

GENERIC INTERFACE FOR DEVELOPING ABSTRACT STRATEGY GAMES

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1. Motivation

The study of board games has proven to be a worthwhile endeavour in computer sciences, mainly in the fields of Artificial Intelligence (AI). Many algorithms and methodologies in AI are rooted in the attempts to develop software capable of playing such games as good as or better than humans. Abstract strategy games (ASG) in particular are games with perfect information, meaning that all players know all the information of the game state at all times, and their solution is always combinatorial in nature, thus becoming the perfect candidate for AI research. However, existing ASG software applications only allow for the playing of a restricted set of games. The development of a tool that enables users to create their own games and provide them with AI techniques for playing them is an excellent way of further developing this field of research. In order to accomplish this, the idea of designing an interface for creating ASG was born. Given a set of options a user could easily define the rules that govern an ASG, and subsequently the interface is tasked with the generation of the game in a format that makes it playable in a general game playing system.

2. Main Goals

The main goal of this project is the development of a generic platform that supports the creation of most types of abstract strategy games. It is also required that games created this way have to possibility of being translated to a general game playing system capable of playing them with AI techniques. The goals of the project are as follows:

- Research on abstract strategy games characteristics, showing similarities between rules, board types and pieces
- Develop a language capable of describing abstract strategy games
- Develop a platform that, through a simple graphical user interface, enables users to create their own abstract strategy games
- Generate the user defined abstract strategy games in a general game playing format
- Improvement of AI problem-solving techniques for abstract strategy games

3. Work Description

The project was divided in three steps. Firstly an

extended research on board games and ASG in particular was done. Secondly, design and specification of a system that could generate such games and lastly the development of a working prototype of the project to assert the research done and the validity of the claim that generalizing ASG creation is possible.

3.1. Research on Abstract Games

An abstract strategy game is a board game played in turns between two players, where each of them tries to overtake their opponent by moving his pieces across the board and using a mix of tactics and strategy. To understand ASG it was necessary to analyse their mechanics, how the rules differ from game to game and how better to categorize and classify them. Different AI approaches to ASG were studied as well, along with general game playing systems capable of playing different games.

There is no clear way of defining ASG, and several sources look at game rules to categorize the games from different perspectives, but this research nevertheless provided the means on how to define these games in a generic fashion, according to the guidelines set forth by the International Abstract Games Organization (IAGO) and the Zillions of Games general game playing system.

3.2. Generic Interface

The idea of being able to create any game via a simplified application and without the need to have any particular programming skills is not new. There are some platforms that help users to create platform games or role playing games. However, in the case of abstract strategy games, such applications do not yet exist.

The capabilities of the General Game Playing platform Zillions of Games are remarkable, they enable the creation of any abstract game or puzzle via the ZRF language and the application is then able to play the games or solve the puzzles applying a powerful rule analysing AI engine. Thus, instead of designing a completely new system, the development of a generic interface capable of generating abstract strategy games in the Zillions of Games format became a main goal of the project.

To be able to generalize ASG creation it is necessary to define the games in terms of board, movements, pieces, goals and rules. This ASG analysis and decomposition is a necessary step because it is essential for designing and implementing the Generic

Interface.

Although Zillions of Games is currently the only suitable application for creating and running playable ASGs, defining the games in an intermediate language that could later be understood by a different platform became another goal of this project. The expandability and generalization provided by this methodology may prove to be an essential step in the further development of this project.

The final step of the project is designing the improvement of existing AI techniques to solve abstract strategy games, analysing the potential of methodologies like machine learning and genetic algorithms with AI agents.

3.3. Prototype

The prototype developed allows users to create some ASG based on a limited number of choices regarding board creation, movements, pieces and goals.

Figure 1 shows the basic architecture of the system.

The Graphical User Interface is the connecting bridge between the system and its users, serving the purpose of sending the different choices pertaining game creation to the Game Data module. It is also responsible for restricting the user's choices depending on the data inserted and to avoid inaccuracies in a game specification to pass to the other modules.

The different modules interact through the Game Data, which is responsible for storing all the information regarding a game. It is basically a mixture of game objects, each of them symbolizing a key component of an ASG. There are movements, the board, pieces (which in turn have associated movements), promotions to other pieces, board zones and goals.

The Code Generation module is the one responsible for taking the game information and translating it to a playable Zillions of Games game file. It is imbued with a set of methods that allow the correct

generation of Zillions' language.

The final module is the Generic Language that basically reads and writes games specified in the Generic Interface by means of XML files. These files are created according to a generic language designed specifically for this project.

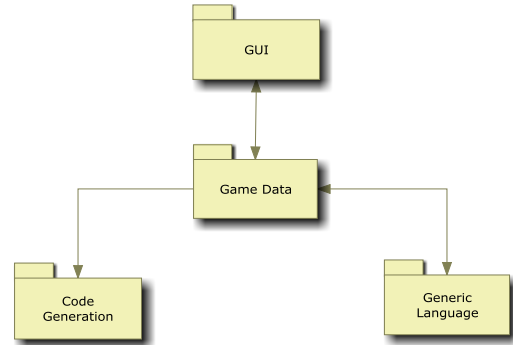


Figure 1. Overall System Architecture

4. Conclusions

Despite the fact that the prototype developed is still not capable of generating all kinds of different abstract games, it is important to note that the main question of the project is answered: it is possible to generalize abstract strategy game creation. Furthermore, it was also made clear that the more options are featured in the Generic Interface the more complex the games possible to create will become. It is regretful that some famous games like *Chess* can be generated but with the exception of particular rules (like castling) that are so specific to each game that their generalization becomes too complex.

This project opens up the possibility to easily create and test games, without the need to program them. It is a step forward in ASG creation in general and it represents a development for AI research.