

Chapter 9

Rocket Jump Mechanics for Side Scrolling Platform Games

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ABSTRACT

This chapter uses the Mechanics, Dynamics and Aesthetics (MDA) framework as a practical guide to incorporate the Rocket Jump mechanic in a side-scrolling platform game. The authors systematically approach the design problem by encoding physically based rules for Rocket propulsion (Mechanics), and then creating appropriate obstacles to construct progressively difficult levels (Dynamics). A comparison is then made to the Rocket Jump with the Conventional Jump with a subjective questionnaire on game difficulty (Aesthetics) using the NASA TLX template. Participants report that they find the rocket jump mechanic more mentally demanding, and thus better immersed in the game. Game-play data is also evaluated to analyze performance differences between the two mechanics modes and find that there is negligible difference. This proves that the Rocket Jump implementation is balanced and quite compatible with conventional platform games. This article aims to provide useful insights and information for the construction of challenging levels with Rocket Jump.

INTRODUCTION

The revival of the platformer's popularity in the recent years could be attributed to new breakthroughs in the area of game design. We have seen new and interesting game mechanics in *Braid* (2008) and *Super Meat Boy* (2010) that had

breathed in new life into the genre. We can see that the platformer genre is reinterpreting game mechanics and design that was popularized in other game genres. For example, *Braid's* idea of time manipulation was heavily influenced by other time manipulation games such as *Prince of Persia: Sands of Time* and *Blinx* (Totilo, 2007). Similarly, other mechanics like parachute jumping, or gliding have been used to inject more fun

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into platformers. Encouraged by these examples, we are looking to incorporate an existing game mechanic from another genre into the platformer.

Rocket Jump is a form of emergent gameplay that had gained popularity in First Person Shooters (FPS) like *Quake* (1996) *Team Fortress 2* (2007). Rocket Jump was originally born from a game glitch that allowed the player wielding the rocket to be propelled across distance. The popularity of Rocket Jump was quickly noticed by many game developers and was subsequently incorporated as a core mechanic for many FPS games.

We are interested in applying the Rocket Jump as a novel movement mechanic for side scrolling platform games. In this game experiment, we compare the Rocket Jump mechanic with the conventional movement mechanics found in most platformers. Also, to aid in the design of the levels, we apply physics equations to the design of our game levels for the tweaking of level difficulty. The details of the Rocket Jump mechanic is discussed in conjunction with links to level design that afford balanced play and progressive difficulty, in a 2D side scrolling platform game. Throughout this process, we will be using the Mechanics, Dynamics and Aesthetics (MDA) framework (Hunicke, LeBlanc, & Zubek, 2004) as a design guide.

We first explore the underlying physical constraints of rocket propulsion (Mechanics). Following that, we create game levels that afford progressive difficulty (Dynamics). We feel that it is important to objectively visualize the challenge posed to the players even before user trials are done. Typically, level obstacle design is done manually by iteratively tweaking important variables and testing the resulting game-play. This approach has obvious limitations in addressing puzzles with many variables and different player skills but as a reference for a technical discussion of a mechanics implementation, we will not consider the design aspects of the mechanics. We describe a simple parabolic motion estimation framework that allows designers to calculate

permissible ranges for successful jumps, and thus allowing them to create scalable difficulty without any guesswork. We suggest some values for key rocket mechanics and obstacle parameters for the reader's reference and predict the corresponding game-play challenge. Besides evaluating the difficulty of the obstacles (Dynamics) by looking at the performance of the players, we also assess the difficulty of the Rocket Jump versus the Conventional Jump, to assess its pros and cons as a new mechanic replacing a well-accepted one.

This chapter guides the reader on how to design platformer levels to suit the Rocket Jump mechanic. The focus is not really on game design, but more on a practical framework for assessing difficulty and comparing the player experience.

BACKGROUND

Why Platformer?

Once best sellers in the gaming industry, platform games (or platformers) have now been reduced to only 2% of the market in 2002 (Boutros, 2006). While one may attribute the massive decline to the emergence of other genres of games, one could not deny that the platformer had been too caught up in the technological advancements that brought about more glitter and glitz into games, preferring to dazzle players with improved graphics or better audio quality. From the classic 2D single screen and side-scrolling platformer, the genre has branched into 2.5D, where the game combines 2D gameplay with 3D visual effects. Unable to compete with the novelty of emerging genres and without much advancement in terms of game design to further the potential of platform games, the sales of platformers languished and had never quite recovered. It is evident from the popularity of recent platformers such as *Braid* (2008) and *Super Meat Boy* (2010) that the genre is far from its end. The truth behind the success of

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