

Battlecats

Adorable furr-ends on a rampage!



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1. Executive Summary

Battlecats is a two to four players local co-operative game set in a comedic world where characters play as cats, rolling through the landscape in a giant ball of yarn equipped with lethal weapons. The game is segmented in short, fast-paced levels where player coordination is the key to reaching the end unscathed. The yarn can be upgraded to navigate levels and fend off waves of enemies more easily.

2. Overview

2.1 Quick Facts

- Genre:** Action, Local Co-op
- Platform:** PC (Windows, Mac)
- Market:** Ages 8-32 (ESRB: Everyone), fans of high-paced, co-op action games
- Setting:** The Forest of Purrs, on the way to visit Grandmaw, assailed by animals
- Plays like:** Lovers in a Dangerous Spacetime meets Move or Die

2.2 Mechanics

2.2.1 Local co-op

The game is designed for 2 to 4 players working together towards the same goal: protecting their vehicle and reaching the end of the level. This vehicle, the “Yarn of Death”, has been decked out with some high-tech warfare machinery. Players can move freely between various stations activating gun turrets, shields, and the vehicle’s navigation system, but the path between stations is not always a straight one, and enemies can come in from all angles. Players will have to coordinate to ensure the yarn’s safety.

2.2.2 Enemies

Waves of enemies consistently assail the players, and come in various kinds: some moving on the ground, others flying in the air; some simply minding their own business, others actively shooting at or exploding close to the yarn. Any contact with enemies’ sprites or projectiles will damage the ship; if the ship’s health reaches zero, the current level has to be restarted from the beginning.

2.2.3 Stations

Players need to operate various stations, including one which controls the movement of the Yarn of Death, several weapons stations like gun turrets and rocket launchers, as well as a station that deploys a shield which protects a limited portion of the vehicle.



2.2.4 Upgrades

Upgrades are available for purchase between levels, in exchange for collectible, in-game currency obtained by completing the previous levels, or simply moving towards in-game coin sprites. Upgrades allow players to improve the survivability of the vehicle, and allow players to surpass the later, more challenging levels of the game. The shield could cover a larger portion of the shield, or be made more resistant to enemy impacts and projectiles; the navigation could benefit from higher acceleration values.

2.2.5 Puzzle-platforming

While the main objective of every level is to successfully reach the end point in a more or less linear fashion, there is some aspect of puzzle solving that has to be completed in order to advance to the next level. For example, a certain enemy must be eliminated in order to reveal a necessary key. A lack of velocity approaching obstacles or pitfalls may prevent players from advancing. Lastly, moving around the yarn itself will require players to move around (using ladders, jumping to raised platforms) to get to their station quickly.

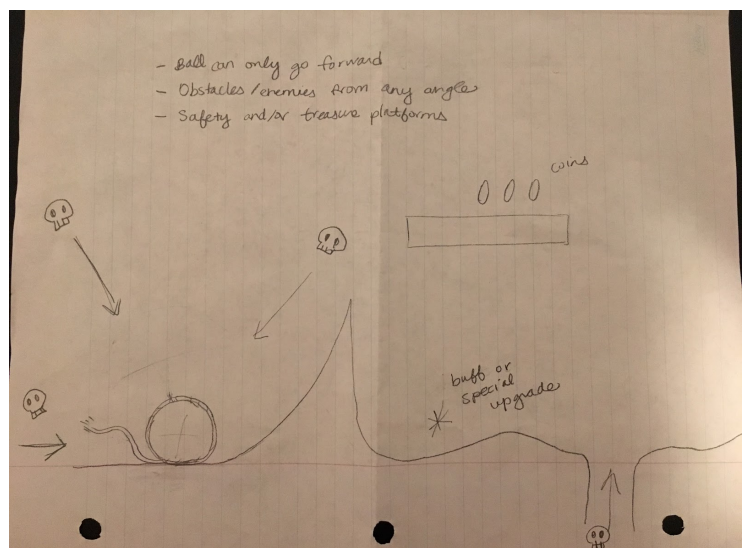
2.3 Selling Points

Battlecats is a fast-paced local co-op game. The simple yet vibrant art design and its collaboration feature makes the game a perfect choice as a family game or a week-end party game. Although it may look a bit too cute from its appearance, the game does require tactics and collaboration to achieve the goal. The players need to develop a solid strategy in terms of operating proper stations of the vehicle that will either move the vehicle forward, or defeat enemies that will try to damage the vehicle. They also need to choose the upgrade that will help them most during the next levels. The game doesn't have a complex narrative, the operation is not complicated either. Players can start the game without any knowledge about it and learn the game gradually as they play.

2.4 Level Design

Levels will be designed around the ship's ability to gain momentum to get up hills and over ravines.

Collectible currency may be spread around more difficult to access areas, rewarding players with faster upgrades, although later levels can still be completed without these more demanding stunts.



2.5 Reference Art

- Lovers in a Dangerous Spacetime, indie action game, main reference [[Steam](#)]
- BattleBlock Theater, indie platformer game [[Steam](#)]
- Super Mario Bros., Nintendo platformer game

3. Related Games

3.1 Lovers in a Dangerous Spacetime [[Steam](#)]

Lovers in a Dangerous Spacetime, developed and published by Asteroid Base on September of 2015, is the main reference for the mechanics of Battlecats. Designed as a local co-operative game, it pits two to four players in their neon spaceship against swarms of enemies and environmental hazards in deep space. It gradually introduces players to the concept of switching between different weaponry and navigation utilities, scaling difficulty as the game progresses.

Battlecats retains the same basic formula, with progression materialized in the form of a sequence of levels that require reaching an exit to complete. Collectibles and keys may be present in a given level, rewarding players with observational and maneuvering skills, and encouraging communication between them. However, it will emphasize fast-paced traversal and present less floaty vehicle controls. Single-player mode will be removed altogether, as it was a common complaint amongst Lovers in a Dangerous Spacetime players for a lackluster experience in using AI-controlled characters.

In-game, a player can actively select which component of the ship they will use, and their character will automatically head in its direction. This allows for quick swapping in a fairly large vehicle with more utilities than there are players. Battlecats, instead, allows the players to freely navigate the insides of the yarn, using a simplified layout and a more restrictive array of components. Players will hence have to plan their next move more carefully, as they could step off ladders and platforms, but the stations they will use will be more flexible in their operation; for instance, gun turrets, instead of simply rotating by 180 degrees around a fixed pivot, will slide around the ship. Thus, turrets cover blind spots that can be observed in Lovers in a Dangerous Spacetime, requiring players to use precious resources in a last-ditch attempt to preserve the ship's health.

Instead of a deep space setting, the yarn in Battlecats moves in a world with gravity, and will roll on the ground following the principles of frictional forces and inertia. Intelligent level design can make use of ramps to launch from and new terrain types, such as dirt that crumbles after the yarn passes over it, breakable walls that require a threshold velocity to get past, and slippery terrain that makes controlling the yarn more challenging.

3.2 Move or Die [[Steam](#)]

Move or Die is a multiplayer competitive game, developed and published by Those Awesome Guys in January of 2016, described as “the 4-player friendship ruining party game” by its creators. It won several awards for its fast-paced action, which revolves around constantly changing, randomly selected rules that players have to abide to to be the last one standing. It encourages foul play and provides a multitude of game modes to enrich the basic experience, and allows players to share their own twists with the community.

While it is a competitive game, Move or Die inspired the hectic atmosphere sought after in the level design of Battlecats. The frequent addition of new components to refresh the experience, be they varying types of

terrain or enemies, or upgrades, as well as the “pick-up-and-play” approach are elements driving its development. It does this by encouraging players to move forward and pay attention to the layout of the level, while remaining aware of both enemies and environmental hazards.

Negative reviews for Move or Die often revolve around bugs that are typically quickly addressed by the developers, but a significant margin also complain about the repetitiveness of the game. Past a certain play time, game modes and modifiers are exposed as remakes of existing ones, losing the interest of avid players. Battlecats attempts to address this with a level-based progression, in which mechanics and twists are gradually introduced to sustain the experience and balance it against the difficulty curve. The combinations created when mixed with physically-based navigation are virtually endless, and easy to iterate upon.

3.3 Metal Slug [[Steam](#)]

A classic run-and-gun arcade game originally developed and published by SNK in 1996 for the Neo Geo, Metal Slug features large hordes of enemies that players equipped with powerful weapons (and an even more powerful melee attack) must clear as they advance through linear levels, which typically concluded in a boss fight. Players can also use vehicles to spread chaos more efficiently.

Metal Slug, with its seemingly endless waves of enemies, inspired the shooting mechanics of Battlecats and the feedback given to players when either their character or their targets is hit; flashy sprites, exaggerated explosions, and camera shaking are staples of the series, which Battlecats attempts to recreate while working towards its target ESRB rating of “Everyone”.

It is difficult to find reviews of the original game, and its recent re-release collected a number of comments on the performance side, citing input latency and low frame rates as a blemish on the franchise. However, there was criticism about its difficulty, with some players at the time suspecting it to be artificially high to force players to purchase more play time at the arcade. Aiming for a more casual gameplay that still rewards observant and skillful players, Battlecats intends to avoid this issue altogether.

3.4 Sonic the Hedgehog

Making its debuts in 1991 on the Sega Genesis, Sonic the Hedgehog is known for actively enabling its mascot’s high running speeds and platforming capabilities. Its gameplay revolves around the clever placement of doodads that directly affect Sonic’s velocity, but also enemies, pits, and spike traps that seek to stop his progress. It is also relatively forgiving in providing the player with potentially unlimited health, as Sonic’s survivability is dependent on him holding at least one golden ring which can be re-collected as it is knocked off him when he gets hit by an enemy.

Sonic the Hedgehog directly influenced the addition of crumbling terrain, springs, breakable walls, and other means of branching paths while maintaining a fast pacing in short but dense levels. Battlecats also takes heed of common criticism towards Sonic the Hedgehog’s difficulty in processing the level scrolling away at fast speeds by offering a dynamic camera whose panning and zooming are directly affected by the players’ movement. User interface cues are used to signal the approach of enemies, allowing players enough time to reach the appropriate stations inside the yarn.

4. Player Composites

4.1 Primary Audience

Rob Mack, 22, senior undergraduate student at his hometown community college. Single. Pretends to like hockey to have a conversation topic at parties. Juggles between the economics homework he struggles with and a handful of quick, online Call of Duty play throughs on week nights. Meets up with old time friends almost every weekend for games and pizza nights, during which his parents sometimes call him to ask when they'll finally meet his girlfriend. Enjoys first-person shooters, competitive multiplayer games like Super Smash Bros. (but only the Nintendo 64 version) and Overwatch. Favorite TV show: Grey's Anatomy (although when asked, he prefers to mention How I Met Your Mother). Drives a 2004 Toyota Camry he bought used when he entered college.

Members of Battlecats's primary audience range between university students and middle-aged persons, particularly men. These players typically live alone, or with a handful of roommates, and mostly enjoy single-player games in their spare time, which they tend to have quite a bit of due to their celibacy. However, frequent meet ups with friends from university or previous education usually end up in game nights at one of their dwellings, during which both cooperative and competitive multiplayer couch games are favored: Mario Party, Super Smash Bros., and the like. These individuals alternate between platforms such as Xbox One, PS4, and PC, occasionally sifting through their Steam recommendations for new indie titles they can suggest on the next meet up.

As students or professionals at the slow beginnings of their career, these players are not particularly wealthy, but make enough to make ends meet, and keep enough in their pockets to indulge in video games occasionally (often alternating purchases between themselves for budget reasons). Their play sessions last anywhere between a couple hours to until the wee hours of the morning, for games with immersive game play. What really clicks with them: skillfully ditching their friend's avatar into a ravine.

4.2 Secondary Audience

Toby Johnson, 8, elementary school pupil. Single, but he totally thinks he has a chance with Emily from Mrs. Janice's class. Knows every single Pokémon created since the series' inception. Thinks he's played all the games out there, but keeps on referring to the Genesis console system as "the Sega". Definitely does not respect the curfew imposed by his mother: he's not allowed to play any games after dinner, but sometimes he sneaks in an extra half hour on his PS4 hooked up to the old CRT TV his dad refuses to let go of. Likes anything with explosions, colorful flashes, and/or that has "action" in its list of tags on Steam. Complains that he doesn't receive an allowance, but always get nearly everything he asks for at Christmas. Has a penchant for Mountain Dew.

Elementary to high school students make up the other major demographic of Battlecats. Often gifted with large amounts of free time after they are done with their homework, they will usually play single-player games on week days, and hang out at another friend's house to play a console they don't own, where they will prefer to play multiplayer games. These individuals are expressive, communicating their impressions of the game and their interpretation of its mechanics out loud; as such, the first twenty minutes of play time

make it or break it for them. They will sometimes play outside, but less often during the winter and rainy days in the fall, where they will resort to entertainment mediums: movies, video games, but sometimes board games like Monopoly or Pay Day.

Members of this demographic either receive a small allowance, which they will save for precious occasional purchases, or work part time during high school to pay for their car insurance, public transportation fare, or lunch. They therefore rarely break the bank for triple-A titles costing upwards of \$80.

Both of the profiles outlined above express an expected low price point for Battlecats, likely at a asking price of around \$20 per copy, with frequent sales at \$15 and below. Player retention will be solely based on weekly meet ups with friends, which means the first impression of the game has to be good enough to keep them from suggesting the game frequently.

5. Game World

5.1 Setting

Battlecats is set in a nondescript era in a cartoonish world dominated by sentient animals. Vibrant colors and flat shading underline the light-hearted atmosphere within the game. Whimsical situations are the norm as the protagonists communicate with one another towards a common goal: reach the end of the forest with their yarn intact.

The Forest of Purrs is unconventional by design, with hovering platforms, slopes, death pits and watery areas. Visual clutter is minimal to allow players to identify incoming threats and platforming elements.

Terrain types include:

- Green grass: regular terrain
- Yellow grass: terrain that crumbles shortly after the yarn passes over it
- Snowy grass: breakable terrain that requires a threshold velocity to go through

These tiles have clear color codes that allow players to quickly identify how to approach the current screen.

5.2 Narrative





Battlecats has a simple premise: a quatuor of bipedal cats embark on a vehicle armed with gun turrets and a complete navigation system to visit their Grandmaw. In order to do so, they have to cross the Forest of Purrs, a dangerous place inhabited by all kinds of animals that will stop at nothing to avenge the deaths of representatives of their species maimed by these furry murder machines. Along the way, the cats will find scraps and currency they can use to upgrade the Yarn of Death, and wreak additional havoc in these once quiet lands.

While simple and whimsical, the plot of Battlecats is straight to the point and invites players in a light-hearted universe, where only one thing matters: to reach the end of the level, and to do it while causing as much rumpus as possible.

6. Game Characters

6.1 Protagonists

The game has a total of 4 possible main characters a player can choose from:

			
Aoi	Kiio	Aka	Midori


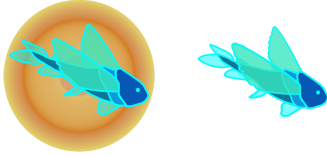

All four cats have the same background, as they are 4 siblings going onto an adventure to bring fish and milk to Grandmaw through the other side of the Forest of Purrs. The forest is populated by enemies, but the Yarn of Death contains all necessary utilities to defeat them all.

The 4 cats are color coded (blue, yellow, red and green), with 2 “tall and slim” and two “tall and round” archetypes. The players can easily identify their respective cat. All cats have the same characteristics, as they can all manipulate the same stations (turrets, shield, navigation). The cats’ movements are restrained within the ship.

6.2 Antagonists

6.2.1 Waves of Enemies

There are 3 antagonists the players will encounter in the levels.

		
Moth	Flying Fish (with shield and no shield)	Bunny

These are creatures of the forest, ready to destroy anything on their way, and of course, the Yarn of Death is no exception. The moth is considered a “low level” type of enemy, but the flying fish and the bunny are considered higher levels as the fish has a shield, and the bunny carries a dynamite that does a significant amount of damage.

6.2.2 Enemy Specifications

Specifications	Moth	Flying Fish	Bunny
Health	50	50	25
Motion Type	Flying	Flying	Grounded
Has shield	No	Yes	No
Shield health	-	200	-
Firing Rate (seconds)	4	8	20
Damage by projectiles	15	50	15
Damage on contact	25	25	300
Yarn Shield's penetration	No	Yes	No

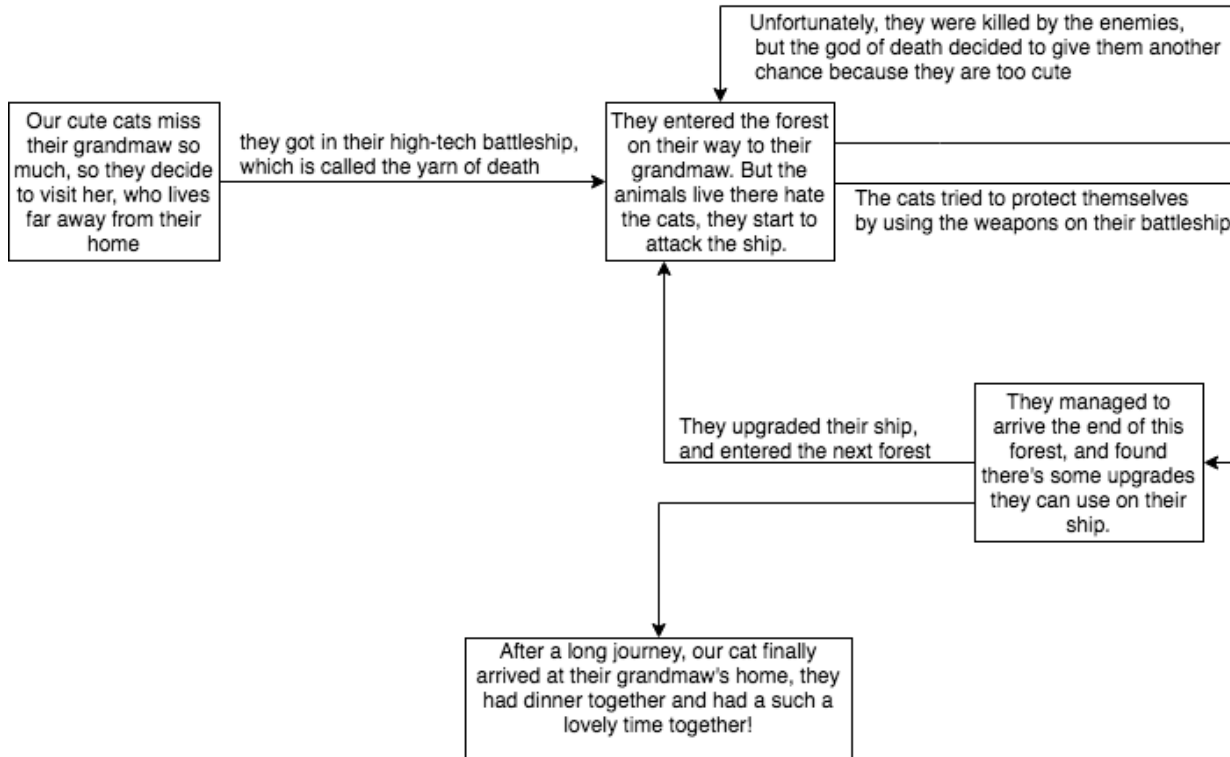
6.2.2 Boss

The final boss is an infuriated raccoon piloting a rocket-propelled trash can. He will shoot bullets, exploding and bouncing grenades, and dash at the yarn in random patterns in a constrained room. Players also have to avoid a dash attack, during which the boss will actively damage the yarn if it comes in contact with it. Fire pillars regularly activate, dealing large amounts of damage.



7. Game Progression

Progression in Battlecats is gradual in ways that resemble Angry Birds's approach: finishing a level gives players an edge to surmount the new challenges that are added in the next level, one mechanic or upgrade at a time. While simple in appearance, this formula is effective in teaching players how to combine new mechanics with ones they have gotten comfortable with in the past, and explore new and creative ways to traverse the world. It also allows the creative process in developers to test out the addition of features incrementally, and to revisit old designs to tweak them in anticipation for incoming yarn upgrades. This creates an elegant game progression outlined in the flow chart below:

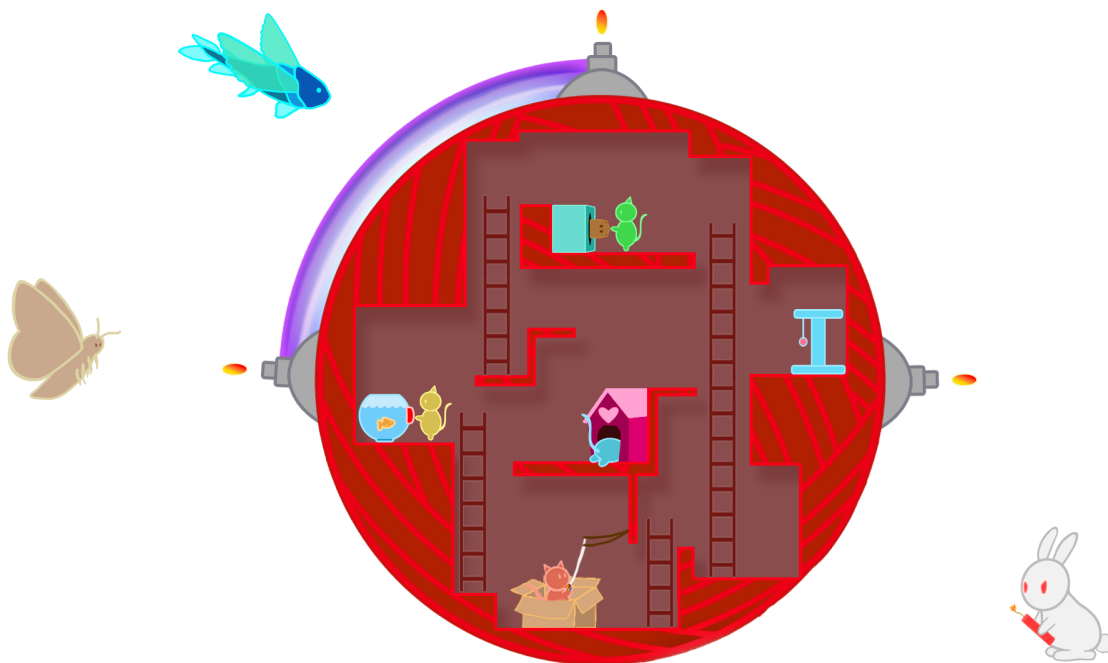


8. Art Direction

8.1 Graphics



Battlecats' two-dimensional art is as whimsical as its main characters - vibrant and playful, characterized by thick outlines filled with saturated colors. Every station in the Yarn of Death is designed in the form of cat-related accessories. Enemies are represented as evil rabbits and fishes seeking revenge on their predator as well as moth that are attracted to the yarn.



The user interface will be designed with the same bright colors and basic shapes as the other assets. The chosen fonts are either bold and irregular or similar to handwriting, evoking the adjectives “adorable” and “carefree”.



The main constraints concerning Battlecats’ art direction are time and artistic abilities. To ease the asset creation process and minimize the graphical requirements of the game, a limited amount of sprites will cover all the characters’ and objects’ animations and no extra lighting should be added in the scene. The simplicity of the sprites is inspired from clipart images and 2D games like Lovers in a Dangerous Spacetime and BattleBlock Theater. To further decrease the asset creation workload, free assets from Unity’s store will be used for terrain and background. We will be very strict in our selection as we want to make sure the free assets match our own.

8.2 Audio

The audio component of Battlecats parlays the cute cat theme that is presented through the artistic assets of the game. Covering both the originally composed music and original sound effects, the audio elements of the game work together with the overall sentiment of gameplay Battlecats seeks to provide. Benefiting from original theme music written specifically with the game play in mind, the mood of the game is amplified and players are quick to become enveloped in an exciting environment.

The audio effects have a dynamic range of tone, covering a feel of intense combat tied in with a playful and humorous dialogue. Explosions and turrets fired bring an edgy combat feel that keeps the players engaged while a more light-hearted kitten sound bank brings a counter-balancing layer of fun and pleasure.

The level music of the game incorporates a balance of very playful melodies that modulate over small intervals creating a sense of urgency and constraint. This adds excitement as players tend to feel they have less time and need to move quickly, generally adding to the original experience provided by the underlying mechanics of the game design.

The music of the game is inspired by classic platformer games like the Super Mario Bros. series of games by Nintendo. The music also uses an arrangement style that provides backing to the artistic direction of the game. The arrangements take into consideration the playful yet profound style of music that defined most of the piano music from the 1920s and 30s. Music that captured a period of uncertainty paired with the need to remain imaginative and uplifting.

9. User Interface Storyboards

9.1 Prototype Screens

9.1.1 Title Screen

Encountered at the start of the game, the user has the following options: Start, Instructions, Settings, Credits, Exit.



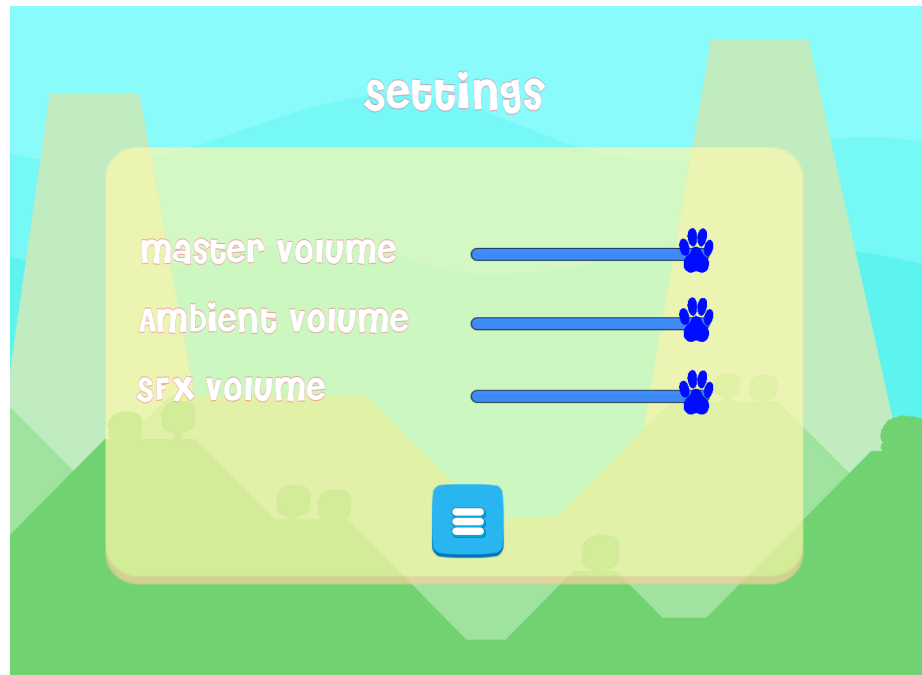
9.1.2 Upgrade Screen

The user will be offered the option to upgrade their ship at the end of each level, via coins collected during the game.



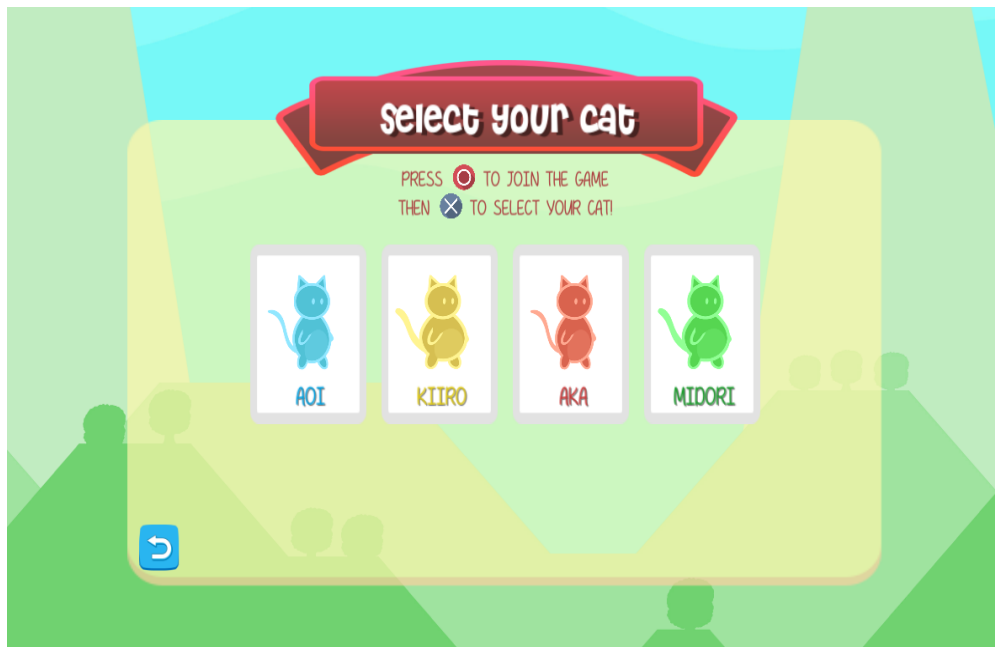
9.1.3 Settings Screen

The user will be offered the option to tweak some settings of the game, such as the volume, or screen resolution.



9.1.4 Cat Selection Screen

Since the game requires 2-4 players and is played locally, each player will have the option to select their respective cat. Selection of a given cat will be limited to one player.



9.1.5 Level Selection Screen

Once the players hit start, they all get to choose the level or tutorial they want to play.



10. Tags and Dialogue

10.1 Tags

A simple tagging system is in the works as of the writing of this document, and will allow to quickly reference and modify the sounds identified in the table below. Note that these are all marked as “to be determined” as this work is an integral part of the current sprint, which has started on October 29th.

Yarn Sounds	
Yarn Rolling	YarnRollStart/YarnRollLoop
Munition Type A Firing	PffoughVerb
Munition Type B Firing	Blope
Munition Type C Firing	PlewVerb
Turret Rotation	Turrent_full_harm
Shield Rotation	shield_full
Enemy Sounds	
Boss Dash Attack	ElecFiltWarp
Enemy Firing Sound	BlopeHarm
Gameplay	
Menu Interaction Confirmation	menuSel
Menu Interaction Back	menuSel
Level Finished	EndLevelSplash
Ambient/Theme	
Title Theme	Progres
Menu/Options Theme	Progres
Level 0 Theme	CatLevelMusic
Level 3 Theme	BossLevel3
Boss	ElecChordmaker

10.2 Dialog

Because of Battlecats's intent to keep the players immersed in gameplay, dialogue is limited to in-game messages on the status of the current level, letting them jump back into the action as quickly as possible. Minor variations to these messages are introduced:

Game Over 1	Mission failed! We will get them next time.
Game Over 2	We couldn't reach Grandmaw!!!
Game Over 3	Oh no!
Retry1	Try again?

11. Technology Plan

11.1 Engine

Unity 3D was selected as the driving engine for the project. Version 2017.4.11.f1, albeit not the latest one, has been chosen for its compatibility with some of the developers' Mac systems, versions 2018 and onwards requiring a software update that was not an option.

The default 2D project preset is used as a starting point, with assets originating from: original production by the team for game characters and doodads; freely distributed Unity standard assets for particle effects and tools (such as tilemaps); and, in certain cases, assets under a CC0 public domain (or similar) licenses.

11.2 Plugins

No custom or imported plugins have been foreseen as necessary to integrate for this project.

11.3 Development Environment

For developers working in a Microsoft Windows environment, Visual Studio 2017 Community Edition is the integrated development environment of choice. Mac users typically prefer to use the latest versions of XCode, Visual Studio Code, or MonoDevelop.

11.4 Source Control

Git (version 2.0 or above) is used as the source control medium of choice for its flexibility in managing and merging branches with a large number of concurrent edits. A private GitHub repository has been set up to host and provide a visual interface to the source control environment.

Developers are free to create as many branches as necessary from a common `dev` branch, while both `dev` (the "staging" branch) and `master` (the "stable" branch) are locked and require prior approval to ensure safe merging and reduce regressions to a minimum. Peer reviews by interested parties are the norm for any pull request onto the staging branch.

11.6 Asset Production

Graphical assets are produced using a combination of mouse and keyboard in Adobe PhotoShop. They are exported as PNG files with transparency for use with the editor, and scaled down to fit in the scene.

Music is composed in the Finale software before being run through a sequencer, Protools, to specify sound samples to use as rhythm and melody. Sound effects follow a simplified pipeline, but use the same software.

11.7 Project Tracking

The Google application suite (Docs, Sheets, Forms) is used to do most of the manual project tracking tasks, while GitHub's integrated issue tracker and project management tools are used to keep an estimate of the project's requirements and advancements.

11.8 Hardware

The game is being developed on both Microsoft Windows and Mac machines, with support for two to four Xbox One and PlayStation 4 controllers connected to a single computer through a USB hub as the final input devices for the release product.

Integrated and external microphones have been used to create quick sounds and voice overs, mostly meant as placeholders to help with debugging, e.g. shooting sound effects and the collision of a bullet with a game entity.

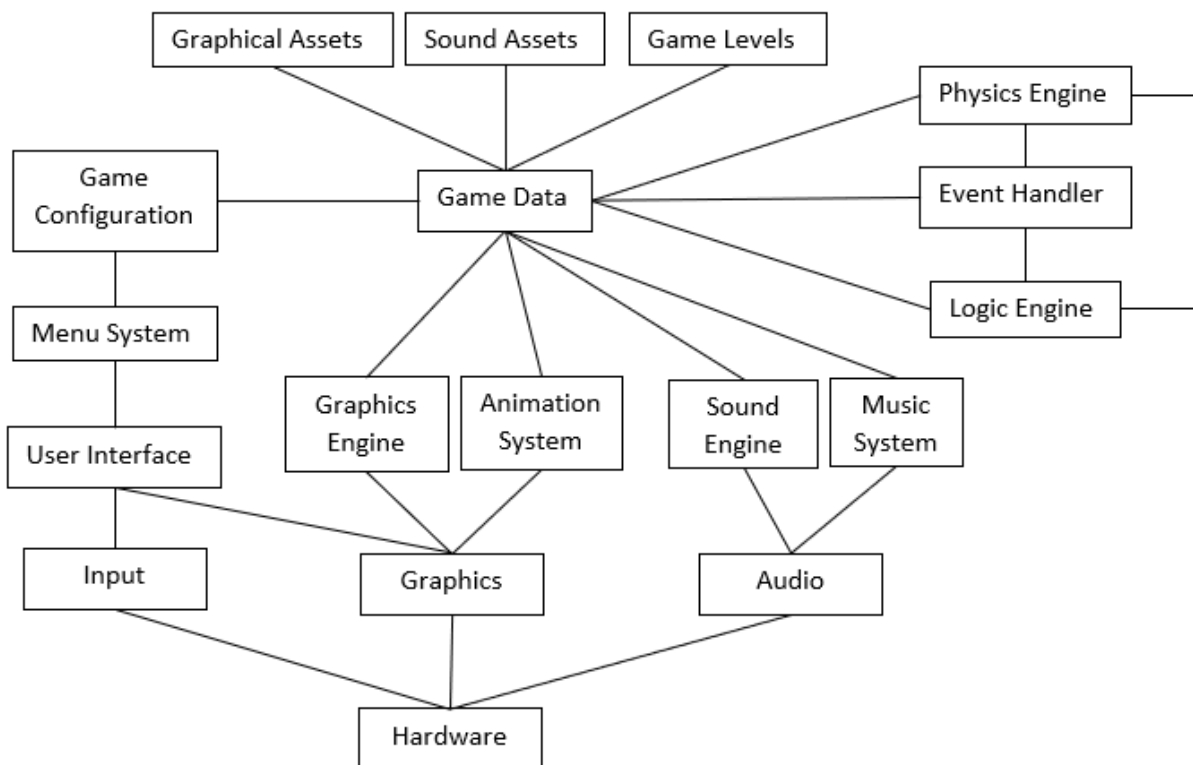
12. Software Architecture

12.1 Game Architecture

Battlecats, produced with Unity 3D, follows a general game architecture that includes the following subsystems:

- Game data
- Event handler
- Logic engine (the core of the game)
- Physics engine (collisions and general physics)
- Graphics engine
- Sound engine
- User interface
- Hardware abstraction layers

These subsystems interact to create the frames finally rendered to the player's screen, in ways summarized in the flow chart below:

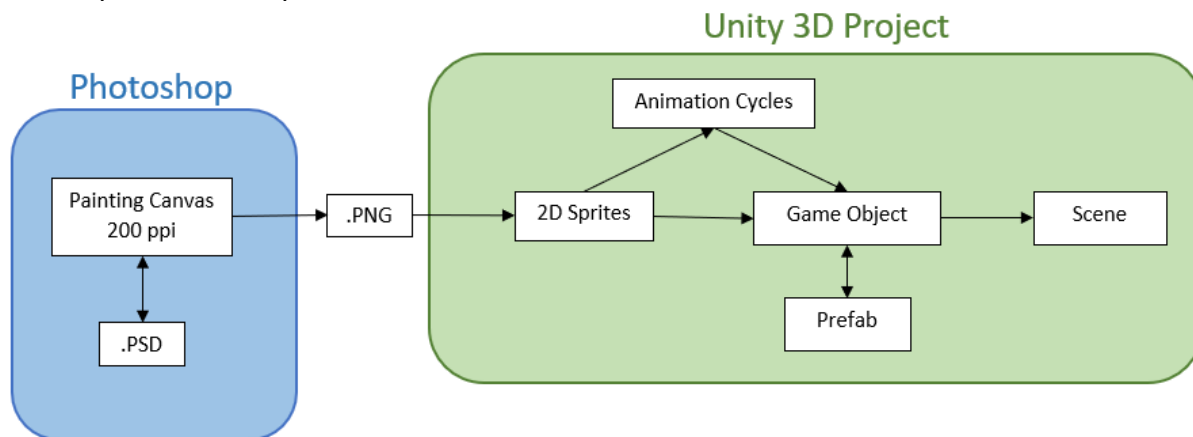


(Inspired from Game Architecture and Design: A New Edition by Andrew Rollings)

12.2 Asset Creation Pipeline

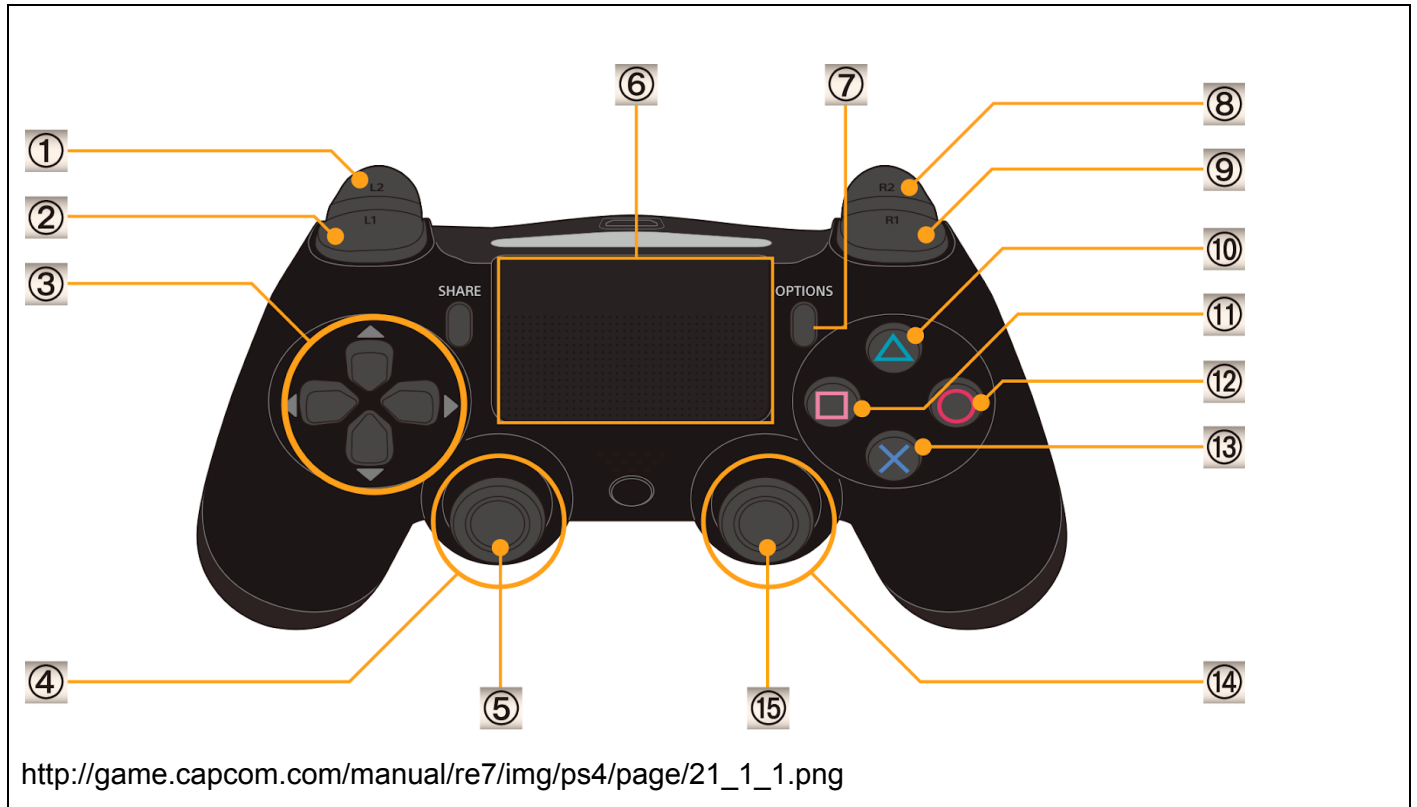
Graphical assets are all flat-shaded sprites created in Adobe Photoshop using 200 ppi presets, exported as PNG files to handle transparency, imported into Unity where their resolution, anchors and pivots may be customized, then finally used in the renderer of a game object present in the scene hierarchy. Series of sprites may be used for dynamic game objects where they are assembled as animations used in animator components. This pipeline is summarized in the following flow chart.

The complete creative process is outlined in [Section 8.1](#).



13. Controls

13.1 PS4 Controller Mapping



Control Number	Action
3, 5	Player Movement/Shield Rotation/Turret Rotation
10	Jump
1	Fire Munition Type 2
2	Fire Munition Type 3
8	Fire Munition Type 1
13	Station Interaction

13.2 Developer Keyboard



13.3 Engine Mapping

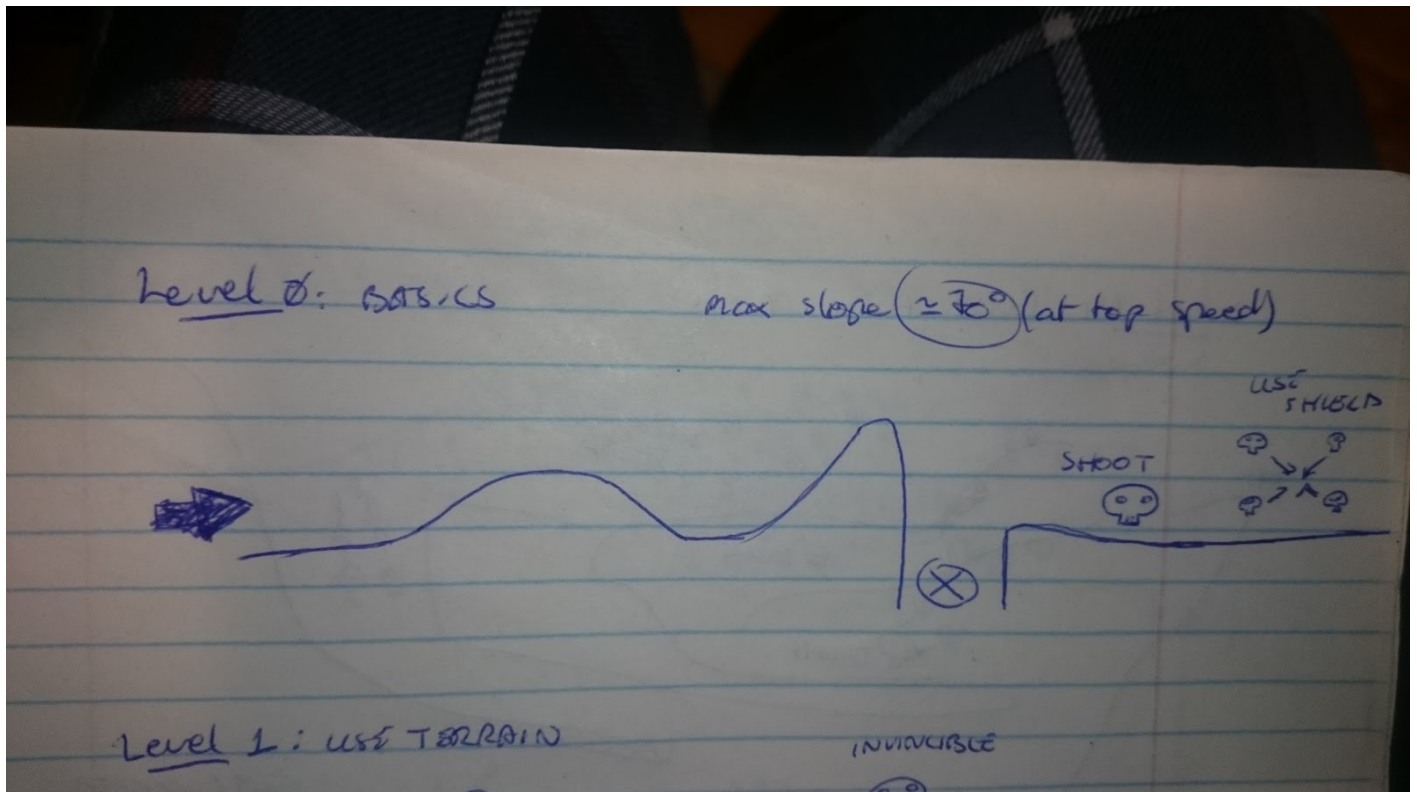
Control Name	Control Key	Engine Callback
Horizontal Movement	Joystick: X Axis PS4: Axis 7(D Pad) Keyboard: A D, F H,J K, : enter	Horizontal_P1 Horizontal_P2 Horizontal_P3 Horizontal_P4
Vertical Movement	Joystick: Y Axis PS4: Axis 8(D Pad) Keyboard: W S, T G,I K, { "	Vertical_P1 Vertical_P2 Vertical_P3 Vertical_P4
Jump	Joystick: joystick button 3 PS4: Triangle Keyboard: C, N, >, 	Jump_P1 Jump_P2 Jump_P3 Jump_P4
Fire1	Joystick: joystick button 8 PS4: R2 Keyboard: 1, 4, 7, 0	Fire1_P1 Fire1_P2 Fire1_P3 Fire1_P4
Fire2	Joystick: joystick button 1 PS4: L2 Keyboard: 2, 5, 8, -	Fire2_P1 Fire2_P2 Fire2_P3 Fire2_P4
Fire3	Joystick: joystick button 2 PS4: L1 Keyboard: 3, 6, 9, =	Fire3_P1 Fire3_P2 Fire3_P3 Fire3_P4
Interact	Joystick: joystick button 1 PS4: X Keyboard: Z, V, M, ?	Drive_P1 Drive_P2 Drive_P3 Drive_P4

14. Level Design

The Forest of Purrs is arranged in a way that encourages platforming aspects, with ledges, ramps, and hovering platforms holding collectible rewards for perceptive players. Several branching paths allow for different ways to approach challenges, some being more punitive than others. At the same time, branching paths always return to a singular, linear path, reassuring players that every path is a good one and not a dead end, with no back tracking required when reaching out for collectibles. This helps keep the yarn moving forward and creates familiarity with movement that is at the core of Battlecats's gameplay.

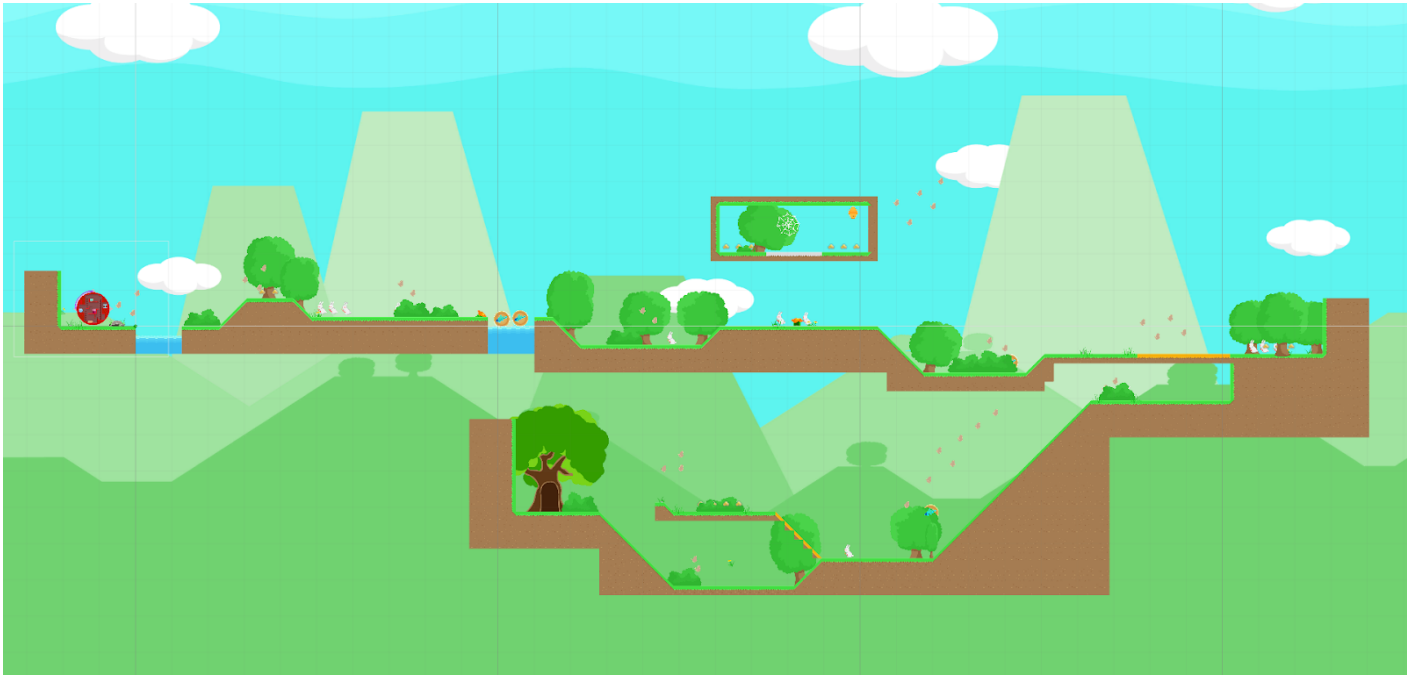
14.1 Mock-Ups

Before actual implementation in the Unity Editor, levels are first drawn on paper. Some of these mock-ups have been combined into a single level, to provide more effective use of in-game time.



14.2 Level Zero

Below is level zero, a prototype tutorial and early level, in the Unity Editor. Players start at the far left of the level, and must reach the goal in the bottom center of the screen.

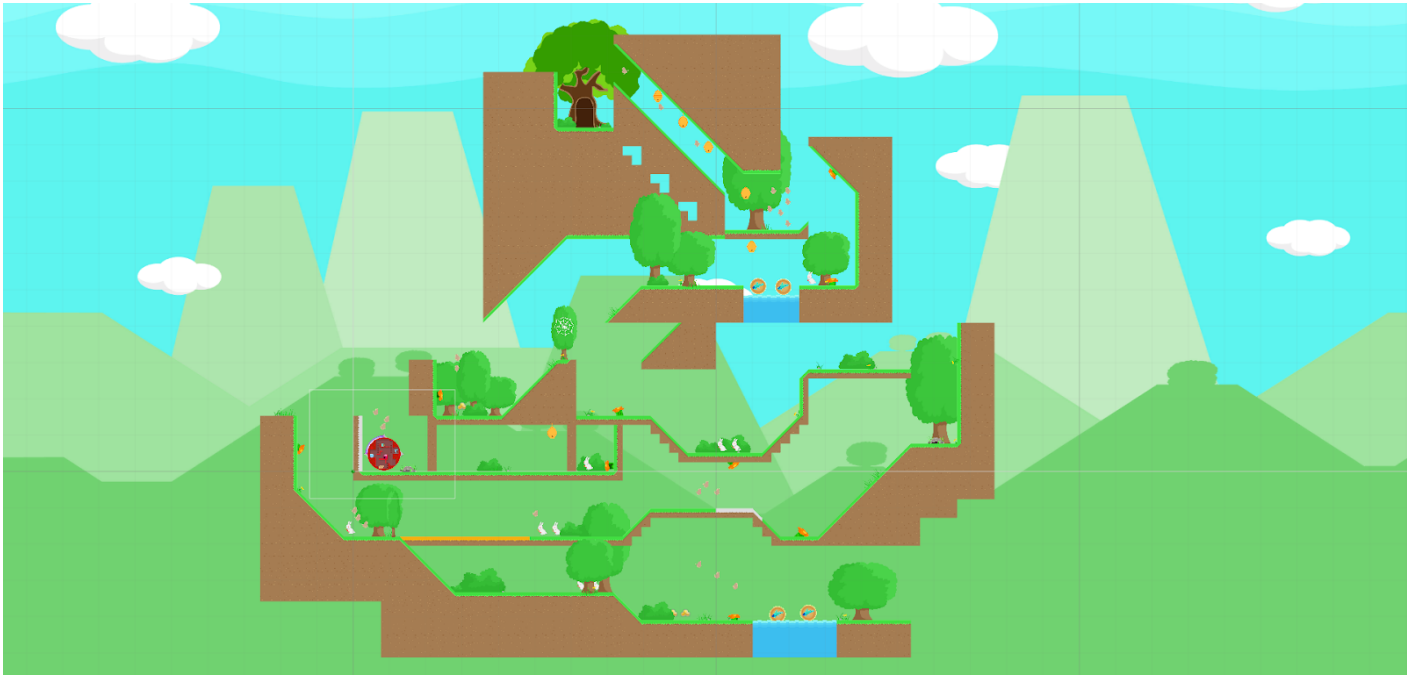


Players are introduced to the use of all of the yarn's stations: navigation; turrets; and shield. They are presented with various platforming challenges, get a feel for the yarn's behaviour when going up ramps, and may collect their first rewards for achieving easy challenges. They are also given a first look at all terrain tiles, outlined in [Section 14.6](#). Branching paths are mild, and come back to a familiar route, and the circular design gets players used to moving in all directions: forwards; backwards; up; down. Puzzle elements are gradually introduced, with springs, breakable walls, and sliding gates making a first appearance.

Simple enemies are introduced in small amounts at controlled locations within the level, giving players enough time to learn from their mistakes in using the shield and turret stations. Just enough enemies will spawn to fully take down the yarn from full health, giving players a chance to experiment with the mechanics introduced in the level.

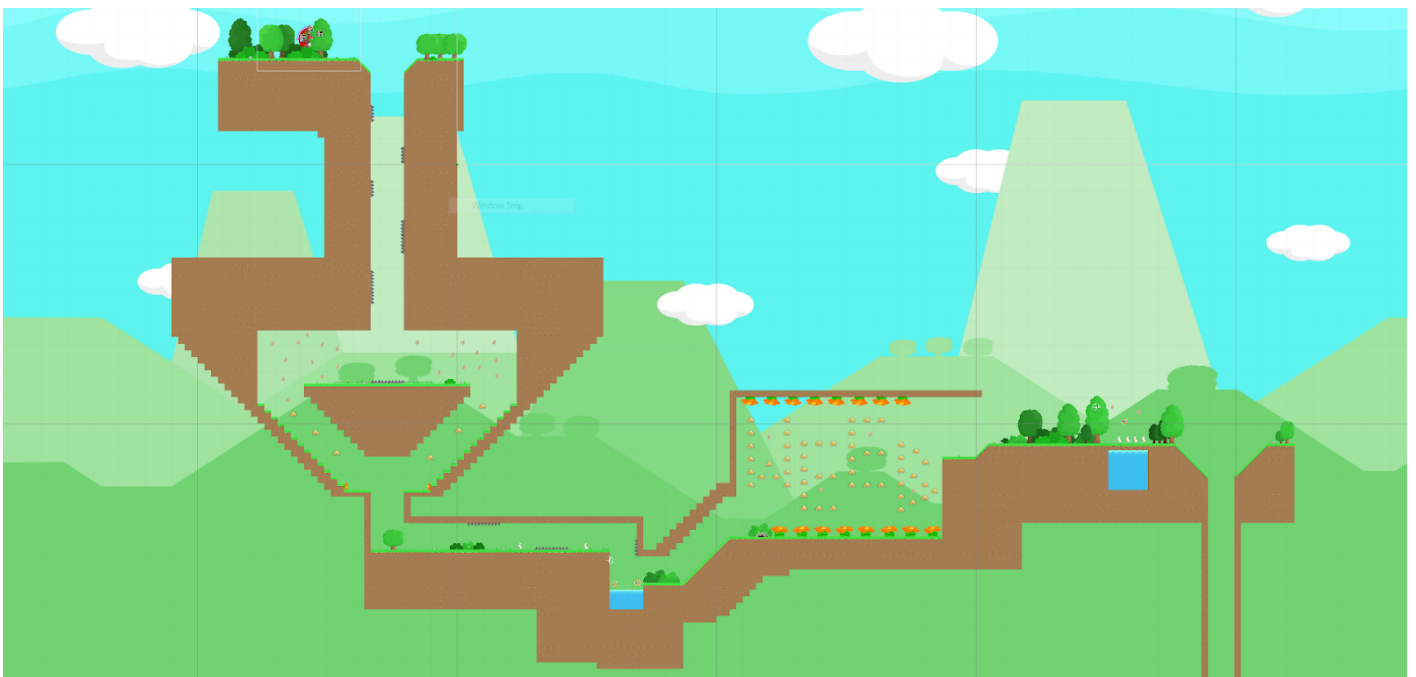
14.3 Level 1

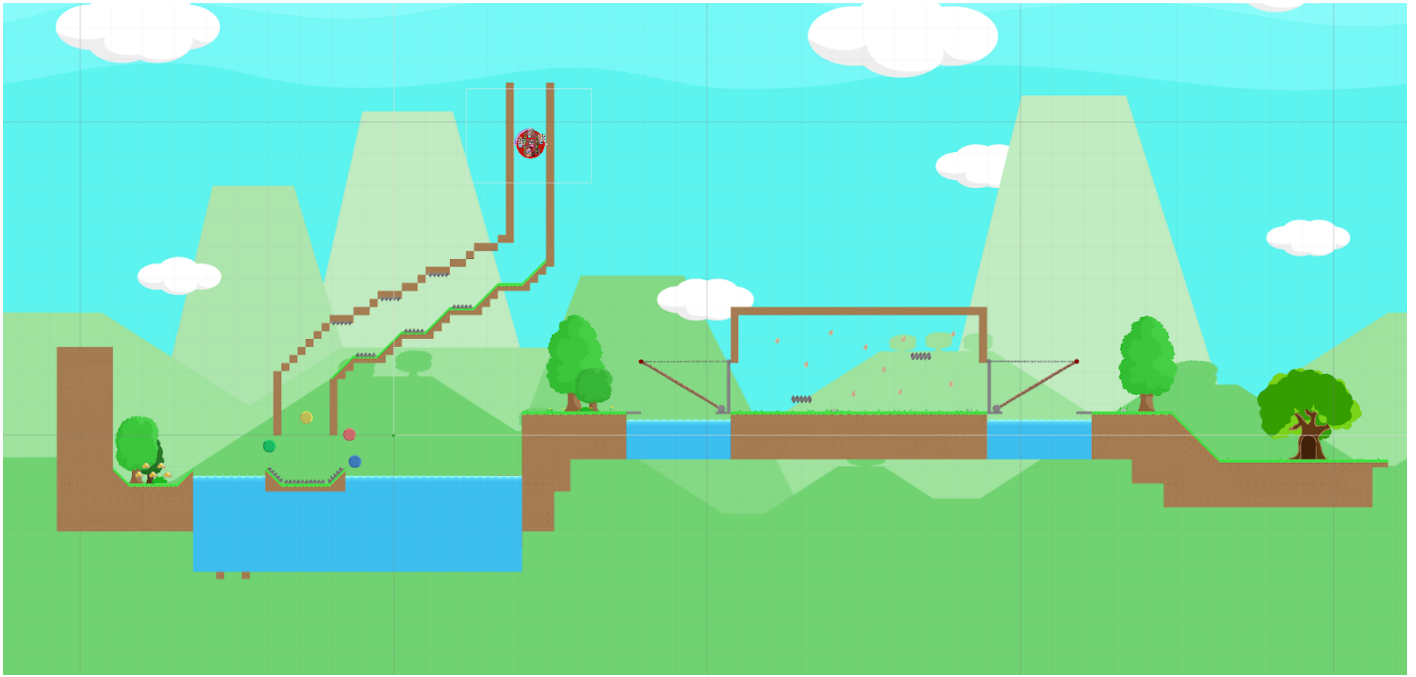
Level 1 takes all the elements introduced in level zero, and compresses them into a much denser map. It takes inspiration from early Sonic the Hedgehog games, with winding paths that play on a vertical scale as much as on a horizontal one. Two death pits, while easily avoidable, are present and will require players to communicate to help each other identify threats that have become familiar. Gaps in terrain have to be covered through activating puzzle elements, and larger packs of enemies warrants prudence when moving through new areas of the level, also contributing to addressing puzzles carefully.



14.4 Level 2

Level 2 provides a harder challenge to players now accustomed with common puzzle elements, and familiar with all enemy types. More sources of damage in the form of spikes that have to be avoided, guarded against using the shield, or covered with activated platforms make their way into level design, and large packs of enemies advocate caution. Effectively, the shield station received particular attention in level 2, with its operation a mandatory condition to victory. Additional means of closing gaps in the terrain are also introduced with slabs on hinge joints. Note that level 2 is dividing into two parts, due to Unity tile restrictions.

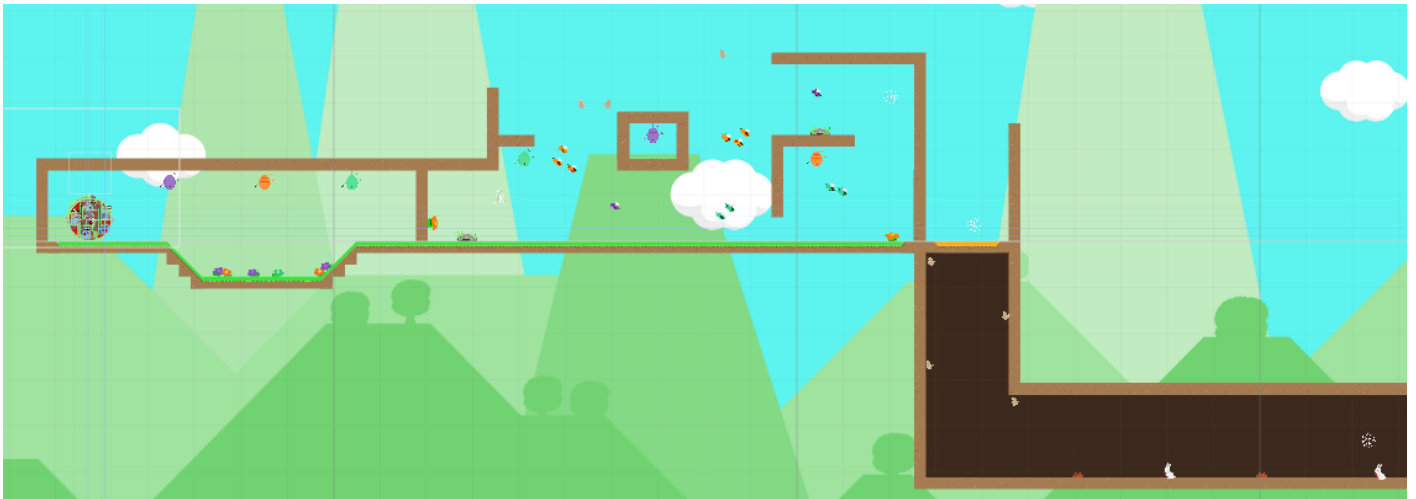




14.5 Boss Level

The boss encounter in Battlecats is actually divided into two portions, the first built around puzzle solving, and the second focusing on fast-paced shooting and avoidance patterns.

In the first part of the encounter, players have to shoot targets in a sequence determined by color-coded objects in the scene, unlocking different areas that employ similar puzzles and combine other elements, including sliding gates and pressure plates.



The second part of the encounter takes place in a medium-sized room with no exit, where players have to avoid pillars of fire activating on a timer, predetermined boss movement patterns including a dash mechanic, as well as both free aerial shots and exploding grenades that roll on the ground. Defeating the boss requires tight coordination between players, between avoiding fire hazard, protecting the yarn against projectiles, and battering the boss at opportune times. It should be noted that the music is much more upbeat in this section.



14.6 Terrain Types


Terrain types include:






- Green terrain: regular terrain
- Yellow terrain: terrain that crumbles shortly after the yarn passes over it
- White terrain: breakable terrain that requires a threshold velocity to go through
- Water: instant death pits; falling through these causes the level to restart

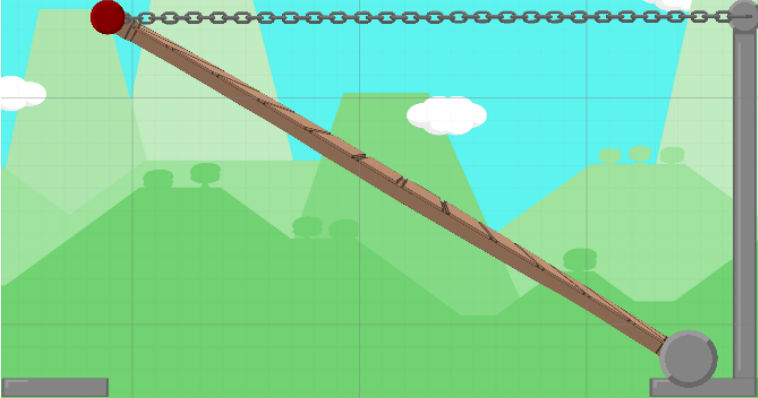


Different terrain tiles were created and painted onto a level grid using Unity's Tile Palette, found in the official 2D Extras package (see [Section 18.4](#)). As an optimization consideration, a large number of tiles have been added to the level without actual colliders. These should be used wherever the yarn will not roll or bounce against terrain.

14.7 Puzzles

The different kinds of puzzle elements available to level design are outlined in the table below:

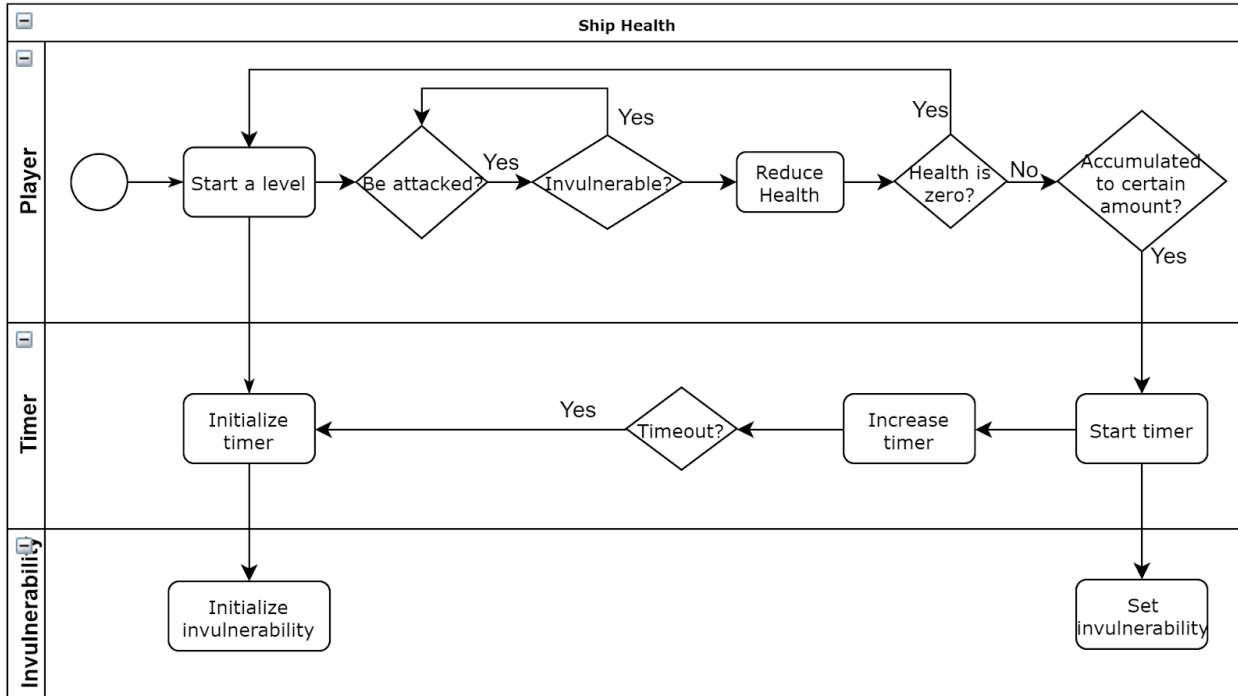
Name	Sprite	Description
Spring		Grants an impulse of speed in the direction pointed by the spring, and lowers gravity temporarily

<p>Pressure plate rock</p>		<p>Activates a linked puzzle object (e.g., a sliding gate) when rolled over</p>
<p>Trigger web</p>		<p>Activates a linked puzzle object (e.g., a sliding gate) when passed over</p> <p>Note: The sprite to the left has been recolored to black</p>
<p>Beehive shooting target</p>		<p>Activates a linked puzzle object (e.g., a sliding gate) when shot</p>
<p>Sliding gate</p>		<p>Slides open after being activated; may have slopes or use different colors</p>
<p>Spikes</p>		<p>Damage the yarn on contact; damage can be prevented by orienting the shield towards them</p>

<p>Bridge on a hinge</p>	<p>Pivots about hinge joint to cover a gap after chain has been shot by the yarn's bullets</p>	
		
<p>Volcanic pit</p>		<p>Shoots out damaging pillars of fire at regular intervals</p>
<p>Level goal</p>		<p>Identifies the exit players have to reach to end the level</p>

15. Mechanics Analysis

15.1 Ship Health



The yarn's health is set to its maximum attainable level when a level starts, and is reduced when attacked by enemies. In order to artificially compensate for hectic combat, the yarn will also gain temporary invulnerability for a short amount of time when taking a threshold amount of damage. This is to grant a slight handicap in the more intense combat sections, with a multitude of enemies and projectiles coming from all directions while struggling to maintain the yarn's heading. When the ship's health reaches zero, the current level is reset after a short interlude, with its health back to maximum. There is no notion of continues or game over; players have an unlimited amount of attempts to finish a given level, and game progression will be saved between play sessions

15.2 Enemies, Shield, and Shooting

Enemies are spawned in two ways: on a timer that can be adjusted per-level, and on demand using trigger areas within the level. Because of the fast movement of the yarn, they are spawned past the boundaries of the camera's view rect along with a user interface cue (e.g. blinking arrow), giving players enough time to rotate the shield or man an unattended turret station. The specifics of each enemy type are presented in a table in [Section 6.2.2](#).

The shield is activated by manning its station. Upon activation, it will cover 1/4 of the yarn's perimeter, protecting it against incoming enemies and projectiles. It can then be rotated about the external surface of the yarn using the left stick of the controller, allowing for dynamic retargeting when going down slopes or attacked from different angles, as are the norms in Battlecats. It can be upgraded in the shop to cover a larger portion of the yarn, rotate faster, or last longer after the cat using the station deactivates it.

Three turrets are available to players, each rotating around $\frac{1}{3}$ of the yarn's perimeter, allowing coverage from all sides. Turrets shoot in a straight line from the tip of the weapon to the edges of the screen, with bullets disappearing outside of the camera's screen rect.

Previous designs planned for three distinct types of rounds:

- Regular: Infinite rounds, low damage; ineffective against shields
- Shield-piercing: Used to destroy enemy shields; same damage as regular rounds otherwise
- Power: High damage; more effective against shields than regular rounds

Regular rounds could still be used to destroy enemy shields, but required a large number of connecting shots to do so. Both shield-piercing and power ammunition had limited rounds, which had to be either collected throughout the level or purchased in the shop in between levels. These different ammunition types were ultimately abandoned, due to the fast pace of shooting in game, which left players with too little time to identify enemies if the yarn was at top velocity, and brought too much complexity to the game loop. Regular rounds are presently the only type of ammunition, with shielded enemies requiring two shots to take down.

15.3 Character, Controls, and Camera

Given the game as a fast paced shooter where characters move through a physics based map, the character, controls and camera are of high importance. In order for players to properly acknowledge the action on the screen, a dynamic camera is used, involving both an adjustment of panning and zoom so that the player steering the yarn can navigate the map effectively. The camera also has the ability to take into account the enemies on screen using arbitrary weights that pull it towards spawning enemies. This dynamic camera is given a destination and drifts towards the target as time goes on. Screen shakes also help the players know when an enemy has collided with the yarn.

In the heat of battle the players on different stations need different camera angles to suit their needs. The dynamic camera compromises the individual needs of players to accommodate them. On the fly however, the players shooting may want to switch to another station and the camera could be pulled back to an uncomfortable level. In this case they are given an adequately sized character sprite, a moderate jumping ability and simple controls to navigate in a hectic battle atmosphere. Controls are hinted to players through the use of UI popups that appear when their character approaches the stations. No button combinations will be needed to make the game less complicated. The yarn itself is a bright color that stands apart from the surroundings and allows the players to keep their attention focused on the object they are trying to protect.

16. Schedule

16.1 Planning

The team agreed to use the Agile methodologies to organize the project. There is a total of five effective development sprints, outlined in the table below:

Sprint #	Start Date	End Date
1	September 26th, 2018	October 14th, 2018
2	October 15th, 2018	October 28th, 2018
3	October 29th, 2018	November 11th, 2018
4	November 12th, 2018	November 25th, 2018
5	November 26th, 2018	December 2nd, 2018

Each sprint contains an a certain amount of user stories that needs to be tackled. They are usually between 2 to 8 user story points each, with a respective risk, priority and epic.

User Story	Point (for vel	Point	Priority	Risk	Sprint Numb
3. E: As a player, I want to be able to use the turret station(s)	10	10			
U: As a player, I want turret rotation to be smooth and responsive, including rotation between 0 and 180 degrees	3	3	H	H	Sprint 2
U: As a player, I want the right trigger to shoot the turret and do damage	5	5	H	H	Sprint 2
U: As a player, I want the turret to keep shooting at a constant rate if the right trigger is held	2	2	H	M	Sprint 3

In order to the determine which tasks needs to be done, their priority and risk are compared. The priority of a task is its importance in including a feature at the release of the game, and the risk indicates how playable and true to its design the game would be without said feature. For example, the players' movements are high risk and high priority, but a boss encounter is low priority and low risk as the game can still function without it. The order of priorities goes as follows:

1. High priority and high risk
2. High priority and low risk
3. Low priority and low risk
4. Low priority and high risk

This means that high priority, high risk tasks are almost exclusively tackled in the first couple of sprints, allowing for adjustments and building features on top of a solid foundation.

To manage our sprints, GitHub's integrated project management tools is used, using the following workflow:

1. User stories are created as issues.
2. Epics are created as labels.
3. Sprints are created as milestones and projects.

For example, Sprint 1 had a total of 71 user stories.

Below is how the Sprint 1 milestone looked, and its issues/user stories:

Sprint 1

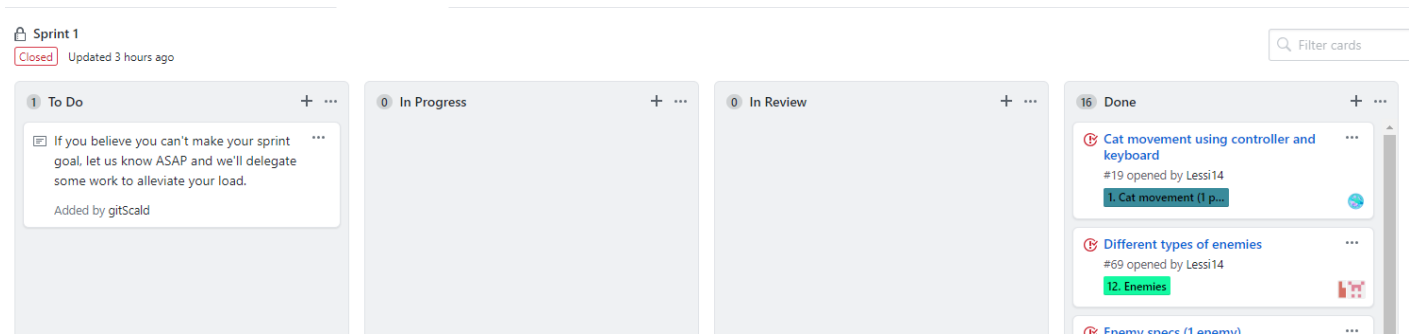
Edit milestone

New issue

⚠ Past due by 17 days 100% complete

0 Open ✓ 16 Closed	
<input type="checkbox"/> Enemies AI, amount and damage 12. Enemies	#70 by Lessi14 was closed 3 hours ago
<input type="checkbox"/> Enemies that touch the ship kills them, but also damages the ship. 7. Ship's specs	#43 by Lessi14 was closed 3 hours ago
<input type="checkbox"/> Ship's implementation and specs 7. Ship's specs	#42 by Lessi14 was closed 3 hours ago
<input type="checkbox"/> Cat movement using controller and keyboard 1. Cat movement (1 player)	#19 by Lessi14 was closed 3 hours ago
<input type="checkbox"/> Enemy specs (1 enemy) 12. Enemies	#67 by Lessi14 was closed 3 hours ago

The Sprint 1 project board, with 4 states (To Do, In Progress, In Review, Done):



The following Gantt chart gives a more accurate picture of the deadlines set for each category of features and tasks. All tasks have been completed successfully, and all (identified) bugs have been fixed in the final build, as of Thursday, November 29th, 2018.

	Start Date	End Date	Timeline	Status
Battlecats	Sep 19, 2018	Nov 29, 2018		
Planning	Sep 19, 2018	Sep 25, 2018		Complete ▾
Cat movement	Sep 26, 2018	Oct 14, 2018		Complete ▾
Basic station manipulation	Sep 26, 2018	Oct 14, 2018		Complete ▾
Ship movement	Sep 26, 2018	Oct 14, 2018		Complete ▾
Ship specs	Sep 26, 2018	Oct 14, 2018		Complete ▾
Enemy specs	Sep 26, 2018	Oct 14, 2018		Complete ▾
Basic terrain	Sep 26, 2018	Oct 14, 2018		Complete ▾
Cat movement constrains	Oct 15, 2018	Oct 28, 2018		Complete ▾
Turret specs	Oct 15, 2018	Oct 28, 2018		Complete ▾
Ship inertia	Oct 15, 2018	Oct 28, 2018		Complete ▾
Shield specs	Oct 15, 2018	Oct 28, 2018		Complete ▾
Win-lose conditions	Oct 15, 2018	Nov 11, 2018		Complete ▾
Coop	Oct 15, 2018	Oct 28, 2018		Complete ▾
Obstacles	Oct 15, 2018	Nov 11, 2018		Complete ▾
UI cues	Oct 29, 2018	Nov 11, 2018		Complete ▾
Ship health recovery	Oct 29, 2018	Nov 11, 2018		Complete ▾
Menus	Oct 29, 2018	Nov 11, 2018		Complete ▾
Multiple enemies	Oct 29, 2018	Nov 11, 2018		Complete ▾
Boss	Oct 29, 2018	Nov 11, 2018		Complete ▾
Control mapping	Nov 12, 2018	Nov 25, 2018		Complete ▾
Upgrade system	Nov 12, 2018	Nov 23, 2018		Complete ▾
Final document	Nov 12, 2018	Nov 23, 2018		Complete ▾
Bug fixing and testing	Nov 24, 2018	Nov 29, 2018		Complete ▾
Assets	Sep 19, 2018	Nov 29, 2018		Complete ▾
Design	Sep 19, 2018	Nov 29, 2018		Complete ▾
		Burndown		

16.2 Task Division Per Member

Benjamin Vial	Team lead, Documentation, level design
Emili Vasseva	Project manager, enemies, level design
Mélodie Thibeault	Graphical artist, shield station
Bruce Edouard Brazier	UI expert, enemies, turret station
Rui Zhao	Animator, shield station
Ling Tan	Ship specs, level manager
Kai Nicoll-Griffith	3C expert, yarn physics and movement
Carlo Gentile	Sound design, level design

17. Budget

No direct financial cost is expected until the completion of the game. The entire project is a student initiative, and all external resources used are distributed to the public domain. The different software used also are either freely available for download, or available through limited educational or personal licenses, which expose enough features to bring the product to market.

The project is to be worked on using both the school's and the developers' personal computers and controllers. Therefore, there is no budget allocated to renting an office space or purchasing additional equipment.

Should the game reach sales beyond \$100,000, regular payments and the purchase of professional licenses would be necessary. However, as a student initiative, there are no current plans to bring this product to a wider audience than the immediately interested parties. Perhaps as a side, personal project for some of the developer, once the delivery date has passed.

18. External Resources

Although most of the game's assets (enemies, yarn, cats, projectiles) were created by the team, some assets were also acquired to complete the look of the game and speed up the development process.

18.1 EZ Object Pools [Unity [Asset Store](#)]

The two following external assets depend on EZ Object Pools:

1. Flare on projectile hit from "EZ Effects".
2. Camera shake when the yarn takes damage from "EZ camera shake"

Published by Road Turtle Games on the Unity Asset Store for free use.

18.2 Free Platform Game Assets [Unity [Asset Store](#)]

Used for all level terrain tiles, collectible, and doodad sprites.

Published by Bayat Games on the Unity Asset Store for free use.

18.3 2D Flat Explosion [Unity [Asset Store](#)]

Used for simple cartoonish explosion effects.

Published by Red Shark Game Studio on the Unity Asset Store for free use.

18.4 Unity 2D Extras [[GitHub](#)]

Provides the official Unity Tile Palette, Rule Tiles, and Scriptable Tile objects.

Published by Unity Technologies on GitHub for free use.

18.5 TinyFire VFX 1.0 [Unity [Asset Store](#)]

Used in some low-poly particle effects in lieu of the default particle material supplied by Unity.

Published by contributor Twelve on the Unity Asset Store for free use.

18.6 Music: Progress - Johann Friedrich Burgmuller

All the music used in the game is original music composed by team member Carlo Gentile, with the exception of the music used for the splash screen and menu music Progress which was composed by Johann Friedrich Burgmuller, arranged by Carlo Gentile. This music is within the public domain, free of royalty.

18.7 Lighting Bolt Effect for Unity [Unity [Asset Store](#)]

Used for boss lightning effect.

Published by contributor Jeff Johnson (Digital Ruby) on the Unity Asset Store for free use.

19. Change Log

This section outlines changes to the original design of the game, as prototype builds outlined problems and the first presentation to critics pointed out potential challenges and issues.

19.1 Proposal Presentation Takeaways

19.1.1 First Impressions

Critics' first impressions of the game were mostly positive, citing the game's art direction to be simple yet effective, and praising the combination of local co-op with puzzle-platforming elements. The game was compared to a mix of the tower defense genre and Call of Duty: Zombies for its cooperative engagement towards defending a common objective against hordes of enemies, and its upgrade system. The team decided to capitalize on these comparisons when designing the upgrade system, aiming for a combination of classic weaponry and health upgrades, but to also insist of the high mobility of the yarn. The design of these features is in the works as of the writing of these paragraphs, but players can expect improvements on level navigation.

19.1.2 Issues Raised

While the proposal was well received, several issues were pointed out by critics, to which the team is reacting accordingly. The biggest concerns have been outlined below.

Issue raised	Solution proposed
Balancing platforming and combat elements	Never spawn enemies in trickier platforming areas
Level linearity and repetitiveness	Add branching paths that converge back to the main route
Upgrades only concern the ship's weaponry and survivability	Provide upgrades for the yarn's navigation system (top speed, acceleration...)
Puzzle elements break the flow of the game; should be optional	Capitalize on the yarn's velocity when designing puzzles (breakable walls, limit dead-ends...)

19.2 First Playable Presentation Takeaways

19.2.1 Impressions

Critics had a favorable view on the state on the game, praising the consistency and effectiveness of both the graphics and the soundtrack. The audience was shown an early prototype level which displayed mechanics that, while in a rough state, were brought together in one cohesive manner that was well received.

19.2.2 Issues raised

While bugs were to be expected in the build that was presented, some concerns were raised, the most interesting of which are compiled below for reference, as well as the solutions proposed to address them:

Issue raised	Solution proposed
Dynamic camera (panning and zooming) makes it difficult to see the characters and move inside	Scale cats and stations up, reduce the amount of obstacles inside the yarn
Little incentive for a player to get out of the navigation station	Design puzzles that require multiple stations in use, create swarms of enemies to force communication

19.3 Play Session Takeaways

19.3.1 Impressions

Testers were presented with a rough iteration of level 1, which displayed a combination of pre-spawned enemy packs and an increased inventory of level puzzles, including breakable terrain, springs, sliding gates, pressure plates, and shooting targets. The variety of these puzzles was appreciated, and the game's art was praised further.

19.3.2 Issues Raised

Issues pointed out by testers mostly concerned the relative scales of objects in the scene, as well as the feeling of the physics of the yarn.

Issue raised	Solution proposed
Discrepancy between regular yarn velocity and speed boosts granted by springs	Lower maximum yarn velocity; springs affect the gravity scale instead of a pure, high force impulse
Difficulty getting up ramps without sufficient initial velocity	Tweak the yarn's mass to increase frictional forces; provide springs near tall ramps to speed up climbs
Hard to see cats and stations inside the yarn	Scale up cats and stations, remove unnecessary ceilings and reduce collider sizes
Hard to see ladders inside the yarn	Provide a strong contrast (color and outline) to ladders for easier identification

19.4 Design Changes

The project went through some design changes out of necessity, as features were added to the prototype and issues were encountered. These changes are outlined below.

Category	Changes	Explanations
Navigation	<ul style="list-style-type: none">● Move yarn through torque and friction forces instead of raw forces● Lower maximum speed	<ul style="list-style-type: none">● Improves movement responsiveness and eliminates abrupt changes in velocity
Turrets	<ul style="list-style-type: none">● Rotate entire turret instead of only the tip of the cannon	<ul style="list-style-type: none">● Gives better feedback on direction of shots● Complete coverage of yarn perimeter (no dead angles)
Enemies	<ul style="list-style-type: none">● Allow spawning of enemies using trigger zones● Add ground-based enemy	<ul style="list-style-type: none">● Allows for dynamic level content● Breaks repetitive patterns● Allows for finer level design
Yarn layout	<ul style="list-style-type: none">● Larger movement area, more ladders● Reduced ceiling count, more contrast on ladders	<ul style="list-style-type: none">● Eases player navigation● Places stations near their associated utilities (ease of identification)
Art direction	<ul style="list-style-type: none">● Flying fish, moth, yarn shield redesigns	<ul style="list-style-type: none">● Match the simple, flat-shaded look of the game better