

A Serious Game for the Tuition of First-Order Logic

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Chapter 1

Introduction

1.1 Motivation

Games are a structured form of play. More commonly known for their fun and engaging nature, they have become a medium for entertainment and social interaction. However, it is their application as educational tools that have piqued the interests of academics alike. Games have many qualities that can complement the learning process. For example, they are interactive and possess a fast feedback loop which makes them effective at regularly testing a person's knowledge. Students often fall victim to burn-out when they lose motivation. Fortunately, motivation is a value that is intrinsic to a game environment. Games provide their own motivation by allowing players to achieve goals, unlock upgrades and progress to the next level. This fosters a sense of achievement among players that encourages them to keep playing and keep learning.

For these reasons, games are well-suited to serve as educational tools in the form of serious games. Serious games, as described by Abt (1987), have an "explicit and carefully thought-out educational purpose and are not intended to be played primarily for amusement". They rely on the intuitive and enjoyable nature of games to enhance the learning process.

First-order logic is a fundamental topic in Computer Science. It concerns sentences that consist of logical statements that evaluate to either true or false. These statements are called *predicates*. Relationships between predicates can be expressed using *logical connectives* and their corresponding truth tables (Gensler (2001)).

Concepts in first-order logic lay the foundation for several other fields such as Philosophy and Linguistics (Jäger and Sieg (2017)). It is also seen as a formal interpretation of foundational Mathematics - a field notorious for being inaccessible in higher education due to its language and notation.

The strict rules and mechanisms that drive first-order logic makes it an excellent candidate for tuition via the format of a serious game. The game-semantic interpretation of first-order logic - as described by Hodges and Väänänen (2019) - will form the basis of this project.

1.2 Aim

The aim of this project is to create a serious game for the tuition of concepts in first-order logic.

People are more likely to use a given technology if it is:

- (a) perceived to be easy to use;
- (b) perceived to be useful.

Therefore, it is vital that the game is perceived to be easy to use and that it is perceived to be useful (Davis (1989)). To increase the game's perceived ease of use, the game should operate on a smooth, intuitive interface. The game mechanics employed should be suitable for the topic at hand in order for players to absorb concepts better than traditional learning mechanisms. To increase the game's perceived utility, it is important that the game teaches concepts in first-order logic from scratch and builds on that knowledge to a level that is equivalent to what is taught at university.

1.3 Objectives

Upon completion of the game, the player should have gained a better understanding of first-order logic concepts. They should have gained confidence in understanding and applying atomic sentences in relation to a model. This will be evaluated via a post-game survey.

Secondary objectives include suggestions for future extensions to this project.

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