Blue Shift

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Game Overview

I aim to create a racing game with movement mechanics inspired by Outer-Wilds' tiny solar system. Instead of having roads and banked corners, players will have to take advantage of orbital mechanics to manoeuvre around turns. Players will be guided through the intended route of each track but will be encouraged to take creative shortcuts. The game will be time trial-based, players will be rewarded for completing the track as fast as possible. Each track will have various badges to obtain based on the player's time, this will incentivise players to replay each track until they earn all badges.

Movement Mechanics & Physics

Universe Physics

The racing physics will be governed by realistic Newtonian gravitational physics. Celestial bodies will attract each other and the player in accordance with the formula:

$$F = G\frac{m_1 m_2}{r^2}$$

The gravitational constant G can in our case be adjusted in accordance with the ship controller to make the movement feel responsive. Some celestial bodies will not be attracted to any other bodies and act as constant objects in each world. These will allow tracks to remain easily navigable. Other bodies will orbit these bodies and interfere with the player's ship.

Ship movement

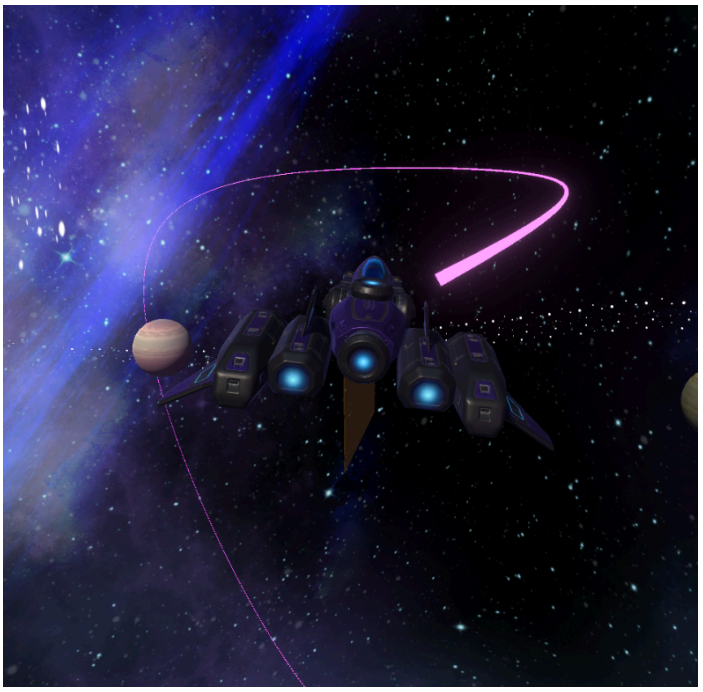
Since direction is relative in space, omnidirectional movement is crucial. The player will be able to control the ship's yaw, pitch, and roll as well as its thrust along 3 axes. This will allow players to quickly change their direction of thrust as they sling around large bodies without having to rotate their entire ship. The camera will be fixed to the player's ship in a strict follow-cam fashion. This is because both joysticks are already in use to fly the ship, so controlling the camera makes the controls too complex. To further ease player movement, holding x on the controller will apply the necessary forces to bring the ship's velocity to zero as fast as the thrust values allow. This serves a similar function to a brake in a car race, allowing players to slow down around a turn without having to negate the velocity manually. Note: A controller is required for iterations 1 & 2.

UI & Player Feedback

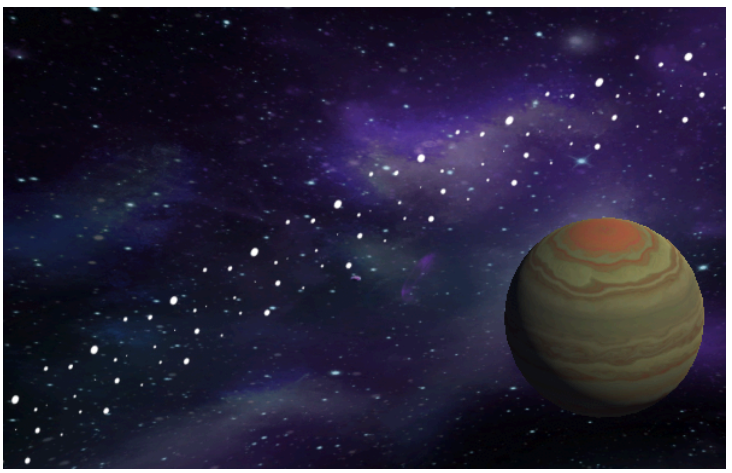
Space is inherently disorienting, player feedback is thus crucial to allow players to navigate tracks with confidence. Various UI elements will be included to assist the player both in navigating the track and controlling their ship:

Navigation Aids

- **Orbital path visualizer:** The system will calculate the player's trajectory and how bodies will affect it in real-time. This will provide players with a real-time indication of where their ship will go if they make no further changes.



- **Breadcrumb-like star trail:** A trail of stars highlighting the intended path through the track. Due to its textured nature, it also aids the player in gauging their speed and distance relative to the path.



- **Distance indicator:** A UI element will show the distance and relative velocity of anybody the player selects.

Movement Aids

- **Thrust Indicator:** A live view of all user-controlled forces acting on the ship will be displayed to indicate to allow precise manoeuvres by indicating exactly how thrust is applied.

- **Velocity Indicator:** The Player's current velocity magnitude is displayed at all times to allow players to gauge how fast they need to go around turns next time they attempt the track.

- **Haptic Feedback:** The Player's controller will vibrate based on how strong the gravitational forces acting on the ship are at any given time. This will give tactile feedback with regards to how much risk the player is taking around a tight turn.
- **Particle effects:** Dynamic Particle effects show the player exactly how thrust is being applied to their ship. The particle trails additionally scale to indicate the player's velocity.

Racing Aids

- **Ghost Racer:** A transparent copy of the player's previous best attempt will play as the player races to indicate where they can improve upon their previous attempt.
- **Checkpoint times:** The delta time between the current attempt and the previous best attempt will be shown at each checkpoint so that a player can see if they are faster or slower than the previous attempt.

Track Design & Components

Static bodies

Large bodies will remain stationary throughout the race and will act as a sort of constant skeleton for each track. They will be what dictates the general flow of each track.

Obstacles

- **Moons:** Orbiting the large bodies will be smaller, but still large moons that can act as obstacles but also sling the player in interesting directions. They can be used to disguise shortcuts.
- **Asteroid belts:** Large groups of small bodies that orbit a Large body. These will have little effect on the ship's gravitational pull, but will easily knock a player off course if they lack precision.

Checkpoints

To guide the player and ensure the flow of the track is not undermined, large rings called checkpoints will be strategically placed along the track. They will also assist the player by dividing their time up into manageable stretches of track. Players cannot reset to checkpoints but they must fly through checkpoints in order.

Track Design principles

The main elements of each track will be gravity-assisted turns. Entering and leaving a large body's gravitational pull at the right moment can drastically influence the speed and angle of a turn. Adding unnecessary turns and hidden shortcuts will further enrich each track's experience. Obstacles will be mostly used to encourage players to find creative workarounds. Given the three-dimensional nature of tracks, players have a lot of room to avoid obstacles, so checkpoints must be placed in such a way that the approach angle to a turn carries great weight.

Tutorial design

The tutorial will be a series of short tracks each introducing a new axis of movement along with simple maneuvers. Players will be prompted to stay as close to the intended path as

they can. On the final tutorial track, all movement will be enabled and players will be encouraged to take shortcuts off the intended path.

Music & sounds

The game will feature electronically created, futuristic sounds to enhance the fast paced tension of the game and to give extra feedback to players.

Iteration 1

The first iteration of the game features all the physics and movement mechanics, it consists of a test track used to fine-tune the universe parameters and controller settings. It further includes most player feedback elements and serves as a good foundational proof of concept. It has no race logic and player movement is restricted to 2 axes. All backend is in place for track components to be built.

Iteration 2

The second iteration enhances all the player feedback devices. It boasts a +-70sec track with difficult lines. It also includes a basic checkpoint system and all axes of movement are unlocked.