PROPOSAL FOR PHYSICS BASED PLATFORMER FOR THE TEACHING OF MOMENTUM.

Mathew Blair (mblair), James Fitzsimmons (fjr), Joana Lopez, (joanal), Pongsakorn Champ Kanjanabutr (pkanj)
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The aim of this project is to provide an educational resource that allows students to learn an overview of the principles of conservation of momentum, impulse forces, quantum tunneling and space-time distortions. We will achieve this through an engaging side scrolling two dimensional platformer in which players must solve otherwise impossible puzzles by exploring these concepts. We will draw inspiration from existing work in this field, mainly from the work of Valve studios in their products "Portal" and "Portal 2", as well as from work done on traditional platformers such as the Super Mario and Super Metroid series (by Nintendo Inc.).

Our product is aimed at students at a high-school level and as such we will not be attempting to teach a thorough mathematical interpretation of the physics involved, but rather develop an intuitive feel for their workings. The difficulty of the puzzles will increase as the game progresses to provide the students with a continuing challenge as their understanding develops.

The game mechanics are relatively simplistic in their nature; the players move around the level with physics that reflect the world we live in. The camera will display a subset of the entire world and will move both laterally and longitudinally, centering on the players location. The player will be allowed the option to zoom out to an overview of the level to get a lay of the land, but while in that view will not be allowed to undertake any other actions. Input will be taken from the keyboard and mouse, allowing the player to both move and aim simultaneously. The only controls at the players disposal are: horizontal movement; jumping; aiming the portal device; creating a pair of portals. Using the portal device to create links between two points, the players will be required to solve a series of puzzles, revolving around the need to press switches, manipulate objects like boxes and balls as well as clear un-passable hurdles (such as insurmountable walls and large chasms).

The momentum comes in to player when we consider the portal's physical characteristics. Namely, The portals allow for conservation of momentum. This means that the player would be able to cross a large gap by placing one portal on a slanted edge as a launching pad, then jumping from a reasonable height, reaching high velocity, gaining sufficient momentum such that when they place a portal at the bottom of the pit, they simply pass through and therefore vault the chasm. In order to ensure that players are not penalized for a lack of understanding of momentum, initially they will not face any damages from miscalculations, however as the levels gain difficulty, the environment will change in order to make the players accountable for their mistakes.

Our game will follow the general form as depicted in the following attached view prototypes:
- "Main menu"
- "In Game View"
- "High Score View"

The "Main Menu" is a prototypical example of a standard game menu, allows you to configure the input controls, change the music levels and display modes. Likewise the high-score view is prototypical of the genre and as such we wont spend too much time discussing it here.

The "In Game View" provides a prototype of what the general in game look will be as well as an idea of the game mechanics. We see the view is largely taken up by the in game camera, with some U.I. elements along the bottom of the frame depicting how long the level has taken and which portals are active. The dotted lines depicted in the prototype are not in-game elements and are merely provided to give an idea of the movements allowed by the conservation of momentum through the portals. Here we see the character has jumped off a high wall, through a portal, and landed in a previously unreachable area.

We will also be looking at adding "cut scenes" to the game in a simple 2D graphic style that will teach the players how to achieve certain objectives, as well as provide some background theory behind the physics.