Game Design Document: Bucket of Bolts

Written by: Brandon Danby Guido Tacchini Samantha Rovers

Version # 1.10

Tuesday, December 16, 2020

Table of Contents

Game Overview

<u>Unique Selling Points</u> <u>Game Breakdown</u> <u>Core Gameplay</u> <u>Match Start</u> <u>Car Assembly Phase</u> <u>Demolition Phase</u> <u>Game Replayability</u>

Core Systems

Enemy Al Camera Online Multiplayer Offline Multiplayer

Control Scheme

<u>Xbox</u>

PlayStation

Nintendo Switch

Car Breakdown

Car Spec Overview Module System Engine

Wheels Fuel

Bumper

Driving/Collision Systems

Driving Calculations Max Speed Acceleration

Damage Calculation

Environment Interactions

Hazards

Explosive Barrels

Health Items

Duct Tape

Narrative

Delivery

Level Design <u>General Design Methodology</u> <u>Design Principles</u> <u>Must-Haves</u> <u>Process/Pipeline</u> <u>Levels/Arenas</u> <u>Interface – HUD</u>

HUD Design HUD Elements Player Name/Number Player Icon

Car Health

Ability Cooldown

Interface – Outer Shell Global Outer Shell Menus Start Game

Settings

Quit Game

Interface – Inner Shell Match Start Screen Car Assembly Screen Demolition Screen (Pause Menu) Continue Game Quit to Title Screen

<u>Glossary</u>

Game Overview

In a post-apocalyptic world, robots mimic the humans of the past by competing in demolition derbies. The problem is, they are hilariously bad at building cars.

Unique Selling Points

Build Your Own Car

- Start each match by building your own car, selecting parts based on specs, features, or purely on aesthetics.

Car Parts are Hilarious

- Available car parts are not what you would typically find on a car. Only the RoBoBs would try to use a toaster for an engine.

Fast-Paced Car Combat

- Crash into enemy cars, push them into hazards, or hit them with special skills.

Game Breakdown

The below pie chart provides a visual representation of the gameplay broken into the three phases: Match Start, Assembly, and Demolition.



Core Gameplay

Core gameplay consists of three phases, Match Start, Car Assembly, and Demolition.

Match Start

The match start phase is where the player(s) create and set the rules of a match. This includes:

- The number of players/AI
- Arena(s)
- The number of rounds in the match
- Time limit for the rounds

Car Assembly Phase

During the assembly phase, all players build the car they will use throughout the match.

- All cars start with the same default frame
- There are four modules required to build a car
 - Engine
 - Wheels
 - Fuel
 - Bumper
- There are multiple part options in each of the module categories each with their own stats and bolt cost
- Each player starts with the same number of bolts to spend on parts
- All players select parts at the same time
- If a part is selected by one player, it cannot be selected by another player
- If a player runs out of bolts before selecting a part in each of the four module categories, they must unselect more expensive parts and select cheaper parts
- Any unselected parts can be selected by other players
- Assembly phase is over when each player has built their car

The assembly phase was designed as a sort of mini game that starts the fun before the demolition derby even begins. Players must be quick at selecting the parts they want while also remembering to budget their bolts.

Demolition Phase

The demolition phase is the most integral part of the core gameplay. It is made up of a series of demolition derby rounds.

- A round begins with each player appearing in opposite corners of the arena
- The player with the last remaining functional car in the arena wins the round (aka last man standing)
- Cars can be damaged by:
 - Colliding with other cars or walls
 - Being pushed into hazards
 - Using an engine skill (if applicable)
- Rounds have a set time limit based on what was selected in the match start phase
- If time runs out before a player wins the round, it results in a tie where each remaining player earns a win.
- The number of rounds in the match is based on what was selected in the match start phase
- The player with the most rounds won, wins the match
- If two or more players tie for most rounds won, they compete in a deathmatch (tie breaker)

Game Replayability

As Bucket of Bolts is a party game, it inherently has replayability. There are a number of factors that make up the gameplay experience in a match, which keeps things fresh. Some of the factors that could change are:

- Who the players are
- Number of players/Al
- Variety of cars that players can build
- Arena(s)
- Number of rounds in the match
- Time limits on the rounds

Core Systems

Enemy Al

Enemy AI is only present when AI drivers are selected during the match start phase. When present they will behave in the following ways:

- In the Assembly phase the AI drivers build a car using the leftover parts ensuring to maximize bolt spending.
- In the demolition phase the AI will focus on the following actions:
 - Avoiding being hit enemies
 - Driving into enemies, prioritizing nearest enemies and those with lowest health
 - If AI health goes below a certain threshold and there is a healing item available in the arena, collect the item.

Camera

The camera is fixed at a 45° angle (isometric) showing the whole of the arena. This allows for local multiplayer without the need for split-screen.

Online Multiplayer

Online multiplayer is not currently in development for Bucket of Bolts; however, there is still a possibility of implementing it in the future.

Offline Multiplayer

Bucket of Bolts was designed as a local multiplayer party game supporting 1-4 players. While player 1 must be a human player, players 2 through 4 can be AI driven. Below are the available combinations of players:

- 1v1
- 1v1v1
- 1v1v1v1
- 2v2

Control Scheme

As a local multiplayer game, Bucket of Bolts is first and foremost a console game. Below are the control diagrams for all major consoles.

Xbox



PlayStation



Car Breakdown

Car Spec Overview

There are five specs that the cars have: Speed, Acceleration, Handling, Mass, and Defence. Here is a brief description on what the values of these specs control.

- Speed = Max speed the car can reach
- Acceleration = How quickly the car reaches its max speed
- Handling = Turn radius/sensitivity
- Mass = Dictates the amount of recoil on collision
- Defence = A direct damage decrease to the result of the damage formula

Module System

Each car is made up of the same default frame and one part from each of the four module categories: Engine, Wheels, Fuel, and Bumper. Here is a concept image showing how the four modules attach to the default frame.



Each module type possesses two specs that influence the way the car functions.

- Engine = Acceleration and Mass
- Wheels = Speed and Handling
- Fuel = Acceleration and Speed
- Bumper = Mass and Defence

Engine

Below are the available engines in the game and their initial specs. Engines will also have a special ability that is unique to each part, to be added in a future implementation.

Part	Acceleration (1-5)	Mass (1-5)	Bolt Cost (1-4)
Washing Machine	3	5	4
Coffee Maker	5	2	3
Oven	2	3	2
Arcade Machine	1	4	2
Toaster	3	1	1
Vacuum	2	2	1

Wheels

Below are the available wheels in the game and their initial specs.

Part	Speed (1-5)	Handling (1-10)	Bolt Cost (1-4)
Hover Wheels	5	6	4
Gears	2	10	3
Tank Treads	1	8	2
Sawblades	4	2	2
Shopping Cart	3	2	1
Bobbin	2	4	1

<u>Fuel</u>

Below are the available fuels in the game and their initial specs.

Part	Acceleration (1-5)	Speed (1-5)	Bolt Cost (1-4)
Coffee	3	5	4
Coal	5	2	3
Windup Key	3	2	2
Fan	2	3	2
Syrup	1	3	1
Potato Battery	2	2	1

Bumper

Below are the available bumpers in the game and their initial specs.

Part	Defence (1-10)	Mass (1-5)	Bolt Cost (1-4)
Sofa	6	5	4
Gross Sponge	10	2	3
Pool Noodle	8	1	2
Cat Tree	4	3	2
Old Teddy Bear	6	1	1
Billy Bass	2	3	1

Driving/Collision Systems

Driving Calculations

Max Speed

A car's speed stat determines the maximum speed it can achieve during the demolition phase. It is calculated by adding together the speed stats from both the wheels module and fuel module on the car. As a result, a car's speed stat ranges between a minimum of 2 and a maximum of 10. The below table shows the speed stat in relation to km/h.

Speed Stat Points	Max In-game Speed	
10	60 km/h	
9	56.25 km/h	
8	52.5 km/h	
7	48.75 km/h	
6	45 km/h	
5 41.25 km/h		
4	37.5 km/h	
3 33.75 km/h		
2 30 km/h		

Acceleration

A car's acceleration stat determines how long it takes a car to achieve its max speed. It is calculated by adding together the acceleration stats from both the engine module and fuel module on the car. As a result, a car's acceleration stat ranges between a minimum of 2 and a maximum of 10. The below table shows the acceleration stat in relation to m/s² as well as how long it would take to reach max speed, assuming a max speed of 60 km/h.

Acceleration Stat Points	In-game Acceleration	Time to reach max speed (assuming 60 km/h max speed)
10	5.53 m/s²	3 s
9	5.25 m/s ²	3.25 s
8	4.98 m/s ²	3.5 s
7	4.7 m/s ²	3.75 s
6	4.42 m/s ²	4 s
5	4.15 m/s ²	4.25 s
4	3.87 m/s ²	4.5 s
3	3.6 m/s ²	4.75 s
2	3.32 m/s ²	5 s

Damage Calculation

Damage on collision is calculated using the below formula:

(Speed on impact * Side of car hit * Angle of impact) - Defense

Speed on impact = The speed in km/h the car was travelling at the time of collision.

Side of car hit = A damage reduction is applied depending on the side of the car that was hit. For example a head on collision would result in less damage applied than a T-bone collision. The exact values are shown in the below table.

Side of Car	Side	Rear	Front
Damage Applied %	100%	75%	50%

Angle of Impact = A damage reduction is applied depending on the angle of impact. On an impact at a 90° angle, 100% of damage is applied. Every 1° of variation on either side from 90° will decrease the applied damage by 1%.

Bumper Defence = the defence stat from the bumper installed on the car.

Environment Interactions

Hazards

Currently there is one type of hazard in Bucket of Bolts which is explosive barrels.

Explosive Barrels

- Explode on impact
- Cause high damage
- Should be avoided
- Players can attempt to use them to their advantage by pushing enemy vehicles into them; although, they risk taking damage if they too are hit by the explosion.

As more levels/arens are created, the number and variety of hazards will increase.

Health Items

There is one health item in Bucket of Bolts which is duct tape.

Duct Tape

- Appears in the arena at random intervals
- Collected by driving through it
- Heals damage done to the car
- Players should also try to collect the Duct Tape even if they don't need it to keep enemy vehicles from healing

Narrative

Bucket of Bolts is set in a post-apocalyptic world inhabited by small simple-minded robots known as RoBoBs. One day the RoBoBs find some old promotional material for a demolition derby. Initially, they giggle at the foolish humans, building cars just to crash them. However, the RoBoBs are generally fascinated by the humans and their bizarre habits, so they decide to give it a try. The RoBoBs proceed to build their own cars and compete in a demolition derby of their own. They end up loving it. What they don't know is just how hilariously bad they are at building cars.

Delivery

The introductory narrative as outlined in the previous section will be shown upon game start before the main menu. It will be an animated short but will not contain any voice acting or subtitles. Communications will instead be shown through gestures, speech bubbles with descriptive pictures, and varying beeps/boops from the RoBoBs.

Level Design

General Design Methodology

Design Principles

The arenas in Bucket of Bolts are designed with a focus on maximizing player interaction. As this is a demolition derby game, we want to ensure that players will be crashing into each other quite frequently. With this in mind, the gameplay arenas will be crafted to suit the core gameplay mechanics of smashing, chasing, and performing crazy stunts. The arena will have to be small enough to allow for plenty of player-on-player interaction, but also large enough to allow players to accelerate and achieve top speed.

<u>Must-Haves</u>

Each arena must have:

- Space for players to gain speed
- Obstacles to present endless chase
- Terrain that allows for jumps and light vertical gameplay.

Process/Pipeline

All of the arenas In Bucket of Bolts are/will be fixed designs. The list below outlines each of the steps required to implement a new arena:

- 1. The level design team draws the design for the level, including supplementary notes where necessary.
- 2. The finished design is then handed-off to the art department to have the models and textures for each piece of terrain made.
- 3. Once all required assets are complete, the level is assembled in Unreal Engine, while also ensuring that any final comments/concerns from the both designer(s) and artist(s) are addressed.
- 4. The arena is then playtested in order to locate any design issues, as well as find any bugs or exploits that will need to be fixed.

Levels/Arenas

The arenas in Bucket of Bolts will be rectangular in shape to maximize use of standard (16:9) widescreen format. The arenas will consist of a layer of mostly flat terrain, with a variety of buildings, platforms, obstacles, and/or dugouts placed strategically in the arena.

This is a rough mock-up of the first gameplay arena. Please note that this image is not to scale, nor does it have all of the design elements displayed accurately:



This arena features:

- An elevated platform in the top-left corner, accessible by ramp on the south and east sides. It also has a jump facing the southeast corner of the arena.
- Directly under the jump is a duct tape spawn point, providing players with a risky location to heal damage to their cars.
- Towards the center of the map is a dugout tunnel that runs diagonally between the northwest to southeast corners. The tunnel goes under a bridge platform with the southeast exit leading to a halfpipe-like section of built up terrain.
- In the northeast and southwest corners of the arena there are sections of flat terrain with explosive barrels lined along the walls. This provides players with space to gain speed but at the risk of colliding with the hazards.

Interface – HUD

HUD Design

The below image shows a rough concept on how the heads up display would look during a round of gameplay. Each player would have their own player cluster displayed in one of the four corners of the screen.



HUD Elements

Each player cluster is made up of four major elements: Player Name/Number, Player Icon, Car Health, and Ability Cooldown. Below is a labeled image indicating where each element is within the player cluster.



Player Name/Number

- Displays the player's name
- If no name is set, displays the players number

Player Icon

- Displays the players icon
- If no icon is set, displays the default icon (shown in image above)

Car Health

- Displays the remaining health of the player's car

Ability Cooldown

- Displays the status of the engine ability's cooldown
- A full bar indicates the skill is ready to be used
- After a skill is used, the bar will empty and then gradually refill

Interface – Outer Shell

Global Outer Shell

The below chart shows the flow of the global outer shell.



Menus

From the main menu the player has three options: Start Game, Settings, and Quit Game.

Start Game

- Selecting Start Game brings the player to the match start phase screen, which is where core gameplay begins.

Settings

- Player can customize graphics settings
- Player can customize audio settings

Quit Game

- Closes the games

Interface – Inner Shell

There are three screens in the inner shell, not including the HUD, each relating to a phase of gameplay.

Match Start Screen

This screen would be a simple menu screen where the player can set the parameters for the match, including the number of players/AI, the arena(s), how many rounds in the match, and the time limit for each round.

Car Assembly Screen

This is the screen where the player(s) all create their cars simultaneously. Below is a concept image for how the screen would look.



Demolition Screen (Pause Menu)

During the demolition phase of gameplay, the arena and HUD are what is normally displayed. There is also a Pause Menu that includes two options: Continue Game and Quit to Title Screen.

Continue Game

Unpauses the game and returns the player(s) to the demolition gameplay.

Quit to Title Screen

Quits the current match and returns the player to the games title screen.

Glossary

Match

- All matches start with the car assembly phase. After that, they consist of the set number of rounds selected in the match start phase.

Module

- Modules are the categories parts are divided into; Engine, Wheels, Fuel, and Bumper.

Part

- Parts are the individual options within each module category.

RoBoB

- The robots in Bucket of Bolts are called RoBoBs. It is a combination of "Ro" from robot and "BoB", the acronym for Bucket of Bolts.

Round

- Rounds are the demolition derby portions of the match.