Untitled* Awesome Cylinder Racer 3000**

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* Couldn't think of a good name. Note that it is descriptive, however!
** 3000 is 1.5x more extreme than 2000. Plus it's not 1999, so 2000 is not longer the mystical "future".

### Brief Description

Untitled Awesome Cylinder Racer 3000 is a futuristic racing game in which the player controls a vehicle that races along the inner surface of an ever-shifting cylindrical track. The track contains obstacles, multiple race lines, varying corridors and boost lines that the player navigates at high speed. The player may also acquire power-ups that give them speed and maneuvering advantages, as well as a chance to change the layout of the track itself.

### Detailed Description

This project is a futuristic racing game with several unique mechanics. It draws inspiration from other high-speed racing games such as F-Zero and Wipeout. Here are a few key ideals:

#### Speed and Sense of Speed

The game uses camera motion and movement effects such as motion blur to make the players feel as if they’re racing at several hundred miles per hour.

#### Balanced Skill vs. Luck

Racing games require careful balancing. Since the race tracks exist in three dimensions, there are literally multiple paths to victory, which reward ambitious drivers' excellent navigation skills. Less savvy drivers can instead gamble with power-ups and manual boosting to come out ahead.

#### Unique Environment Effects

Race tracks are dynamic and evolving through movement and random chance. While some parts might be stationary, others contain segments of slowly undulating segments, creating an ever-changing course that keeps...
drivers on their toes. Some power-ups allow players to manipulate the environments to their advantage, much to the chagrin of other racers.

**Look and Feel**

The game would use a combination of bright, clean and gritty, industrial visual styles:

1. Levels contain neon outlines and colorful lighting effects.
2. Racing vehicles are highly aerodynamic, rocket-powered or spaceship-like.
3. The large cylindrical tracks have structural obstacles and typical future-world tropes, such as extreme industrial decay or bright, sleek structures.
4. Tracks contain winding pathways, some of which may intersect, contain multiple elevations, offer a challenging shortcut or narrowly avoid obstacles.
5. Tracks come alive with ever-changing configurations, such as rotating segments, quickly rotating segments that threaten to crush players, and ejecting segments with jump pads.

**Player Controls and Vehicle Properties**

The player vehicle pivots left and right on the cylinder surface as the player presses left and right keys (either arrow keys or A and D in the WASD configuration). The player would also have control over acceleration and braking.

The vehicle could also jump vertically to land on the opposite side of the cylinder to avoid obstacles or gain a navigational advantage. Designers may consider mapping the jump to a double-press so that the action is very deliberate on the player's part.

The player can acquire power-ups placed on the track. Once collected, they may manually activate the power-up with a button.

Vehicles use a health bar to incentivize careful driving—too many collisions with obstacles and the vehicle will explode. The vehicle will reset after exploding. This health bar doubles as a boost power that the player may manually activate with a button (held down) to gain a temporary speed advantage. Boosting depletes the health bar, so aggressive drivers can risk destruction in exchange for adrenaline. The health bar slowly replenishes after a period of inactivity following a collision or after exiting manual boost mode.

**Race Track System**

The cylinder track is made up of segments, some of which are stationary, some of which slowly rotate or unexpectedly eject as an additional
environmental hazard or challenge. The player would sometimes be able to trigger these actions themselves through some track-changing power-ups. (See Power-Ups section for more details).

The tracks would also have boost lines that grant the vehicles a temporary speed boost (independent of their manual booster) as long as they are on top of the line (it wouldn’t strictly be a line; it’d cover a portion of the track surface). Certain areas would also include jump ramps for daredevils and racers trying to escape the plummet of an ejected track segment.

The race track itself would appear from the outside as a large enclosed cylinder. The racers navigate the course on the interior surface of the track. The segments offer a convenient reusable element for designers to duplicate and form the basis of several animated changes to the track during the race session.

The designer would indicate an optimal path through the segment in their design tool. This will be essential for (potential) AI programming and some of the functionality of track-changing power-ups.

The race track would contain a handful of different segments. For discussion purposes, an individual segment can be part of a series of segments or as part of the track superstructure, (i.e. all the segments that make up the race track).

Stationary Segment

This segment doesn’t move or change unless affected by a track-changing power-up.

Slow Rotators

A series of segments (4 or more, depending on size) that slowly twists in a rotating motion, with each segment slightly behind the rotation angle of its preceding segment. The multiple race lines in these segments are slowly but constantly changing. Developers would have to carefully program this functionality to avoid creating completely impassible track segments. Slow rotators may also change their translation in addition to their rotation, so that entire portions of the track superstructure continuously modify themselves.

Fast Rotator

This trepidatious single segment quickly rotates 180 degrees every 10 seconds (or so) as an environmental hazard. Players can avoid them by jumping as they pass through or quickly boosting through them. Designers may want to visually designate them with a color, such as bright orange.

Ejector
This segment disconnects and drops from the track superstructure, leaving some drivers plummeting to their end. These segments would be ejected for the remaining duration of the race. Edges of track segments would enable jump ramps so that racers may jump through the gap left by an ejector. This applies to segments on the ejector as well—clever players may jump to the top edge of the segment and use a jump ramp to safely escape the falling ejector.

Many of the track system’s properties work hand-in-hand with track-changing power-ups. Please refer to that section for more information.

**Standard Power-Ups**

Like other racing games, the race tracks contain locations where players can acquire power-ups. All power-ups are manually collected when intersecting with a power-up generator placed on the race track. Players have one power-up at a time until they manually activate it.

**Boost Frenzy**

A power-up that lets the player manually boost as much as they want for a short period of time with no health bar penalty.

**Phase**

Lets players safely pass through obstacles without colliding with them or taking any damage for a short period of time.

**Time Freeze**

Temporarily slows down the moving segments in the race track.

**Track-Changing Power-Ups**

These power-ups are rarer than standard power-ups and allow the player to actively modify the race track in some way.

**Optimize**

For a short time, every nearby track segment rotates to align its optimal path with the forward movement vector of the player’s vehicle. This gives the player an easy, literally straightforward drive for a few seconds. Conceptually this resembles an autopilot power-up in other racers, but its ability to reposition the track segments creates a challenge for non-player vehicles to navigate an unexpectedly changing race line.

**Reconfigure**
Temporarily causes the segments ahead of the player to rotate and translate into a new path at medium speed, starting with the few segments ahead of the current 1st place vehicle. This resembles the non-player-controlled slow rotators. Reconfigured segments will return to their original configuration after the power-up’s effect ends.

**Eject**

Players may manually eject the segment containing the current 1st place vehicle. This segment is permanently ejected.

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### Scalability Plan

The simplest possible version would consist of only the cylinder track, the player, and some obstacles. The player could pivot along the cylinder surface while avoiding simple obstacles. This would work as a simple game concept. As time allows, more features like power-ups, multiple race lines, and AI opponents could be added.

If racing AI is difficult to develop, the developers could flesh out the environmental challenges the player faces as they navigate the race track. This new focus would require further consideration of the track system as a dynamic, changing entity.

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### Game Principles Discussion

The game will make use of several game design principles to make sure it’s fun. The game won’t have much of a plot, just one or more tracks in which the goal is to reach the end or beat the other racers. Many racers utilize a dual approach of a “career” or “circuit” mode for completionists and a “quick race” mode for casual players. More tracks and perhaps more vehicle customizations could be unlocked as the player continues to win races.

The actual gameplay will need to focus on several key aspects. One of these is fairness. Due to the ever changing nature of the track, the track layout needs to be well constructed to avoid being overly difficult. Another major design component of our game is allowing many play styles with varying degrees of risk and reward. The track layout allows multiple paths and the power-ups allow players with less skill to still have fun. Also, the boost/health meter allows players to play aggressively if they wish.

Another design principle that needs to be focused on is visibility. The player needs to be able to view enough of the upcoming track in order to maneuver the vehicle around obstacles in time. Also there needs to be some visual
representation to the power-ups as far as actions and timeouts go.

Design Challenges

Track Design

The game allows multiple paths which are constantly changing, so much thought needs to be put into the design of the track layout. Breaking down the track into segments can help alleviate this challenge.

Responsive Controls

The game focuses on speed, so the controls need to respond near-instantly to avoid player frustration.

Visuals

There will be a lot going on during a race (rotating segments, other racers, power-ups, boost lines, etc.) so there needs to be a way to represent these things without cluttering the screen too much.

Technical Overview

There are several major technical components of our game. One of these components is a 3D engine that can keep up with the game’s fast speed. Another is collision detection, which needs to be simple enough to not slow down the game, but robust enough to not appear to be broken. Collisions will need to be detected between the track surface as well as obstacles, power-up boxes and optionally other racers. The opponent AI is another major technical component of the game. Since the track structure is dynamic, this needs to be partially performed on the fly. Finally, representing the track also becomes a technical challenge. The track is in a cylinder, so some thought needs to be put into how to accurately represent this.

Technical Challenges

Track Representation

Representing the track is a major technical challenge. Breaking the track into segments is a good way to break the track into smaller problems. As for the segments, each segment could be made up of different structures (obstacles, boost lines, power-ups) that have start and end coordinates in the segment.
**Enemy AI**

Having good AI in a dynamic environment could be difficult to program. This problem can simply be ignored if needed, and the game can focus on only providing obstacles for the player to overcome.

**Dynamic Structure of the Tracks**

Since the track can change over time, there need to be event handlers which perform the specified action as well as restore the track to a manageable state. The track-changing power-ups especially the eject power-up need to alter nearby track segments to make it possible to proceed.