

# Momentum

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## 0. Introduction

This document describes a game idea that combines skills and racing elements in an innovative way. The objective is to propose a game that entertains up to four players simultaneously on one big screen (without splitting it into four small views), is fast-paced, easy to learn and provides fun for everyone. Because it is inspired by two well known game concepts, skills and racing, it is easy for new players to quickly get into the game.

## 1. Game Description

### 1.1 Background Story

Jimmy just threw the lever for the warp drive generator. In any moment, he expects to jump out of his misery: the black hole attracting everything in its wake.

If only he knew what was going on underneath the thick metal plates of his engine room. Nondeterministic quantum particles are speeding through architectural labyrinths of the machines' inner workings, eventually reaching their goal: The warp drives core matrix. The probability of a successful warp jump is well above 99.9%, but occasional accidents have been reported to happen. If a particle strays off it's path from the warp engine to the core matrix it is lost forever within the endless space of time, and the warp bubble would collapse, destroying the ship. To reduce this risk, a redundant amount of up to four particles are sent on their way. But only one can reach its goal, the others are lost forever. It is what you have been training for all your lifetime. Do not stray from the path.

Now go! It's the moment of your life!

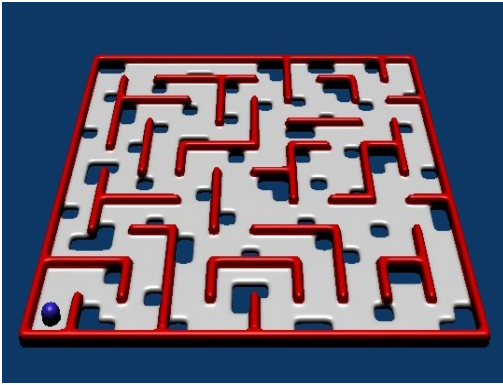
### 1.2 Game Idea

Momentum is inspired by the original board game where you have to balance the wooden board in order to move a metal ball from one side of a labyrinth to another, avoiding the holes along the path. Momentum enhances this game idea with several aspects that are only possible within a video game and combines it with the concepts of race games. The design goal is to provide a single and a multiplayer part, without the necessity to split the screen in small sections. The implemented realistic physics lead to an overall intuitive gameplay.



*Illustration 1: The classic board game*

The game includes different game modes, where Momentum is the main mode. Each game mode consists of several levels to complete.



*Illustration 2: The classic game mode draft*

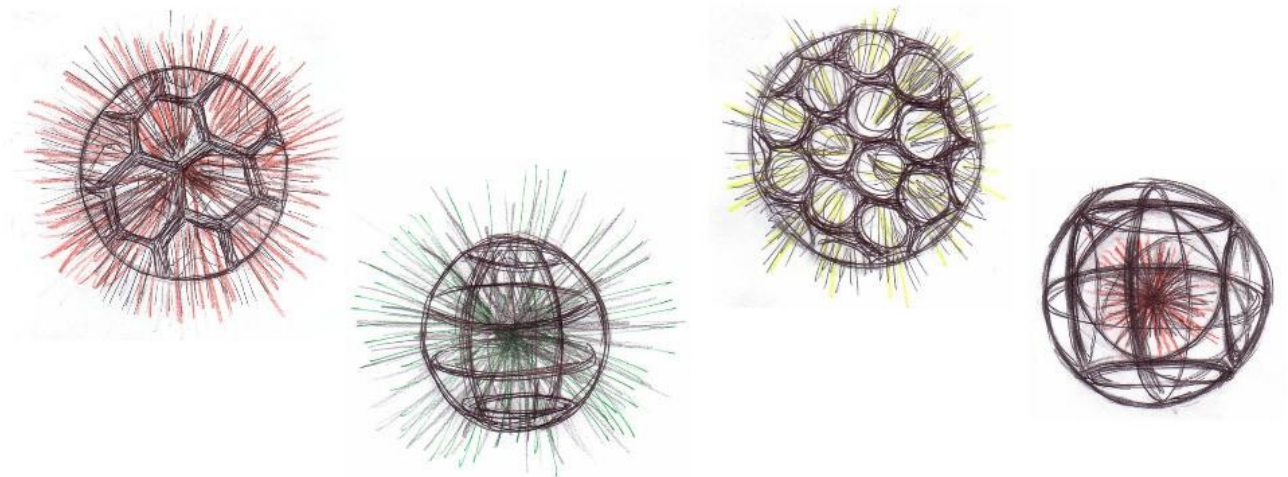
### **Classic mode**

The classic mode represents exactly the same game play as the original. The player controls one ball by balancing the board. If the ball falls into a hole, the game is lost. The player wins the game when the ball reaches the designated goal.

In the multiplayer version each player controls an edge or axis of the board. The players have to cooperate to win the game.

### **Momentum mode**

In this mode, the player directly controls his ball without balancing the board. Inputs from the players controller are translated into acceleration of the ball into the given direction. This makes it possible to have several players, each controlling one ball on the same board.

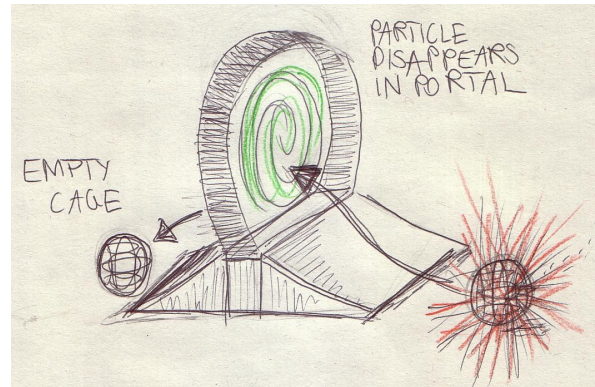


*Illustration 3: Sketches of the balls*

In addition, the game play is enhanced with the momentum energy. The ball has to be thought of as a metal cage that encloses a quantum particle (which is visualized using many graphical particles). This quantum particle has the ability to store the rotation energy of the surrounding cage, and to release it at a later moment. This energy is called momentum. The ball begins to rotate when the player accelerates it. The faster it rotates, the more momentum is being generated, up to a specific maximum. If the ball collides with an obstacle of the labyrinth, some momentum is lost (which is visualized using graphical particles). The amount of accumulated momentum energy is visualized by the glowing effects of the quantum particle. The more momentum a particle has gained, the brighter and stronger it glows and shines (and the more graphical particles it is made of). If it has reached the maximum amount of momentum, the ball begins to burn (with the players and the particles color). In that state, the player can release the gathered momentum energy to perform special moves, such as jumps, speed ups and gain grip enhanced mobility.

The goal of this mode is the same as in the classic mode; the player has to direct his ball to the finish area and overcome different obstacles along the path. The finish area is a portal to the warp core matrix.

The **single player** version is meant for the player to train his skills and to prepare him for the multi player race. To make the game more difficult, the board is randomly shaken, tilted and otherwise distorted by the computer.



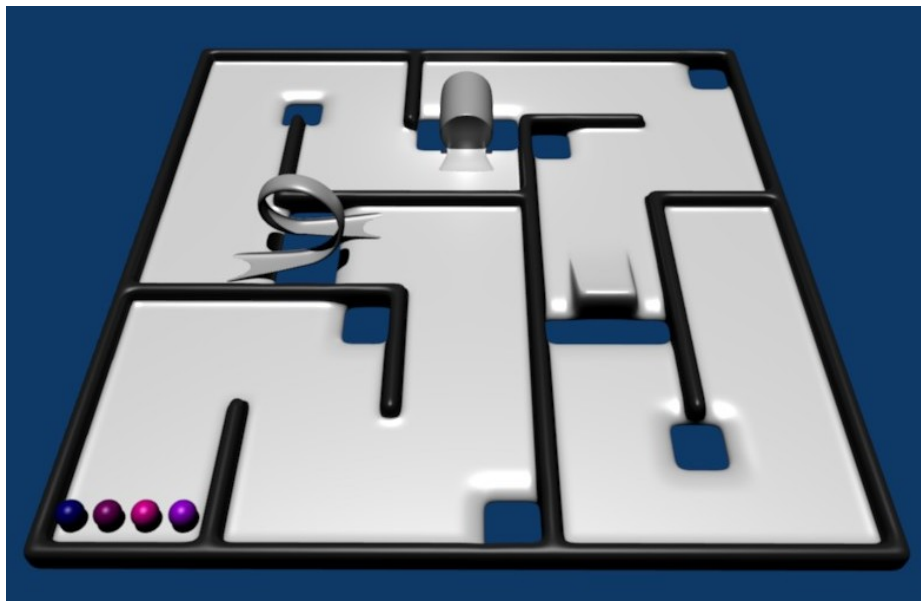
*Illustration 4: Draft of the finish portal*

In the **multiplayer** version, up to four players compete against each other in a race to finish as first. The players try to push their opponents off the board and avoid to be left behind. Here the momentum plays another important role: If two balls with different amount of momentum collide, then the ball with more momentum will cause more impact on the other one. If a player's ball drops off the board or falls into a hole, his ball is lost and he cannot participate in the race anymore.

The players that dropped out can compete against each other to take control of the board and to disturb the remaining players. At random time intervals, a button symbol appears on the screen. Whoever pushes the corresponding button first, is allowed to control the board for the next time interval.

If all players drop out, the race is restarted.

The race ends when a player reaches the warp core matrix portal. He wins the level and scores a point. A bright flash fills the screen and slowly reveals the next level. After a specified amount of levels a high score list with the total scores is displayed, showing the overall winner of the game.



*Illustration 5: Draft of momentum mode with some obstacles*

## **2. Development Schedule**

### **2.1 Description of Layered Development Schedule:**

We intend to develop an efficient physics engine to enable the construction of diverse game boards by simply importing a geometric model built using external software (e.g. Blender, in our case the software used for 3D content creation).

Our development plan is designed to support increasingly complex game boards going from a basically flat game board to a board with different kinds of obstacles, holes, loops and ramps. Basic stages will only support single player mode, while advanced stages will offer multiplayer interaction.

These transitions will imply developments especially at the level of the physics engine, which will be dependent on an increasingly efficient collision detection library. Artwork and other resources like sound will be added sequentially, culminating in rendering the momentum ball containing a whirl of particles, using particle simulation.

#### Functional Minimum:

This stage will also represent the Game Prototype which we will present to the class on March 18. It will be a software prototype (using XNA) showing basic components and core game play.

This stage of development will support single player mode with one ball on a simple, basically flat game board. The ball is just defined as having center and radius and rendered simply as an opaque sphere. Using the gamepad, the player can move the ball on the board directly or indirectly by tilting the board. Geometry is rendered without any artwork like textures.

#### Low Target:

Enhanced game board geometries are supported, including building a maze from walls and posts, as well as loops and ramps. This entails modifications in the physics engine and a need for efficient collision detection. The ball also supports single-player momentum effects like extra acceleration and jumping. Feedback on available momentum is given by a simple progress bar. Basic artwork is introduced with texturing of the game board as well as basic acoustic feedback, e.g. when the ball hits a wall of the maze. Also rendering is enhanced by shadowing. A startup menu allows the player to select a gamepad control mode (direct control of momentum ball or indirect control by tilting the board).

#### Desired Target:

This stage introduces multiplayer mode with cooperative (single ball) or competitive (one ball per player) gameplay. In competitive multiplayer mode higher momentum translates to higher inertia of one player's ball. The progress bar of the previous stage as a means to indicate available momentum is now replaced by a particle simulation, with higher densities of the particle whirl - which is bounded by the wire frame of the ball - meaning higher momentum. When the momentum ball touches the walls of the maze or when the player uses momentum e.g. for acceleration, some particles are seen leaving the boundaries of the ball and consequently momentum will decrease. These effects translate the plot of the game and at the same time will be visually appealing, amounting to a main visual characteristic of the game.

The startup menu at this stage additionally includes choices for single/multiple player modes.

After incorporating all important elements of the gameplay and with visually

appealing rendering the game will now offer fun for hours to come.

#### High Target:

Enhanced obstacles on the game board are implemented. These include dynamic obstacles like moving hammers or anvils deflecting the momentum balls. Other examples are ice, water or glue on the board, each necessitating enhancements to the physics engine.

#### Extras:

The properties and effects of the dynamic obstacles of the previous stage are enhanced: e.g. when the anvil hits a momentum ball, the ball will be deformed as a penalty, recovering its shape over time.

The game now includes a level editor, where game boards can be composed, only bounded by the player's mind.

## 2.2 Task List and Timeline:

(abbreviations: B = Bernhard, C = Claudia, J = Juergen)

Week	Tasks/Milestones	Who	Time
03-09 März	<i>Rough draft of Formal Game Proposal</i> game description text development schedule game assessment text + mockups	B J C	2 2 2
10-16 März	<i>Final draft of Formal Game Proposal</i> physics engine – basics, gamepad input collision detection library interface basic scene rendering board model for Functional Minimum, Content Pipeline	all B J J C	2 10 2 3 5
17-23 März	<i>Milestone 1: Prototype / Functional Minimum</i>		
24-30 März	game board with enhanced geometry basic startup menu physics engine – single player advanced efficient collision detection	C C B J	15 3 25 25
31-06 April	texturing momentum bar	C J	10 2
07-13 April	basic sounds shadowing	C J/C	1 2
14-20 April	<i>Milestone 2: Low Target</i> physics engine – multiple player advanced particle simulation	B J/C	20 15
21-27 April	lights advanced complete startup menu	J C	5 5
28-04 Mai	advanced sounds	C	5
05-11 Mai	<i>Milestone 3: Desired Target</i>		
12-18 Mai	<i>Playtesting</i>	all	20
19-25 Mai	<i>In-class Presentation</i>	all	10
26-31 Mai	<i>Public Presentation</i>	all	10

### **3. Assessment**

Momentum combines known game concepts from reality like racing and skill games with new elements that can only exist in video games, such as the momentum energy or a player controlling a quantum particle.

It is a fun game for several reasons:

- The game allows players to play alone as well as with friends in a cooperative or competitive game mode.
- The multiplayer race competition on one screen encourages social interaction among the players.
- By training their skills players can master more challenging levels or complete levels faster.
- It is interesting to experiment with the momentum energy and the real world physics and to find out how the balls behave.
- The glowing and burning effects of the particles and the portal are nice to watch.
- The fast-paced and easy to learn game play provides instant fun. There are no complicated rules or control mechanisms to learn. It is a party game, made for everyone!

The game is a success if it meets the above mentioned fun factors and if the real world physics, the particle simulation and the graphical effects are implemented convincingly.