets, cars, people, church bells...

- smells: food, people, smog ...

- social events: regular gatherings (markets, weddings, mass etc.)

- people: tourists, locals, age groups (children, adults etc.)

- "atmosphere": time of day, lighting, weather, special occasions such as Christmas markets

Additionally, every place has a unique history and "facts" (as in: trivia) associated with it, which can be used in multiple ways in a game. For example, you could use your game to teach these things to the players, which results (ideally) in CHANGED PERCEPTION OF REAL WORLD PHENOMENA. The opposite would be to use their existing knowledge of history and trivia (e.g. in a game aimed at locals) as a basis for a gameplay mechanic where they have to use that knowledge to solve riddles.

Real-world artifacts can be used in a multitude of ways to create a great experience for the player(s) - the patterns DESIGN FOR COINCIDENCE, EXPLORATION CENTRAL TO GAME and LANDMARKS contain some of the most prominent ideas.

Trade-offs:

Using real-world artifacts in a game also introduces "real-world problems" into it - REACHABLE LOCATIONS probably being the most important one.

Additionally, LOCATION GRANULARITY needs to be considered to avoid PLAYER CONFUSION.

And finally, from a more technical point of view: NETWORK INFRASTRUCTURE can have a huge impact on what locations are actually suitable for location-based games.

Inspiration:

- `REXplorer`
- `Interference`

Related to:

- POSITION VS. LOCATION
- LOCATION GRANULARITY
- DESIGN FOR COINCIDENCE
- PLAYER CONFUSION
- EXPLORATION CENTRAL TO GAME
- NETWORK INFRASTRUCTURE
- CHANGE PERCEPTION OF REAL WORLD PHENOMENA
- REACHABLE LOCATIONS

LOCATION GRANULARITY

Design Ideal:

Misunderstandings between game designers, players and the game sytem about positions and locations must be avoided.

Design Solutions:

As described in POSITION VS. LOCATION, to GPS, a position is merely a set of coordinates. To WiFi or cellular-based positioning services, position information might be a set of signal strengths and network IDs.

To players however, location can mean a lot of different things: It could be a street, a building, a room in a building, the place in front of a certain side of a building.

Furthermore, there is no fixed size for what constitutes a location: anything from which side of a table you are sitting at up to which city you are in.

Game designers need to match these two different views, the semantic, context-dependent view players have of a location and the discrete, mathematical/geometrical view computer systems have of a position.

To further illustrate the problem: Imagine a player is standing just outside of Aachen Cathedral's south wall, close enough to touch it. For some reason, let's say a quest that is part of a game based on city exploration, he should go into the cathedral. Now, to cope with uncertainty of GPS, the game assumes the player is inside the Cathedral and marks the quest as "completed". While the system might not see a difference between position *X* and position *X+1m*, to the player these two positions are totally different locations.

While it might be possible to predict these mismatches, the only way to be adequately sure is to do extensive user/player/beta-testing and watch out for symptoms of these problems, such as PLAYER CONFUSION.

Trade-offs:

In a lot of cases, this mismatch is actually not a severe problem, one example being `Feeding Yoshi`: Players memorized e.g. that a certain Yoshi lives in front of a store. While the NETWORK INFRASTRUCTURE responsible for creating this Yoshi might not actually belong to that specific store, it does not change it's position and (presumably) always covers the front of that store.

Therefore the game experience is not always disturbed by the mismatch between player view of *location* and system view of *position*.

Inspiration:

- Feeding Yoshi

Related to:

- POSITION VS. LOCATION
- NETWORK INFRASTRUCTURE
- COPING WITH UNCERTAINTY
- PLAYER CONFUSION

REACHABLE LOCATIONS

Design Ideal:

Game locations should be reachable by anyone, anytime.

Design Solutions:

If a game uses LOCATION AS CONTENT, it is important to ensure players can actually reach the game's locations.

There are many factors that can influence how and if players can actually play the game at the intended location, such as:

- opening times

- traffic

- social events (e.g. a farmer's market might restrict access to a public place)

- construction

- weather

Extensive scouting of the locations used as content has not only the advantage of minimizing the impact of the above-mentioned factors, but additionally one might notice artifacts that could be used to DESIGN FOR COINCIDENCE.

Trade-offs:

Sometimes, a certain difficulty to reach a location can actually be a part of the game, `Geocaching` being the best example for how this is appealing to players.

It is also important to note that it is not necessarily "bad" to limit the general availability of a game: Players will for example accept they can only rent and use an interactive tourist guide such as `GroupAixplorer` during the opening times of the game's location.

Inspiration:

- `Geocaching`

- `GroupAixplorer`

Related to:

- LOCATION AS CONTENT
- DESIGN FOR COINCIDENCE

OTHER CONTEXT OF PLAYER

Design Ideal:

Location-based games can and should use more information than just the current position of a player.

Design Solutions:

The full context of the player includes more than just information about his *position* and *location*.

Using all this information allows to create interesting interactions and gameplay mechanics.
For example, at every location you can probably find things such as:

- the sounds the player can hear

- the people he can interact with

- the ambiance (e.g. the weather)

- the buildings at the location

Incorporating these (and whatever else you can think of) allows for more variety in gameplay and content, e.g. by using these artifacts in order to DESIGN FOR COINCIDENCE.

Trade-offs:

While the context of the player can be used to greatly enhance gameplay, e.g. through DESIGN FOR COINCIDENCE, it can sometimes be hard to predict. Therefore it is important to have mechanisms in the game that can deal with unexpected errors and similar problems to avoid PLAYER CONFUSION.

While variety in gameplay is great to bind players longterm and therefore great for "persistent" games such as Ingress, it also increases the time it takes to learn and understand a game, making it less suited for players such as commuters looking for short distraction.

Inspiration:

- `Interference`
- "Tangible pleasures of pervasive role-playing" Montola

Related to:

- DESIGN FOR COINCIDENCE
- LOCATION AS CONTENT
- PLAYER CONFUSION

DESIGN FOR COINCIDENCE

Design Ideal:

Seemingly coincidental events are a great way to manipulate the APPARENT FRAME of a game.

Design Solutions:

Study the places your game will be played at carefully. Observe what kind of visual cues, sounds and social events happen regularly (and are predictable) and incorporate them into your game.

Additionally, you can manipulate the environment to create circumstances which will seem coincidental to the player.

Both require, in almost all cases, the game to use LOCATION AS CONTENT.

Player interviews in case studies of LARPs and other pervasive games often indicate that players really appreciate coincidental events that seem to be part of the game world. This is not surprising: real life is full of (perceived) coincidences while game worlds are often governed by strict rules and are strongly scripted, making them feel "artificial".

The goal now is to take an "artifact" from the real world, be it a visual cue, a person or an event and give it a meaning inside the game world. For a wider overview of what artifacts can be used in a game, see OTHER CONTEXT OF PLAYER.

A perfect example on how to achieve this can be found in the game `Prisoner Escape from the Tower of London`:

The "beefeater" guards in the Tower were given RF transmitters, while the players had devices able to detect the location of those transmitters. One of the player's goals is to "escape" the Tower, i.e. leave it while avoiding the guards. When detecting one of the guards' transmitters, the player's device would alert them and they would lose the game. As a result, the real world activity of the guards - patrolling the Tower and talking to tourists - had an additional meaning to the players of the game. Even more so since not all guards were carrying transmitters - which the player's did not necessarily know. This resulted in players hiding from guards which were just going about their everyday duties, turning a coincidental encounter into a part of the game world.

While the above mentioned guards still continued their everyday routine, it is also possible to fully fabricate coincidental events. This is often achieved by hiring actors for no other purpose than to interact with the players.

Lastly, there is one more way to blur the APPARENT FRAME - which is also the most difficult one: to use an actual coincidence as part of the game.
`Uncle Roy all Around You` achieved this by essentially gambling with probabilities. One instruction for example, given in a crowded place, was to "follow the black-haired woman". Obviously there is a decent chance that in a crowd the player will sooner rather than later spot a black-haired woman and follow her. The vague description in this case is essential to increase the probability of the player spotting someone to follow. The game constantly tracked the player's position and had several coordinated actors in place to "step in" when the game administrators suspected she might be lost or when she actually came close to where the game continued.

Trade-offs:

Designing for coincidence is obviously reliant on predicting both the behavior of the player(s) and the environment - which is definitely hard at times.
It is therefore important to have "fail-safes" in place, in order to recognize PLAYER CONFUSION and help.

Additionally, if the "timing" is off, e.g. a player is supposed to count the number a church bell rings but does not pay attention at the right time - the whole game can fall apart.
A possible fail-safe in this case could be a recording on the player's device that she could play at will after the church bells finished.

Inspiration:

- `Prisoner Escape from the Tower of London`

Related to:

- APPARENT FRAME

- LOCATION AS CONTENT

- OTHER CONTEXT OF PLAYER

- PLAYER CONFUSION

LANDMARKS

Design Ideal:

Landmarks are perfect for location-based games.

Design Solutions:

The main advantages of landmarks are:

- they are easy to spot: they might not necessarily be visible from everywhere in a city, but you can definitely see them from some distance

- they are easy to recognize: there is only a very small chance someone will confuse Aachen Cathedral with the church next to it

- they are known to locals: even if a player has difficulties finding a landmark, the local population will not

The combination of these three properties makes landmarks very useful for navigation - tourists everywhere on the world can attest to this. Through the use of landmarks, a game can help players find out:

- where they are

- where they need to go

- what way they should take to their target

To achieve this, the game should tell them what distinctive buildings (like clocktowers), features (like hills) or even social settings (a busy marketplace) they should or shouldn't be able to see.

Displaying pictures of the landmark can further reduce ambiguity and help with navigation. This is especially helpful in areas with less accurate position information (see: COPING WITH UNCERTAINTY, NETWORK INFRASTRUCTURE).

Landmarks can also help to reduce the problem of LOCATION GRANULARITY - there is a general consensus of the size and borders of a landmark. Additionally, most landmarks are buildings and as such have a front, a back and often labeled entrances, which can be very useful for precise navigation.

But while using landmarks for navigation is already great for location-based games, they are also very well suited as content for the game (LOCATION AS CONTENT). In many cases, landmarks are not only visually unique but carry additional cultural, historical or social meaning. Some ideas to use these unique properties in location-based games are:

- as reward: if players solve a quest, they recieve information about the history of a building - very useful for interactive tourist guides

- as part of a game mechanic: players might have to find out the date a church was burned down and enter it into the game to proceed

- as atmospheric background: e.g. if a game is set in 1600 a.d., playing in front of or in an actual building from 1600 increases the player's sense of IMMERSION

- as part of the game world: in a story-based game, blurring the boundary between game and reality (see APPARENT FRAME) can "transform" an ordinary church into the headquarters of a secret society

Trade-offs:

In POSITION AS INPUT, we give examples of games that do not use LOCATION AS CONTENT. Such games therefore can make little use of landmarks.

One additional trade-off is similar to the one mentioned in REACHABLE LOCATIONS: Games such as `Geocaching` draw much of their appeal from the fact that the game's locations are difficult to find.

Inspiration:

- `REXplorer`
- `Geocaching`

Related to:

- POSITION AS INPUT
- LOCATION AS CONTENT
- REACHABLE LOCATIONS
- APPARENT FRAME
- IMMERSION

CHANGE PERCEPTION OF REAL WORLD PHENOMENA

Design Ideal:

Many games are appealing because the players learn something about themselves, others, and the world.

Design Solutions:

While important for and present in almost all kind of games (the work-in-progress pattern language of Björk contains a version of this pattern more focused on classic games), location-based games have a distinct advantage.
Since they are played in the physical world, they can more easily change the perception players have of the places they are played at, especially if they actively use that LOCATION AS CONTENT.

A classic example would be an interactive tourist guide such as `GroupAixplorer`, teaching players what life was like at their current location during a specific period of history.

Through role-playing, players could learn something about themselves or about characters they portrait.

AUGMENTED REALITY can be also be very helpful in achieving this ideal, e.g. by overlaying historical views on the current version of a building.

Trade-offs:

The (maybe) central problem in game design: different players like different kinds of games. Not everyone plays a game to learn something about the place they are at. E.g., for players that just want to "waste some time" and have a little bit of fun, learning about a very tragic fact about the history of their current location might be a game-breaking intrusion.

Additionally, purposefully designing to achieve this is very difficult, as Björk explains in more detail in his pattern: both the players knowledge and willingness and the ability of the system to model the real world or interact with the real world have heavy influence on a successfully changed perception.

Inspiration:

- `GroupAixplorer`

Related to:

- LOCATION AS CONTENT
- AUGMENTED REALITY

EXPLORATION CENTRAL TO GAME

Design Ideal:

Location-based games should provide motivation to explore a cityscape or landscape.

Design Solutions:

The advantage of playing in the "real world" allows players to explore more than just a virtual game world.

There is no question about exploration being a great motivator for players. Be it single-player games or MMORPGs on consoles or PC, players will always use the freedom they are given to explore that particular virtual world.
Obviously, a little reward from the game for doing so is helpful, but not much is required - humans seem to be explorers by nature.

Therefore, location-based games should try to give players as much freedom as possible:

- let them choose their own path between locations

- let them choose the order for visiting locations

- lead them "off the beaten path"

- provide motivation for them to explore their environment - with all their senses

Trade-offs:

While exploration is great in order to achieve several goals, such as CHANGE PERCEPTION OF REAL WORLD PHENOMENA as well as being appealing gameplay, there are limitations to it.

First, there are trust issues as in described in ETHICAL AND LEGAL PROBLEMS: Urban areas for example can be dangerous - it might be useful to prevent players from exploring them.

Secondly: Players might be of different navigational skill level - there is obviously a difference between exploration and simply being lost (see PLAYER CONFUSION).

And in some games, exploration might simply not fit in with the overall theme or

idea of a game: a game with a strong, linear narrative and time constraints (since it may use hired actors) can not give the players a lot of freedom in choosing their way between locations in order to keep the narrative flowing at a certain pace.

Inspiration:

- `Feeding Yoshi`

- `Ingress`

Related to:

- CHANGE PERCEPTION OF REAL WORLD PHENOMENA

- LOCATION AS CONTENT

- ETHICAL AND LEGAL PROBLEMS

- PLAYER CONFUSION

PLAYER CONFUSION

Design Ideal:

Since player confusion in location-based games can have significant consequences, it needs to be prevented and alleviated.

Design Solutions:

In games played at home, players can easily turn off the game and take a break when they encounter a problem they can not solve. In location-based games, a game confusing the player could lead to her being lost in a city she might not know.

In `Uncle Roy All Around You`, the game designers kept constant track of the position of their players. When they suspected a player might be lost, they instructed one of the actors that were part of the game to intervene.

This shows one of the central challenges in recognizing confused players: it requires constant supervision, done by human observers. One of the best solutions to help confused players is implemented in all MMORPGs: Game-masters. Players can contact them if they are lost or stuck and will receive (ideally) immediate help. Additionally, the availability of game-masters provides players with an increased sense of security, even if they don't need them.

As with any device or software, a "help" function should always be available, providing the player with information on how to deal with possible problems. This help should be available off-line, i.e. even if the device is currently not connected to a network, to avoid problems of the NETWORK INFRASTRUCTURE.

Trade-offs:

As mentioned above, recognizing if a player is truly confused or maybe just enyoing EXPLORATION CENTRAL TO GAME is near-impossible from tracking data alone. Human observers can provide more accurate guesses than an automated system, but it is still mostly guesswork.

The (arguably) best solution, game-masters, require a considerable effort of money and man-power. Therefore, a good help functionality, available off-line, is essential.

Inspiration:

- Uncle Roy All Around You

Related to:

- EXPLORATION CENTRAL TO GAME
- NETWORK INFRASTRUCTURE

ETHICAL AND LEGAL PROBLEMS

Design Ideal:

Players put a lot of trust into the game creators when they play a location-based game in a public space.

Design Solutions:

It is important to keep the social context in mind when designing a location-based game.
As an example: ten adult men chasing a woman over a marketplace may not be correctly interpreted as part of a game by bystanders.

It is therefore important to design the game-play in accordance with local laws and customs.
Even if players know some action would be unlawful, they might still rationalize completing it, e.g. by assuming the game creator acquired a permit or has otherwise coordinated the game with local law enforcement.

While staying within the confines of the law will keep players out of jail, staying within local customs is great for MINIMIZING SOCIAL AWKWARDNESS, making a game more accessible.

Trade-offs:

While breaking the law should never be part of a game, breaking local customs and social conventions can actually be very appealing to players. The pervasive role-playing game `Interference` is a good examples for this.

Inspiration:

- `Interference`

Related to:

- MINIMIZING SOCIAL AWKWARDNESS

MINIMIZE SOCIAL AWKWARDNESS

Design Ideal:

Location-based games are mostly played in public settings. If a game requires any interaction that is unusual for the public setting (such as loud verbal communication, gestures etc.), the feeling of awkwardness might discourage players from playing it. Additionally, bystanders not knowing a game is being played might further increase the feeling of awkwardness.

Design Solutions:

When designing your game's interactions, be aware of the social context the game is played in.

The easiest way to reduce awkwardness is CO-LOCATED MULTIPLAYER, especially if it involves local co-operation since this invites players to form an EPHEMERAL MAGIC CIRCLE. This circle can distinguish play from everyday behavior in the eyes of bystanders - helpful for avoiding ETHICAL AND LEGAL PROBLEMS.

In games that are played by a single player but in very public settings, in most cases it is a good idea to avoid interactions that involve expressive gestures, loud verbal interactions or role-playing, as they might make the player (and bystanders) feel uncomfortable.

Trade-offs:

Minimizing social awkwardness is important as it has a fundamental impact not only on the player experience, but also can make it easier for bystanders to understand a game is currently being played.

It seams that one of the best ways to reduce this awkwardness is CO-LOCATED MULTIPLAYER, which is great since location-based games often work better as social experiences anyways.

However, balancing social awkwardness and interesting game mechanics is not a simple process: Gesture-based interactions, for example, certainly can increase awkwardness, but they are also very appealing mechanics (especially in role-playing games, where AUTHENTIC ACTIVITY is required).

Inspiration:

- Interference

Related to:

- CO-LOCATED MULTIPLAYER

- EPHEMERAL MAGIC CIRCLE

- AUTHENTIC ACTIVITY

- ETHICAL AND LEGAL PROBLEMS

EPHEMERAL MAGIC CIRCLE

Design Ideal:

In CO-LOCATED MULTIPLAYER games, help your players form a safe zone in order to MINIMIZE SOCIAL AWKWARDNESS.

Design Solutions:

When standing shoulder next to shoulder, facing inwards, players form a "magic circle of play".
This magic circle is ephemeral because it is disbanded as soon as the group starts to move again or splits up for another reason.

This helps both them and bystanders to separate play from ordinary life, reducing the social awkwardness.

Gameplay mechanics that require face-to-face communication, device sharing and similar forms of cooperation will naturally lead to the formation of such a circle.

Some case studies of pervasive LARPs indicate that role-playing feels less awkward when not done alone.

Both for the players and onlookers, a clear distinction of play and ordinary life is helpful in avoiding miscommunication and feelings of social awkwardness. The circle formed by multiple players, while not a "hard boundary" such as a closed door, is a clear signal to bystanders that a social group activity is going on. For the players, knowing they are sending a clear signal to outsiders "we are playing a game inside this group" helps them to feel secure and be more outgoing.

Trade-offs:

While this clear distinction is helpful in MINIMIZING SOCIAL AWKWARDNESS, the circle puts the APPARENT FRAME into the focus of players and bystanders. As explained in the pattern APPARENT FRAME, blurring this (perceived) boundary between play and real life is a great tool to create IMMERSION, which helps players enjoy a story-driven game.

Inspiration:

- `Interference`
- "Tangible pleasures of pervasive role-playing" Montola

Related to:

- MINIMIZE SOCIAL AWKWARDNESS

- APPARENT FRAME

- CO-LOCATED MULTIPLAYER

NETWORK INFRASCTRUCTURE

Design Ideal:

Location-based games rely on wireless technologies - these should ideally not have a negative impact on game design.

Design Solutions:

Unfortunately, there are three ways the available infrastructure can impact a location-based game:

- the game design is (more or less) final and a fitting infrastructure needs to be chosen

- only a very specific infrastructure is available and therefore influences game design

- the game is designed based on a very specific technology

The first way can be the case of a game designed for all modern smart-phones - whatever the current standard of technology is, will probably be used in the game (e.g. GPS or Assisted GPS or maybe even WiFi-localization).

The second case if often encountered in games that use LOCATION AS CONTENT, for example interactive tourist guides and similar games. These often rely on custom-build devices that can be rented at the location where the game is played (such as `GroupAixplorer`). These devices may use standards like GPS (if available at their location), but often additionally use custom systems for indoor-localization.

A perfect example for the third case would be `Feeding Yoshi` which utilizes the difference between unsecured and secured WiFi-network access points as a basis for gameplay.

Furthermore, it is important that network infrastructure is not limited to the localization technology, but also includes data down- and up-links and device inter-connectivity.

When designing a game, the available technologies need to be carefully evaluated, especially on how they try to cope with uncertainty. In "Coping with Uncertainty in a Location-Based Game", Benford et al. show that very high error rates can create game-breaking scenarios, ruining the player experience.

Special attention should be paid to the impact of network connection on player be-
havior: in their game `Savannah`, the researchers noticed that a player would often
stop immediately when notified that she reached a game location, i.e. at the edge
of this location. This would sometimes cause the players following this player to
stop outside of the detection radius of this location and therefore not being able to
help with the players "quest".
To tackle this problem, the researches suggest to separate game locations into two
zones: trigger the "quest" only when a player enters the inner zone, so that players
in the outer zone can also be given the quest and help him.
Another way to help with this is to have players project a "personal aura" around
them. If a player triggers a quest, all players in his vicinity should be able to collab-
orate with him, even if they are not perfectly inside of the game location.

Trade-offs:

Currently, indoor localization is not in any way standardized or even available
which makes it near-impossible to use in games that can not rely on custom-build
hardware.

It is also important to realize that even if localization works well, data connectivity
can be bad at a location. If a game relies on exchanging information, e.g. between a
client device and a game server or between devices (mainly in multiplayer games),
this can also create game-breaking problems, for example in the form of "lag".

Inspiration:

- "Coping with Uncertainty in a Location-Based Game" Benford et al.

- `Savannah`

Related to:

- LOCATION AS CONTENT

- COPING WITH UNCERTAINTY

COPING WITH UNCERTAINTY

Design Ideal:

Technical limitations and problems should not have a negative impact on the game experience.

Design Solutions:

Technologies like GPS and WiFi-networks have levels of uncertainty. The accuracy of the location information can for example depend on many factors and range from a few meters to several hundred meters. Wireless technologies have different levels of connectivity and can experience considerable delay.

Three elementary techniques to cope with this are:

- *avoid*: design game mechanics etc. so that they don't need accurate measurements (e.g. use LANDMARKS for navigation)

- *reveal*: explicitly tell players the current level of accuracy so they can make an informed decision

- *hide*: design game mechanics and interfaces so they work even with lower degrees of accuracy

Obviously, this is all heavily influenced by the choice of a NETWORK INFRASTRUCTURE.

Revealing uncertainty is a great way to reduce the impact of technical problems on PLAYER CONFUSION. However, it requires both that the information (e.g., how much latency there is in milliseconds) to be displayed in a clear and concise manner and that the player actually possesses the technical knowledge to understand what kind of impact this will have on her experience.

Hiding uncertainty is often done by trying to catch all foreseeable errors - one example for this, from `Can You See Me Now`, might be to exclude all "impossible" (such as a pedestrian standing in the center of a lake) locations from reporting.

Trade-offs:

While revealing uncertainty is great to avoid PLAYER CONFUSION, in games that

rely on narrative and IMMERSION, hiding the uncertainty might be more desirable.

In any case, if your game uses LOCATION AS CONTENT, it is very useful to scout those locations with the kind of device you wish to use in your game. In `Can You See Me Now`, for example, the researchers found that urban landscapes have a significant effect on GPS accuracy.

Inspiration:

- `Can You See Me Now`

Related to:

- LOCATION AS CONTENT

- LANDMARKS

- PLAYER CONFUSION

- NETWORK INFRASTRUCTURE

- IMMERSION

APPARENT FRAME

Design Ideal:

The apparent frame is the player-perceived boundary between real world and game world. Manipulate it to achieve IMMERSION.

Design Solutions:

Benford et al. call the boundary the player perceives as separating real world and game world the "apparent frame" of the game.

Manipulating this frame can be done primarily by either shrinking it or extending it:

- To illustrate "shrinking the apparent frame", imagine a hired actor behaving like a bystander towards the player. The player perceives him as outside of the game's frame, thus shrinking it.

- Involving a "true" bystander in the game therefore would be extending the apparent frame, since players would perceive him as part of the game

More detailed examples can be found in `Uncle Roy all Around You`, which uses both techniques to immerse the player in a narrative/story.

The appeal of this and other techniques leading to IMMERSION is unquestionable, considering how many people immerse themselves everyday in virtual game worlds. These games are often judged by how "alive" their virtual world feels to the player.
The implication for location-based games is: if we sufficiently blur the apparent frame, the player will experience the game world as part of or maybe as an extension to everyday life. Since "real life" is, after all, the most "alive" world imaginable, this allows location-based games to create very immersive game worlds. See the IMMERSION pattern for more on this.

Trade-offs:

The apparent frame can never be completely blurred, akin to how complete IMMERSION can never be obtained: while the player willingly suspends her disbelief, she still knows she is playing a game, setting limits to how far you can (or should) blur it.

Additionally, interacting with bystanders is opposed to Minimize Social Awkwardness.

Both the willingness to suspend disbelief and how much social awkwardness is tolerable are also strongly influenced by the player herself: extrovert, experienced role players probably will not have problems talking to actors or bystanders as if they were part of a game, but more introvert people, who maybe just want to do some interactive sight-seeing, have a completely different mindset.

Inspiration:

- `Uncle Roy All Around You`

Related to:

- Immersion

- Minimize Social Awkwardness

IMMERSION

Design Ideal:

Location-based games can achieve great levels of immersion.

Design Solutions:

Almost all location-based games fall under Montola's definition of "pervasive games" by extending the "magic circle of play" locally.
This allows them to use LOCATION AS CONTENT, which sets them apart from traditional games, especially if they use OTHER CONTEXT OF PLAYER. However, they also can use virtual resources of all kinds: images displayed on a screen, audio files played into headphones or even AUGMENTED REALITY technologies.

The combination of the real world and a virtual world allows them to create an immersive game world, providing a unique experience for players. There are however a few things to consider when trying to create an immersive experience:

- it is futile to attempt what is called a three-sixty illusion, i.e. a fully immersive experience

- certain techniques are absolute musts if you are trying to achieve immersion

- the degree of immersion heavily depends on the player(s)

The first point is quite obvious: players will always know they voluntarily suspended their disbelief, therefore a complete immersion is impossible.

In case studies it was observed that some things can be very immersion-breaking if not done correctly. One of these is blurring the APPARENT FRAME of the game: no player seriously expects there to be *no* boundary at all between real world and game world - but if this boundary is not even slightly blurred, no amount of willing disbelief can immerse the player.

The second major problem mentioned in several case studies is if AUTHENTIC ACTIVITY is not correctly implemented. If the activity is repeated often in the course of the gameplay, it will disrupt the immersion every time.

Trade-offs:

Immersion is great to increase the game experience in a game with a strong narrative.

This however implies: If the game does not have a strong narrative, it is more or less impossible to immerse the player in a game world. Speaking of game world: without a certain level of detail, e.g. provided by believable characters, it will not serve a purpose in telling a story. Furthermore, the game world has to have common ground with the real world, or it would be to hard to role-play characters - for example: a game world with inverted gravity would be very hard to depict overlapping with reality.

And, as mentioned above, immersion strongly depends on the player: to truly immerse herself in the game world, she needs to role-play a character in that world. This does not necessarily require LARP-levels of role-playing, but a certain mind-set ("What would my character do" instead of "What would I do") is certainly required. Therefore immersion works well in games targeted at audiences interested in role-playing and similar experiences, but will often be "wasted" on audiences not willing to suspend their disbelief and act out a role.

Inspiration:

- "Tangible pleasures of pervasive role-playing" Montola

- "The three-sixty illusion: designing for immersion in pervasive games" Waern et al.

Related to:

- LOCATION AS CONTENT

- APPARENT FRAME

- AUTHENTIC ACTIVITY

- AUGMENTED REALITY

- OTHER CONTEXT OF PLAYER

AUTHENTIC ACTIVITY

Design Ideal:

To achieve IMMERSION, actions in the real world should closely imitate the actions they represent in the game world.

Design Solutions:

As stated in the paper "The three-sixty illusion designing for immersion in pervasive games" by Waern et al.: "A game offers authentic activity when every game action is represented by the identical player action".

Something important to consider when trying to achieve IMMERSION in a location-based game: a lot of virtual activities can not be represented because of ETHICAL AND LEGAL PROBLEMS. The obvious example would be any kind of violence such as sword fights or similar scenarios.
There are two major techniques to cope with this problem:

- symbolic activities: instead of swinging a real sword, the player presses the button labeled "swing sword" on the touchscreen of his device

- (almost) authentic activities: replicating the game action as close as possible.

While the first technique is often possible, it just does not provide the same experience to the player as a truly *authentic* activity.

The second technique takes advantage of very recent developments in consumer technology. It is nowadays very common to have tilt and gyroscopic sensors in smart-phones and similar devices, allowing to track what motions or gestures the player performs with the device, for example used in `REXplorer`.

To realize the possibilities, imagine children play-fighting with imaginary lightsabres, and you have a perfect example of how to use this sensory information to replicate the game action as closely as possible with comparatively little effort.

Trade-offs:

While the technological advances allow to implement authentic activity, there are still a major factor at play that might reduce the IMMERSION created by this: the player.

First of all, if the game is played in a public setting, activities such as imaginary sword fighting are very much the opposite of Minimized Social Awkwardness - as all public role-play is.

Secondly, the player still needs to suspend his disbelief to a certain degree, therefore only specific target audiences will receive the full effect of Immersion (and enjoyment) out of this.

Inspiration:

- `Interference`
- "Tangible pleasures of pervasive role-playing" Montola

Related to:

- Immersion
- Minimizing Social Awkwardness
- Ethical and Legal Problems

AUGMENTED REALITY

Design Ideal:

Augmented reality (AR) technology provides great possibilities for location-based games.

Design Solutions:

While they have not yet fully arrived for consumers, devices capable of augmenting reality with visual overlays are definitely on the horizon. These devices will enable location-based games to:

- provide an experience of IMMERSION for players

- have more variety in gameplay

`Ingress` provides examples for both these major points, although the execution is still limited by available technology - mobile phones not yet being fully able to provide a constant visual overlay. The arrival of Google Glass later this year might be the first step towards comfortable, fully AR-capable glasses in the near future.

First of all, `Ingress` immerses the player deeply into the game world by showing him elements of the game world that are part of the narrative. While imagining such elements when given a description is second nature for experienced role-players, other players might need engaging visuals to immerse themselves into the story.

While `Ingress` also enhances gameplay through AR, a better example for the possibilities of this would be `Bitstars Jump'N'Run`: just as in classic jump'n'run games, the player needs to avoid and traverse obstacles. However, these obstacles are virtual elements, only visible through the "lens" of AR.

Trade-offs:

While AR technologies will offer great opportunities for location-based games, the technology is as of now still limited in both its capabilities and its availability.

Inspiration:

- Ingress
- Bitstars Jump'N'Run[1]

Related to:

- IMMERSION

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[1]www.bitstars.com

CO-LOCATED MULTIPLAYER

Design Ideal:

Meaningful interactions between multiple players in the same location offer unique opportunities for location-based games.

Design Solutions:

First of all we want to stress the difference between playing *with* another player in contrast to playing *alongside* another player: the latter is already possible in almost all mobile games, the former is what can provide unique appeal for location-based games.

To illustrate the general idea, consider `GroupAixplorer`: In this game, players (generally) move as a group and solve quests through co-operation.

While it certainly is possible to create appealing location-based games that are geared towards single players or competitive experiences, most existing games seem to be both co-operative and co-located, although in different degrees. It seems that location-based games are great at enhancing or augmenting activities that are already mostly experienced in groups of people anyway.

Consider these examples:

- `Feeding Yoshi` - many of the players played at work or met up to play with people from their team

- `Interference`, `Conspiracy for Good` - LARPs or ARGs are predominantly constructed as group experiences

- `GroupAixplorer` - research has shown that most people explore museums in groups

- `Geocaching` - most players will go out in pairs or as groups to find caches

Since location-based games are often played in public settings, they are inherently social experiences. It seems natural to support these social aspects by encouraging players to play together, which can be done easily by introducing a common goal and co-operation.

Competitive co-located gameplay carries more possibilities for bad experiences than co-operative, in order to achieve a successful competitive experience it is first

and foremost important to have clear rules. How unclear rules can negatively impact an experience can for example be seen in `Conspiracy for Good`.

As seen in `GroupAixplorer`, COMMUNICATION CHANNELS are not obsolete in co-located multiplayer games. Groups will temporarily split up, and even a comparatively small building such as the city hall of Aachen can make it difficult for group members to find each other.

One of the main beneficial aspects of co-located multiplayer: it can MINIMIZE SOCIAL AWKWARDNESS, especially through the EPHEMERAL MAGIC CIRCLE.

Trade-offs:

Obviously, having a game rely on co-located multiplayer severely impacts what people will play it and how they will play it. If, for example, a game allows group sizes of 3 or 4 people, any group below or above that number of members will not be able to play it.

Additionally, if the game augments an existing group activity, the consequence might be that only people already interested in that activity will play it. Concerning this point however: `GroupAixplorer` was able to provide a great experience even for people who, according to their own statements, "never" use audio guides. This could indicate that location-based games can be the necessary "gamification" which can interested new user groups in these activities.

Inspiration:

- `GroupAixplorer`

- `Conspiracy for Good`

- `Feeding Yoshi`

Related to:

- COMMUNICATION CHANNELS

- MINIMIZE SOCIAL AWKWARDNESS

- EPHEMERAL MAGIC CIRCLE

COMMUNICATION CHANNELS

Design Ideal:

Players in multiplayer games want to communicate.

Design Solutions:

If your game enables players to collaborate or to compete, give them a way to communicate with each other. This is especially important if your game requires players to cooperate or coordinate while in different locations.
In competitive scenarios, the option to communicate is appreciated, e.g. for friendly banter.

Since most location-based games use devices like mobile phones, text-based and voice-based communication are very intuitive and easy to provide. However, creative and unusual ways to communicate can create more appealing gameplay.
One example would be visual "breadcrumbs" which could be left by one player (who's responsibility is to scout ahead) for a group of other players.
Another example might be simplified, iconic signals: Maybe the device just has a button "come to me" that sends a signal to all other players. Using AUGMENTED REALITY technology, the other players would then have to check the sky for a virtual signal flare to find the source of the signal.

Additionally, communication about the game often happens outside of the actual game, the `Geocaching` community being a very good example of this: Players provide feedback about caches after returning home, primarily via online forums. Often, multiplayer games also have a "lobby" or similar system, whose primary function is communication while not actually playing the game, e.g. in order to exchange strategies or arrange parties.

Trade-offs:

First of all, players should by default be identified via pseudonyms to limit privacy concerns. Secondly, when communication is not an absolute neccessity for "beating" a game, players should be able to turn it off. Both these points are useful in order to MINIMIZE SOCIAL AWKWARDNESS.

In competitive scenarios, communication needs to be regulated: friendly banter might turn less friendly or players might try to collude/cheat.

In all cases, it is important to support natural communication: Your game should not force players to use mechanics such as the "signal flare" described above if

they are already standing next to each other, i.e. in games with CO-LOCATED MUL-TIPLAYER.

If your game uses custom devices, this communication channel might be a lot easier to create than e.g. in the case of a game playable on all kinds of mobile phones. While communication channels are available in that scenario (text message, E-Mail, Phone), they are probably going to cost the players money.

Providing external communication such as lobbies carries the inherent dangers of players exchanging information that might negatively impact a new player's experience. For example, a discussion about plot twists could ruin the enjoyment of a well-crafted story, while unwanted tips or help could reduce the joy of solving a puzzle.

Inspiration:

- `GroupAixplorer`

Related to:

- CO-LOCATED MULTIPLAYER

- AUGMENTED REALITY

- MINIMIZE SOCIAL AWKWARDNESS

Chapter 6

Summary and future work

"Show me your children's games, and I will
show you the next hundred years"

—*Heather Chaplin and Aaron Ruby*

6.1   Summary and contributions

In this thesis, we presented a game design pattern language for designing location-based games. Based on the concept of game design patterns as introduced by Björk and Holopainen in [2004], we gathered design challenges and solutions from research on location-based games and from commercial products and compiled the findings in the established format of a pattern language. While the patterns in "Patterns in Game Design" by Björk and Holopainen are applicable to location-based games, the unique properties of this emerging field of games were so far not specifically collected in one pattern language.

Pattern language for designing location-based games

In order to use the idea to "harvest patterns" originally introduced by Björk and Holopainen, we conducted an extensive literature review of research on location-based games and pervasive games because commercial products with

Harvest Patterns and gather feedback

these properties are not yet widely available. After creating an initial set of patterns in a format specifically created for our own purposes, we held a variation of the writer's workshop as used in the design patterns community.

Identified key communication problem and proposed solution

In addition to providing extensive feedback on our format and the initial patterns, the workshop allowed us to identify a key problem: communicating about "location" is prone to misunderstandings. In order for our pattern language to help with this communication, the participants of the workshop (mostly researchers from the domain of location-based games) proposed a solution that became the core pattern for our pattern language. Through the suggested use of *position* and *location* as introduced in the pattern POSITION VS. LOCATION, we expect teams working on location-based games to have an easier time communicating about their project.

Include many examples

Additionally, our patterns present both crucial challenges as well as tried and tested solutions unique to the design of location-based games. Since we use as many examples as possible to illustrate these, this language helps designers and developers to predict problems they might encounter, find solutions to problems they already encountered and create new ideas for exciting games.

6.2   Future work

Use writer's workshops to collect feedback

As mentioned before, the design patterns community uses shepherding and writer's workshops at conferences (for example the PLoP conference series). Submitting our language to such a conference and receiving the invaluable feedback of experienced pattern authors will help improve our language.

Collaboration with game developers

Additionally, we will continue to keep working on the patterns using the wiki system of the media computing group. We consider it important to receive feedback not only from experienced pattern authors, but even more so from experienced game designers, especially if they have worked on mobile games. One of our primary goals is to help increase

the number of location-based games available for the public, i.e. commercial games that have entertainment as a primary purpose, such as `Ingress`. The ideal potential developers for such games are probably designers with experience in the field of mobile gaming, therefore their feedback on the form and content of our patterns would be especially helpful. Our goal is to make our wiki publicly available and distribute the information about where to find it to as many game development studios as possible.

Of course, this is not only to evaluate existing patterns, but also to come up with ideas for new ones. We have already identified several candidates, especially in two areas: multiplayer and role-playing. For example, closer looks at games such as `GroupAixplorer` can reveal more detailed insights into how groups collaborate in location-based games. Furthermore, the work by researchers like Montola or Bichard and Waern into pervasive role-playing games, e.g. `Interference` already resulted in a few pattern "stubs" later in our process which did not reach a stage where they could be included in this thesis.

Ideas for new patterns

We are also thinking about building more explicit relations to other game design pattern languages, especially to the extensive one by Björk and Holopainen. Since they cover so many base aspects of game design, our patterns could only profit from for example having direct references and links into their pattern collection.

Connect to other game design pattern languages

Ultimately, if more developers engage in this so far rather small field of location-based games (or pervasive games in general), combined with the technological advances of devices such as mobile phones, we could see a new generation of engaging, entertaining and simply fun location-based games - we think (and hope) this pattern language can contribute to this development.

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