

Physics Laws as Game Rules

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Physics laws are the rules of the 'game' we all live in. However, designing a board game out of them is not the straightforward process one would expect. This article discusses some of the issues that may be encountered, and illustrates several concepts through a design exercise, a board game that recreates the very first minutes of our universe.

1 Introduction

LET me start by saying that I am a physicist that designs board games. This paper dealing with the link between physics and games, most of what follows corresponds to my personal view from my experience in both fields.

The aim of physics is finding the laws that explain how the universe we live in works. These laws should not only describe the phenomena that we witness today in our surroundings; they should let us reconstruct how the universe evolved from its origin to its current form and, ultimately, let us model the direction it will take in the future. We look for simple patterns within complex environments, trying to derive from them laws that are few and simple.

In thematic board games, designers try to abstract the events they want to recreate into few and simple rules. This exercise is required to a lesser extent in video games, in which complex algorithms may be hidden behind the pressing of a button, but is essential in board games, where the players must execute manually on the board the movement and behaviour of all the game pieces. This abstraction often requires more or less arbitrary choices and simplifications, that often lead to more or less complex rule sets.

So on one hand we have designers trying to translate the events of their games into few and simple rules, and on the other hand we have real events that obey few and simple rules already. Logically, one should expect a lot of board games about physics, since the abstraction work has already been done by nature in the form of laws which could be taken almost directly as rules for board games. So why are (good) board games about physics so rare? How should one proceed in order to make a game from physics laws?

In this paper I will try to answer these questions. I will distinguish between teaching tools and serious games, then deal with the concept of design for effect and discuss some examples of games that have translated a law into rules, with uneven success. In order to illustrate the wider scope of the problem, I will then spend

more time considering a case study, in which all the steps from the physics to the final game will be accessible. It will be shown that the abstractions performed by nature in the form of laws are not always well suited for a board game.

1.1 Games or Teaching Tools?

The majority of board games about physics I am aware of fall into three main categories:

1. Pedagogical tools used for the popularisation of science.
2. Detailed simulations of complex processes.
3. Board games with a physics theme.

At science exhibitions I have observed an increasing trend to propose tools that give a flavour of physics in a playful framework. Their main purpose is to attract young people to the field, but can be also used to teach physics at an introductory level. For example, the 'Billotron' [1] uses marbles rolling on a flat surface to illustrate Rutherford's famous 1911 experiment designed to discover the atomic nucleus. Further, the 'Supernova Fountain' [2] displays the complex instabilities that appear in the first stages of a supernova explosion with flowing shallow water. However, most of the teaching 'games' I have seen are not very good as games. They do teach, or give an idea of, some physics processes, so they fulfill their mission, but they were not designed to provide a competitive, challenging or fun gaming experience. In fact, most of their creators are scientists unaware of the board gaming hobby.

Setting these objects aside as teaching tools, we are left with the other two categories, in which the game itself is the goal. The border between detailed simulations and board games with a theme is not well defined in general. In almost any gaming theme one can find complex, highly detailed games and lighter, more abstracted ones, the latter being the more popular offer nowadays. If the laws of physics are simple, though, why should the games be complex?