## Episode I: The Tube Awakens

Game Design Document

CPSC 585: Games Programming

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Team 2

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# 1.   Game Design

Car Wars is a fast paced combative driving game intended for friendly competition. A unique level design will offer players interesting interactions with the environment and other players. Use power-ups and skill to destroy the other vehicles and be the last car standing!

## 1.1.   Game Analysis

Car Wars is not based solely on any one game but borrows combative ideas from Twisted Metal for combat and the wall driving mayhem of Rocket League. The goal of the game will be to damage other players using weapons, hazards and straight up collisions. To fit with the arena combat theme game modes will include: Death Match, Time Attack, and Last Man Standing . All game modes will feature enemy AI vehicles utilizing different strategies in an attempt to win the game. A multiplayer mode will be available that replaces AI vehicles with players.

## 1.2.   Game Concept

The player(s) will be placed in a horizontal cylinder arena which rotates along its primary axis. The cylinder's rotation will provide a distinct style for Car Wars, allowing us to provide an environment that is continuously changing for our players that not only keeps things interesting but forces the players to adapt to their constantly changing surroundings.

Players will be forced into a hunt or be hunted environment where movement is essential. With hazards strung about the environment and enemies closing in, the players will have to keep moving in order to stay one step ahead of their opposition. Staying in one spot for too long, and they will soon find that their surroundings have changed and what was once a viable hiding spot has now become a dangerous area of death or a patch devoid of cover. Players will be forced to:

- **Adapt** to their changing surroundings, the patterns of their enemies and the different weapons they may be using.
- **Maneuver** through an obstacle-ridden environment fraught with hazards that may make the ground in front of you more dangerous than the enemies at your heels.
- **Hunt** their opponents, luring them into areas of comfort, that will give them a distinct advantage.
- **Destroy** all who oppose them, the only way to survive is to dominate!
- **Collect** power ups scattered (pseudo-randomly) throughout the arena.

- **Recall** a full rotation of the cylinder will provide a familiar battleground for attentive players to take advantage of.

Car Wars will feature the following gameplay modes:

- ○ Death Match - A team or free for all competition where the goal is to lay waste to the enemy, scoring points for each enemy vehicle "destroyed" until a goal determined by the player(s) is achieved. Vehicles will respawn until a victor is determined. The victor is the player/team that reaches the goal first.
- ○ Time Attack - A team or free for all event similar to Death Match in which eliminating enemy vehicles will score points, and the vehicles will respawn until the match ends. The match ends when a time limit (determined by the players) is reached, the player or team whose score is the highest when the match ends is declared the victor.
- ○ Last Man Standing - Each vehicle has a single life and once they have been destroyed they become an observer of the chaos. The victor is the last vehicle remaining.

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## 1.3.  Game Goals

Car Wars aims to provide a fun and chaotic environment that gives players different tools to accomplish the same goal. Different strategies will need to be executed as the environment changes and different power-ups and hazards are in play. The hazards give the player that is being chased a chance to "shake off" their pursuer. Power-ups will add offence, defence and mobility upgrades to give the player more options in battle. The game will also offer different cars and drivers to allow for a customizable experience pre-game that will suit their game style, which will also add more varied AI opponents. The game will have a similar driving feel as Rocket League with the addition of weapons like Twisted Metal. The main goal of the game will be to eliminate the competition.

We hope to make the game easy to pick up and play. With driving and shooting being the core of the gameplay we believe that intuitive controls can be made to allow new players to jump right into the action. A constantly changing environment provided by the cylinder's rotation and the pseudo-random placement of power-ups will restrict the advantage of more experienced players.

A visually appealing and informative interface will be present to select different game modes, cars, drivers, weapons, and options.
Multiplayer will allow players to compete against friends and family in a fun and chaotic environment by playing side by side.

## 1.4. Game Genre

Car Wars is a competitive third person arena based driving shooter with a signature "changing environment" provided by a horizontal cylinder based arena.

## 1.5. Target Market

Lacking a single player story mode and online multiplayer, our target audience will be families and friends of various gaming prowess. A perfect game for relaxing with friends or party entertainment, but not a game to be targeted to intense gamers who wish to sink all hours of the day into it. As stated previously Rocket League's driving mayhem has inspired some of Car Wars chaotic nature. We feel what Rocket League inspiration adds makes Car Wars stronger, but what it implies is heavy competition from the game itself. 2018 has a scheduled release for a first time ever Twisted Metal theatrical release. As we have based much of our gameplay on the Twisted Metal franchise we may be able to market Car Wars to appeal to fans of the established franchise who have yet to receive another installment of the game since 2012.

## 1.6. Gameplay Direction

- Car Wars focuses on spontaneous moment to moment content that is achieved through surprise during chaos and competition, rather than through story or meta game features.
- Players will be punished for remaining stationary in a constantly changing environment.
- Finding hazards now can be useful later and collecting power ups can snatch victory from certain defeat.
- Gameplay rules are simple enough that explanation should not be necessary. Game controls should be simple and intuitive. Measures will be taken in attempt to lessen the gap between experienced and new players (pseudo-random power up placement for example). All these features and more will hopefully direct the game in a simple and fun direction where competition may even take a backseat to fun mayhem.

# 2. Proposed Features

## 2.1. Feature Summary

### 2.1.1. Arena

- Stages will take place within a hollow horizontal cylinder full of jumps, bumps and dangerous hazards across the cylinder's inner surface, all of which will contribute to the strategy of the players. Using the terrain to outsmart, out-maneuver, and outplay opponents will be crucial to victory.
- The map is designed to keep the play area small but make it feel much larger due to the constantly changing environment provided by the cylinder's rotation. Nowhere will be safe as the map changes gradually, preventing players from "holding" locations and encouraging exploration. New obstacles will come into play, allowing for new ways to escape pursuers and new power-ups to change the tide of battle.

### 2.1.2. Pre-game choices

- The user can select from a variety of drivers, weapons and vehicles to find a setup that works best for them.
- Drivers will come with special stat bonuses.
- Vehicles have different base stats.
- Weapons will deicide how you will take down your opponents whether it be through continuous damage, explosions, or one fatal shot.
- If time permits we would like to add special abilities that will recharge after use and provide unique interactions with the players and environment to "shake up" gameplay

### 2.1.3. Power ups

- Shields that absorb damage.
- Oil slicks that can be dropped behind your vehicle to cause your pursuer to lose control.
- Speed boosts to out-maneuver your opponent.

### 2.1.4. Multiplayer

- The user can bring friends along to prove who is the best driver in the universe, or practice against the computer drivers to hone your skills and find out what best fits their playstyle.

## 2.2   Feature Breakdown

- Driving
  - Movement with collisions.
  - Smoothness (physics complete)
    - Spring
    - Dampener
    - Cling (sufficient time in the wall before dropping)
    - Cylinder interactions (rotation does not interfere with gameplay)
    - Material based friction (oil slicks, metal surface, asphalt, etc…)
  - AI driving controls
  - Adjustable vehicle attributes
  - Driver attributes
  - Action skills
- Environment
  - Cylinder
    - Collision (physics body)
    - Texture / Mesh
      - Basic
      - Complete
    - Material
  - Obstacles
    - Scenery
    - Hazards
      - Static
      - Dynamic
  - Placement
    - Spawn Points
    - Power-up locations
    - Obstacles
  - Minimap
    - Terrain
    - Static objects
    - Dynamic objects
  - AI pathfinding

- ■ Navigates terrain
- ■ Avoids static objects
- ■ Avoids / Seeks dynamic objects
  - ● Damage/Interactions
    - ■ Health/Defence
    - ■ Ramming Damage
      - ● Orientation Based
    - ■ Weapons
      - ● Machine Gun
      - ● Missile Launcher
      - ● Rail Gun
    - ■ AI Weapon use
      - ● Cone of vision
      - ● Latency
      - ● Accuracy Improvement
      - ● Machine gun
      - ● Missile
      - ● Rail gun

# 3.  Game Design Elements and Terminology

## 3.1.  Rules

Car Wars has the possibility to accommodate multiple different game modes, each with customizable options to help enhance the users experience and allow them to create a more personalized match for them and their friends to enjoy. However our goal is to ship the game with the three games modes listed above: Death Match, Time Attack, and Last Man Standing.

## 3.2.  Game Information

### 3.2.1.  Arenas

Car Wars will ship with a single game arena, with the potential for additional arenas to be incorporated. Our main arena, and one of the main highlights of our game is a giant cylinder in the likes of the O'Neill Cylinder (pictures provided under concept art), in which vehicles will occupy the inner workings of the cylinder in a rotating, tumbling catastrophe of vehicles and intractable hazards.

### 3.2.2.  Power-Ups

Car Wars will feature collectable power-ups that bestow random benefits upon collection. Benefits will include enhanced mobility, offense or defence, providing an edge over other vehicles in the arena for a limited period of time.Specific power ups include:
- Speed up: provides a moderate increase to driving speed to help chase or escape other vehicles.
- Defence up: provides a moderate increase to a vehicles defence, reducing the amount of damage dealt to a vehicle by a given value.
- Oil slick: Gives the vehicle a one use oil slick that will spill behind their own vehicle. Any vehicle that traverses the inky mess will lose control of their vehicle and be sent spiralling out of control for a brief period of time.

### 3.2.3.  Weapons

After selecting their vehicle, players are able to select which weapon they would like to use in the arena. We hope to ship with three distinct weapons that will change not just the damage a vehicle can dish out, but the method in which they must do so as well. These weapons are as follows:

- Machine Gun: A rapid fire weapon that deals death like thousand cuts! That is a small amount of damage applied rapidly. The projectiles are fast and hit their targets near instantaneously, and missed shots are forgiving due to the insanely fast rate of fire.
- Missile Launcher: Provides a devastating amount of damage provided the user is able to accurately land the smaller, slower moving projectile. Recommendations are to aim for the ground or obstacles near the opponent because upon contact with a physical entity the missile will detonate damaging all vehicles in the immediate vicinity, allowing the user to hit even if their aim is a little off, or the target moves out of the missiles path. Any vehicles caught in the explosion will be thrown by the force of the explosion.
- Rail gun: A long charge rate, but worth the wait. Unlike the other weapons, the rail gun won't fire immediately after begin triggered. The user will have to "charge" the rail gun before firing it. In exchange for this delay the amount of damage and instantaneous speed of projectile is devastating. Missing with the weapon feels very punishing as the weapon will fire immediately after its charge is complete, preventing "precharging". Not being able to "precharge" this weapon will allow opponents the ability distract the user or dodge the rail guns vicious attack. Upon contact an immense amount of force is applied to the vehicle hit at point of contact.

### 3.2.4.  Vehicles

Each play will be given the opportunity to select a unique vehicle before the game begins. The goal is to ship the game with 3 unique vehicle classes that cater to the skills and goals of each player. These vehicles are as follows:
- Light Class: This class of vehicle will appeal to those who like to live fast and dangerously. These vehicles will feature high speed cap, high acceleration, slightly below average handling, and a weak defence. Allowing for a large possibility of maneuvers, including a speedy getaway, a quick repositioning, or the ability to chase down a target while pelting them with bullets.
- Medium Class: The Medium Class will feature vehicles with fairly average stats. These vehicles will best suit newer players who don't have a preferred playstyle quite yet. With average speed, acceleration, handling, and defence. This class will provide staple vehicles for all types of users.
- Heavy Class: Finally we have the Heavy Class. Vehicles from this class will have a low speed cap, low acceleration, but strong handling and defence. These vehicles will be selected by those who enjoying being in the thick of battle at all times. With the high defensive capabilities in this class, players will be able to spend a little more time sitting still in order to line up that perfect shot.

### 3.2.5.  Game Difficulty

We intend to make the rules simple, the controls intuitive and the mayhem off the charts. The game is intended to only be as serious as the players make it. Mayhem = fun and the more mayhem we can provide in the game's release, the more fun we believe it will become. Competition is important, but we believe that racking up the points in deathmatch mode will be a secondary reward to the satisfaction of making an opponent run head first into a hazard you narrowly avoided.

With this in mind it will be as difficult as your friends and family will make it. In a solo game (against only AI opponents) the most difficult part should be learning the environment and how to use it to your advantage. The AI's will be skilled enough to replicate the accuracy and driving capabilities of a competent player but what they will lack is the ability to learn the environment and use it to their advantage in a strategic way. This will make the game a challenge for players who wish to go "head to head" with the AI's, but easier for players who wish to play creatively for their victories.

# 4. Schedule

  a. Milestone #1         January 22, 2018 @ 12:00 PST
    i. High-concept Design Document
    ii. Feature List
    iii. Rough Schedule
    iv. Game Application Framework
  b. Milestone #2         February 12, 2018 @ 12:00 PST
    i. Gameplay Prototype
    ii. "Red Brick" Rendering
    iii. Player Driving Model
  c. Milestone #3         March 5, 2018 @ 12:00 PST
    i. First Playable
      1. Game Rules Implemented
      2. Opponent Driving AI
      3. Working 3D
      4. Working Audio Engine
      5. Refined Gameplay
  d. Milestone #4         March 26, 2018 @ 12:00 PST
    i. Feature complete
  e. Final Product         April 13, 2018 @ 12:00 PST

Notes on scheduling:
- All days are considered 8 hours days and 7 day weeks for the purposes of time estimates
- Deadlines are hard and are not a direct reflection of the time estimates
  - Early deadlines are assigned to tasks that are depended on by tasks within the same milestone
  - Tasks with hard deadlines shortly before milestone deadline are tasks that should not be considered during the final stretch
- Some tasks such as Weapon Aiming and Refined Weapon aiming are listed as two separate tasks within the same milestone to offer room to "delay" improvement to the next milestone if the need arises
- Due to the nature of this project and the varied schedule of its workers, task assignments will be made and altered on-the-fly based on individual workload, availability and comfort with given tasks (which will hopefully improve as the project progresses)
- Some tasks will be completed by partners as per AGILE's paired programming philosophy

| Task | Time | Deadline |
|---|---|---|
| Entity/component system | 2 Days | 01/14/2018 |
| ✓ Creating and destroying entities | 3 Hours | |
| ✓ Adding and removing components | 3 Hours | |
| ✓ Accessing entities via ID or tag | 2 Hours | |
| ✓ Organizing entities and components in efficient data structures | 1 Day | |
| Graphics system setup | 1 Week | 01/22/2018 |
| ✓ Pulls cameras from components | 4 Hours | |
| ✓ Pulls meshes from components | 4 Hours | |
| ✓ Draws split screen up to 4 cameras | 1 Day | |
| ✓ Renders all meshes in the world with correct position, rotation, and scale | 2 Days | |
| ✓ Renders meshes with shading and textures | 3 Days | |
| Data loading | 3 Days | 01/22/2018 |
| ✓ Load textures, meshes, and materials | 1 Day | |
| ✓ Load JSON files | 4 Hours | |
| ✓ Load scene file format to generate entities and components | 1 Day | |
| User Input | 1 Day | 01/22/2018 |
| ✓ Input from Mouse | 2 Hours | |
| ✓ Input from Keyboard | 2 Hours | |
| ✓ Input from Controller | 2 Hours | |

| Task | | Time | Deadline |
|---|---|---|---|
| PhysX Red Brick | | 1 Week | 02/05/2018 |
| | Create the red brick model | 2 Hours | |
| | Learn PhysX API | 3 Days | |
| | Implement PhysX sample code | 2 Days | |
| | Test and correct interactions with the cylinder | 1 Days | |
| Sound | | 3 Days | 02/10/2018 |
| | Learn sound API | 4 Hours | |
| | Gather and review sounds | 1 Day | |
| | Implement simple sounds | 1 Day | |
| Improve graphics | | 2 Weeks | 02/10/2018 |
| | Implement assimp library | 1 Day | |
| | Add support for bump and specular maps | 2 Days | |
| | Add directed lighting support (with baked shadows) | 4 Days | |
| | Add dynamic lighting support (with dynamic shadows) | 4 Days | |
| | Add skybox support | 1 Day | |
| | Add GUI support | 2 Days | |
| Make basic map | | 5 Days | 02/12/2018 |
| | Create model (cylinder + basic obstacles) and textures | 3 Days | |
| | Implement rotation physics/interactions with vehicles (PhysX) | 2 Days | |

# Milestone #3    March 5, 2018 @ 12:00 PST

| Task | | Time | Deadline |
|---|---|---|---|
| Camera | | 1 Week | 02/25/2018 |
| | Camera follows vehicle | 2 Days | |
| | Camera rotates around vehicle | 2 Days | |
| | Weapon aiming | 1 Day | |
| | Refined weapon aiming | 1 Day | |
| | Camera effects | 1 Day | |
| Vehicle Weapons | | 1 Week | 02/28/2018 |
| | Firing ray casts | 2 Days | |
| | Simple machine gun mechanics | 1 Days | |
| | Simple missile launcher mechanics | 1 Days | |
| | Simple rail gun mechanics | 1 Days | |
| | Weapon animation/sound | 1 Day | |
| | Weapon testing and simple balancing | 1 Day | |
| | Firing animations (machine gun shake, rail gun zoom, rocket pushback) | 1 Day | |
| Weapon "Physics" | | 1 Week | 03/05/2018 |
| | Missile launcher explosions and shockwaves | 2 Days | |
| | Rail gun shockwave and laser | 2 Days | |
| | Testing and simple refinement for game balance | 1 Day | |
| Computer AI | | 1 Week | 03/05/2018 |
| | "Flattened" minimap | 2 Days | |
| | Simple AI pathfinding | 2 Days | |

| | Rough AI combat (FUN not guaranteed) | 3 Days | |
|---|---|---|---|
| Interface | | 2 Days | 02/20/2018 |
| HUD | | 2 Days | 02/28/2018 |
| Test for FUN | | 2 Days | 03/05/2018 |

| Task | | Time | Deadline |
|---|---|---|---|
| Improved interface and selection | | 4 Days | 03/21/2018 |
| | Refined interface graphics | 2 Days | |
| | Selectable driver | 4 Hours | |
| | Selectable vehicle | 4 Hours | |
| | Selectable weapon | 4 Hours | |
| Refined Weapon Mechanics and Physics | | 3 Days | 03/21/2018 |
| | Implement power-up effects | 2 Days | |
| Map improvements | | 10 Days | 03/15/2018 |
| | Assortment of obstacles | 3 Days | |
| | Assortment of static hazards | 2 Days | |
| | Small assortment of dynamic hazards | 3 Days | |
| | Power-up boxes | 2 Hours | |
| | Obstacle and hazards placement | 1 Day | |
| | Test for FUN | 1 Day | |
| AI refinement | | 1 Week | 03/21/2018 |
| | Fun guaranteed AI combat | 2 Days | |
| | Pathfinding against obstacles and static hazards | 2 Days | |
| | Pathfinding against dynamic hazards | 2 Days | |
| | AI Overall Testing | 1 Day | |
| The Game | | 2 Days | 03/26/2018 |
| | Game mode selection and options | 1 Day | |
| | Tallying score for deathmatch | 2 Hours | |

| | Victor declaration | 4 Hours | |
|---|---|---|---|
| | Victory splash screen | 2 Hours | |
| Test for FUN | | 2 Days | 03/26/2018 |

# 5.  Concept Art

## 5.1.  Arena Concept Art
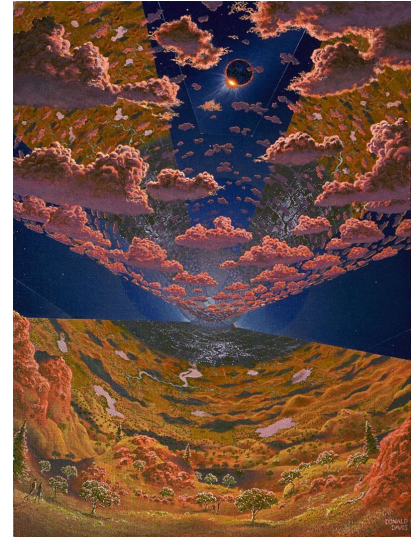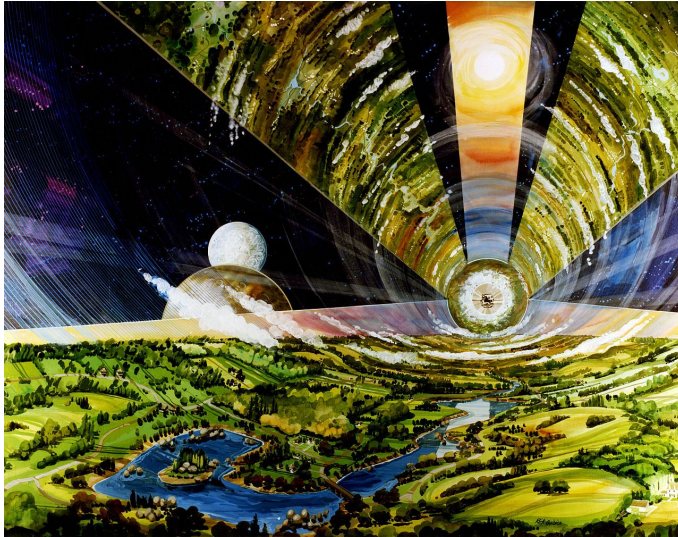




Above: O'Neill Cylinder designs, the core aesthetic concept of the Car Wars rotating arena

## 5.2.  Cars