A Pattern-based Design Environment for Creating Geogames

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Introduction and Motivation

Location-based games have attracted a substantial amount of interest from player communities and game designers alike, but they are still in their infancy when it comes to commercial success (Von Borries et al 2007). This could be a direct consequence of a number of difficulties developers face designing this kind of games (Jacob/Coelho 2011). In traditional board and video game design, game design patterns take a key-role in idea generation, development of game concepts and balancing of game mechanics. (Bjork/Jussi 2004). Game design patterns used in location-based games are not well explored yet. First attempts have been made to create pattern languages and compile a list of commonly used game mechanics (Will 2013, Davidsson 2004). However these isolated efforts alone cannot provide game designers with enough input to easily develop and balance advanced game mechanics. Without some kind of spatial simulation or extensive field studies, outcomes of combined patterns are difficult to predict.

In general, games make use of a variety of game design patterns and the possibilities of combining these patterns into game mechanics are seemingly endless. For designers it can be a very complex task to anticipate the effect any of these pattern combinations might have. Authors of design pattern libraries often point out possible interactions between patterns, however, the interactions are typically not described formally (Dormans 2013). This problem becomes increasingly challenging for location-based games due to the interferences between game mechanics and the spatial layout as well as the environment where the game is played at (Heinz/Schlieder 2015). These issues have not been sufficiently addressed by research so far. Nevertheless, they are fundamental for the development of tools that support the designers of location-based games in exploring the strength and weaknesses of a given design.

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Research Questions

My PhD project aims at a better understanding of design patterns for location-based games, as well as how they interact with each other. The final result of this research will consist of a design framework based on (1) a carefully chosen, limited number of basic patterns, (2) simulation routines associated with each pattern and (3) a software tool that can run simulations that consist of combinations of these routines in different spatial environments to explore game balancing problems. Building such a framework requires addressing a number of research questions:

- What is the best choice when looking at of basic location-based game pattern? How can they be expressed in a formal spatio-temporal representation language?
- Which interactions between patterns are most relevant from a design perspective? How are they best formally described?
- What simulation routines are needed to cover the most important types of spatial behavior? In what way should they be connected to build test cases for pattern interactions?
- Which criteria can be used for balancing game design patterns and what parameters should be used to accomplish this?
- What computational tools can support the task of balancing a game mechanics for a specific spatial environment?
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Related work

Existing game design pattern libraries support the design, analysis, and comparison of games. Various collections of game design patterns have been compiled in the past (Bjork/Jussi 2004). These mostly describe how the player interacts with game elements and how this affects the game state. (Will 2013) and (Davidsson 2004) compiled a lists of patterns especially for mobile and/or location-based games. Unfortunately, these pattern descriptions are not stated in a formal spatio-temporal representation language. They are formulated in natural language, which is useful for communication within a design team, but such pattern descriptions cannot be easily associated with simulation routines because the exact pre- and postconditions of a pattern are not available.

When it comes to balancing video game mechanics, designers normally turn to game analytics. Spatial methods of game analytics, such as trajectory- or behavioral analysis all require player data (El-Nasr et al 2013). Obtaining such data for

location-based games involves extensive and expensive field studies. Simulation models can provide a remedy for this problem. For non-location-based games a language for creating and visualizing game mechanics already exists[1] (Adams/ Dormans 2012). Integrating geographic information systems (GIS) into simulation engines to analyse problems which incorporate location, mobility and environment-interaction aspects, however, introduces new challenges (Crooks et al 2008). Together with the "Geogames and Playful Geodesign" team[2] within the research group on Computing in the Cultural Sciences at the University of Bamberg, I myself have contributed to different location-based games, game editors and analysis tools. We were able to show that an agent-based simulation framework can be used for the analysis and the evaluation of existing location-based games. (Heinz, Schlieder 2014). Such tools can substitute at least some of the field tests in the early design phase of the development of a game. However, they do not provide much support for designers who want to explore and evaluate game mechanics under different spatial and environmental conditions. The need for simulating even simple game mechanics arises from the fact that even expert have difficulties to assess the effects of spatial environment on a well researched game mechanics. (Heinz, Schlieder 2015)

Method and expected results

As part of my PhD project, I will develop a conceptual framework for modeling selected, basic location-based game design patterns and provide a tool in which these patterns can be analyzed in different contexts, like location, mobility and environment-interaction aspects. This tool will also feature means to combine patterns into more complex game mechanics by respecting pre- and postconditions as well as spatial and temporal resolutions of underlying game events. I will specify a spatio-temporal representation language that defines all changes to involving game elements. The objective of this work consists in assisting game designers in designing and relocating game mechanics as well as in changing them to consider local spatial and environmental characteristics.

My PhD project is divided in three separate phases, the first of which I am currently working on. This first phase reviews and systematizes game design patterns used in existing games. It describes the patterns and their effects on game elements, in both, a textual and a formal way. I decided to direct my focus on finding basic game design patterns that build the foundation of most location-based games, like capturing a certain place or searching for a hidden item.

The main task for phase two will be implementing simulation routines that reflect the basic patterns. The routines are integrated into a software framework that allows its users to combine them into more complex models of game mechanics.

[1] http://www.jorisdormans.nl/machinations/

[2] http://www.geogames-team.org

A graphical user interface will provide means to conduct simulation run mechanics in different spatial environments. The user will be presented with a comprehensive analysis about game balancing. The last phase will consist of an evaluation of the conceptual framework and the software tools.

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