CATSTRONAUTS: THE GREAT EARTH ESCAPE

GAME DESIGN DOCUMENT

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1. CONCEPT

Our game is a four-player cooperative adventure where the players take on the roles of four stranded space cats, trying to escape Earth. They sneak through the city to collect treasures for the gangster cat Scarpa while secretly searching for the missing parts of their spaceship.

With a light-hearted tone, our game blends classic stealth mechanics with exploration, teamwork and time pressure. The game unfolds across multiple locations with evolving objectives and cutscene-driven storytelling.

Team up as four space cats on a mission, stealing for a grumpy gangster and outsmarting animal control – all to rebuild your ship and escape Earth!

1.1. Game Overview

Game Title: CATSTRONAUTS: THE GREAT EARTH ESCAPE

Platform: PC

Genre: multiplayer cooperate/ light-hearted adventure/ party game/ stealth mechanics

1.1.1. Key Features

- 4-Player Cooperative Gameplay: Players must coordinate actions, distract enemies, solve puzzles, and use their unique skills to succeed.
- Collect and stealth Mechanics: Collect unique things in different interesting areas. Sneaking, hiding in crowds, using distractions, and timing to avoid detection.
- Cheerful and chaotic atmosphere: Working together with friends or framing each other.Shout loudly to get rescue or work together to attract grandma's attention.
- Moderate Pressure: The tracking of enemies and the time limit of levels add tension to the game.
- Narrative-Driven: Light-hearted storytelling with cutscenes and character interactions, including the grumpy gangster cat Scarpa. Diverse, evolving levels with unique themes and challenges.

1.1.2. Visual Style

The game features a vibrant, cartoon-inspired pixel art style with exaggerated character designs and colorful environments. The cats are expressive and distinct, each with unique accessories and animations. Environments blend urban decay with whimsical details, creating a lively world full of humor and charm.

1.1.3. Game Flow Summary

Players start at the main menu, where they prepare their team and select a level. Each level consists of several progressively challenging sub-levels, each with unique objectives. Players navigate the maps using stealth, distractions, and puzzle-solving to collect items while avoiding detection. Time limits and escalating threats add tension throughout. After completing each sub-level, players receive a score and proceed to the next. Once all sub-levels within a level are cleared, players unlock the next major level. Cutscenes appear at key milestones to advance the story.

1.2. Story

High above Earth, four adventurous space cats – Bob, Tuna, Kiki, and Rupert – cruised through the stars on a routine mission from their home planet, Meow. Suddenly, disaster struck. The ship malfunctioned and spiraled out of control, crashing toward an unfamiliar planet. They crash-landed in a shadowy alley – territory of a

grumpy old gangster cat who guards his hoard of junk like it's gold. His name? Scarpa. And now, his precious stash was in ruins. To avoid his claws, the space cats promised to help rebuild his collection, while secretly searching the city for the scattered ship parts they need to get back home.

1.3. Characters

The characters that are currently in the game are the four playable cat characters, Bob, Kiki, Rupert and Tuna, and the non-player characters (NPCs), Officer Clawson and the three grandmas.

1.3.1. Bob

Bob is a former astro-navigator from Meow's air force. He's seen it all and handles most situations with calm experience. He retired early due to a mysterious "incident," which he refuses to talk about. When the mission to Earth came up, he reluctantly agreed to one last job. He insists it's "strictly temporary" – but he's secretly fond of the team.

1.3.2. Kiki

Kiki was Meow's youngest-ever engineer. She joined the mission to test her new fish-fueled spaceship system, but a few miscalculations led to the crash landing on Earth. Now, she's obsessed with understanding Earth's "primitive but fascinating" technology and keeps detailed notes on everything she encounters.

Figure 1. Bob (left) and Kiki (right)

1.3.3. Rupert

No one really knows how Rupert joined the mission. He just showed up, waved, and everyone assumed he was someone else's recruit. He always wears a little helmet – not for safety, but because he thinks it makes him look "extra official".

1.3.4. Tuna

Tuna used to be part of Meow's space-wrestling team, but was let go after accidentally headbutting a referee during a celebratory hug. He's not the brightest bulb in the box, but he's endlessly kind and just a bit too big for his own good. Though originally brought on as security, Tuna mostly just breaks things by accident and makes sure Rupert gets what he wants.

Figure 2. Rupert (left) and Tuna (right)

1.3.5. Scarpa

The evil gangster cat. A greedy hoarder who always wants more. Was once someone important in the cat underworld, and dreams of becoming someone again.

1.3.6. Officer Clawson

Officer Clawson works for the city's Animal Control Department, and takes his job *very* seriously. Grumpy, out-of-shape, and constantly one step behind, Clawson has made it his personal mission to catch the "suspiciously coordinated stray cats" causing chaos around the city. One day, he swears, he will catch those cats and finally be taken seriously.

Figure 3. Officer Clawson

1.3.7. Other NPCs

The three grandmas each guard their own market stand, and they take the job very seriously. They may look harmless, but they're quick to swing their canes if anyone gets too close wpermission. Rumor says they're sisters, but they might just look alike because of yesterday's fashion. Either way, no one dares to mess with them.

The current game version has three color variations of the same NPC, but development of further levels will include creating different NPCs.

Figure 4. The three grandmas

1.4. Game progression

Scarpa keeps sending them to new places, always asking for more stuff for his stash. He's greedy, and the jobs keep getting tougher. Eventually, the cats have had enough and decide to escape with their repaired spaceship. But when they return to the alley, ready to go, Scarpa has figured everything out. He doesn't want them to leave – he wants to keep them working for him forever. The team fights with him to get their spaceship back and to finally become free.

The game is structured around a level-based progression system, with each major level representing a distinct urban environment. Each major level consists of multiple short sub-levels that gradually increase in complexity and introduce new mechanics, enemy types, or cooperative challenges. Players must complete all sub-levels within a major level to unlock the next location and continue the story.

1.5. Levels

Each level consists of several progressively challenging sub-levels, with each sub-level in the same location.

1.5.1. Level One: The Market (we have developed in the demo)

Figure 5: The Market map

1.5.1.1. Synopsis

The space cats' first mission lands them in a noisy, rundown city market. This level introduces basic stealth, distraction, and team coordination mechanics. Under Scarpa's strict orders, the cats must sneak through the chaotic environment to gather a complete meal—quickly and quietly. It's their first test as a crew, and their only way out is through teamwork and clever movement.

1.5.1.2. Objectives

Primary Objectives:

- Sneak through the crowded market without drawing too much attention.
- Collect a full meal for Scarpa: beer, fish, popcorn, apple.
- Return all items to the beat-up cargo truck at the center crossroads.
- Leave the market safely once all items are secured.

Optional Objectives:

- Knock over a stack of fruit crates to cause a temporary distraction.
- Steal a piece of premium tuna from a locked freezer stall (requires a team puzzle to bypass the lock).
- Find a spaceship part hidden inside the cluttered warehouse behind the market.

1.5.1.3. Map

The level is set in a dilapidated medium-sized urban market, with various stalls, obstacles, and patrol routes.

- Main Paths: A large cross-shaped road divides the market into four interconnected open areas.
- Entry Point: The team starts at a beat-up cargo truck parked at the center of the crossroads.
- Key Areas: (1) Seafood Stall – fresh fish guarded by a grumpy vendor; (2) Produce Stand – apples and fruit crates a good place for distractions;(3) Outdoor Bar – beer barrels are present but closely watched. (4) Communal Bench Area – popcorn and snack remains scattered near benches; (5) Old Warehouse – hidden spaceship item, plus some climbable crates; (6)Garbage Pile – alternate escape route or hiding zone.
- Stairs and small ladders are scattered throughout, enabling rooftop access, alternate entry to the warehouse, or quick escapes.

1.5.1.4. Encounters

- Market Patrols: Animal Control patrol units (e.g., dogs in uniform) wander the public zones.If a cat is caught, it gets locked in a holding cage ("market jail"), requiring at least one teammate to break them out via a timed puzzle or stealth unlock mechanic.
- Vendors: Vendors can notice nearby sneaking cats. If they spot a player stealing, they will shout, chase, and attempt to block the cat's escape.Vendors return to their stall after a short chase, giving players a chance to retry or regroup.
- Co-op Mechanics: Some objectives (like unlocking the freezer or escaping the jail) require two players working together.A teammate might need to hold a switch, create a diversion, or carry a stunned friend.
- Cutscene: After returning to the truck, Scarpa is seen eating the food while delivering insults about the cats' "clumsiness."He tosses them a scribbled map and demands they "find better loot next time" — leading into Level Two: The Plaza.

1.5.2. Level Two: The Plaza

1.5.2.1. Synopsis
The space cats sneak into a crowded city plaza where Scarpa has spotted a shiny object. With humans everywhere and patrols on alert, the cats must use crowds, distractions, and timing to steal the item and escape before the subway gate closes.

1.5.2.2. Objectives

Primary Objectives:
Steal various small trinkets from passersby, street performers, and vendors—shiny pins, fridge magnets, small flags, playing cards, and more.
Avoid detection while sneaking through the plaza.
Escape through the subway gate before it closes.

Optional Objectives:
Interact with three strange pigeons to uncover clues about spaceship fragments and locate a spaceship item.
Overflow the fountain to cause a major distraction**.**

1.5.2.3. Map

- The plaza is a wide open area with a raised stage in the center.
  The performer and the target items are on or near the stage.
- Surrounding areas include diverse street stalls, benches, and snack stands.Narrow alleys offer stealthy alternate routes.
- The subway exit opens briefly at the end of the show.
- Crowds move constantly—cats can blend in to stay hidden.
  Low rooftops, tables, and signs offer short climbs and alternate paths.

1.5.2.4. Encounters

- Animal control officers patrol with nets. If caught, a cat is dragged toward a van and must be rescued.
- The performer reacts to noise and movement—stealing items requires distraction and good timing. Distractions include cans, café bells, and noisy objects.
- The subway gate begins closing after the theft, adding time pressure.
- Cutscene: The cats escape through the gate. The stolen trinkets are revealed to contain clues to their ship. Scarpa hints that the next clue lies “up high, where the birds rule the rooftops.” The next mission begins.

1.5.3. Level Three: The Rooftops

1.5.3.1. Synopsis

The space cats climb onto city rooftops, a dangerous maze of narrow ledges and chimneys. They must navigate carefully, avoid aggressive birds, and find a spaceship part hidden in a large bird’s nest. Precision jumps and teamwork are key to survive the height and complete the mission.

1.5.3.2. Objectives

Primary Objectives:

- Traverse the rooftops without falling or alerting the birds.
- Collect hidden items scattered on ledges and vents.
- Return safely to the fire escape ladder.

Optional Objectives:

- Find and steal the spaceship part from the bird’s nest.
- Chase and catch a pesky bird to distract the flock temporarily.
- Use environmental objects to create shortcuts or block bird patrols.

1.5.3.3. Map

The rooftops form a vertical maze with narrow walkways, ledges, chimneys, and satellite dishes.Key areas include the bird’s nest, tall chimney, and fire escape ladder.Some ledges require cooperation, such as stacking crates or using ropes.Bird patrols circle nests and popular perches.

1.5.3.4. Encounters

- Aggressive birds patrol the rooftops and swoop down on noisy or nearby cats.
- Players can distract birds by throwing objects or chasing one away.
- Falling causes damage and forces respawn at last safe spot.
- Teamwork is needed for tricky jumps and environmental puzzles.
- Cutscene: After stealing the spaceship part, the cats regroup on the fire escape. Scarpa’s hologram warns the next mission is riskier — a high-end restaurant district filled with guards and gourmet leftovers. The adventure continues.

1.5.4. Level Four: The Factory Alley

1.5.4.1. Synopsis

The cats sneak into a grimy alley behind an old factory. Here, they must gather valuable industrial materials like rusty gears and scrap metal. The area is patrolled by security guards and automated machines, requiring careful stealth and teamwork to avoid detection and complete the haul.

1.5.4.2. Objectives

Primary Objectives:

- Collect industrial materials: rusty gears, scrap metal, wires, and pipes.
- Avoid or disable factory security guards and patrol drones.
- Locate a spaceship part hidden inside a broken machine.

Optional Objectives:

- Trigger machine noises to distract guards.
- Find and collect rare electronic components scattered around.
- Access a locked storage container using a team puzzle.

1.5.4.3. Map

The alley is narrow and cluttered with crates, pipes, and old machinery parts.
Key areas include scrap piles, storage containers, patrol routes, and a broken machine hiding a spaceship part.
Some areas have conveyor belts and mechanical traps.
Overhead catwalks provide alternate paths.

1.5.4.4. Encounters

- Security guards patrol on foot; drones hover and scan with spotlights.
- Players can distract guards by triggering noisy machines or throwing objects.
- Some drones require teamwork to disable temporarily.
- Environmental hazards include moving conveyor belts and crushing presses.
- Cutscene: After gathering the materials, the cats regroup to inspect their haul. Scarpa's hologram appears, impressed but impatient, hinting the final mission lies deep underground—in the museum basement. The team prepares for the ultimate challenge.

1.5.5. Level Five: The Museum Basement

1.5.5.1. Synopsis

The cats infiltrate the dark, maze-like basement of an old museum, rumored to hide valuable bones, gold artifacts, and the last missing spaceship parts. This level combines stealth, puzzle-solving, and a final confrontation with Scarpa, revealing twists in the story and culminating the escape plan.

1.5.5.2. Objectives

Primary Objectives:

- Navigate the museum basement without triggering alarms.
- Find and collect valuable bones and gold items.
- Locate the final spaceship parts hidden in secret vaults.

- Confront Scarpa and survive the ensuing showdown.

Optional Objectives:

- Solve puzzles to unlock hidden rooms and caches.
- Disable security cameras and traps.
- Discover notes revealing Scarpa's true intentions.

1.5.5.3. Map

The basement is a labyrinth of storage rooms, display cases, security checkpoints, and hidden vaults.
Key areas include ancient artifact displays, security hubs, puzzle rooms, and Scarpa's secret lair.
Tight corridors and shadowed corners offer stealth opportunities.
Multiple exits lead to the final escape route.

1.5.5.4. Encounters

- Security guards patrol with flashlights and motion sensors.
- Players must avoid or disable cameras and traps.Puzzles require teamwork to open vaults and secret doors.
- The final boss fight with Scarpa involves all four cats working together to outsmart and defeat him.
- Cutscene: After defeating Scarpa, the cats repair their ship with the recovered parts. They share a brief moment of triumph before blasting off into space, leaving Earth behind and beginning a new adventure.

2. TARGET GROUP

2.1 Primary Audiences

Our game targets two main player segments:

- **Young Adults (Aged 20–30)**
  This group includes players who are early in their careers or building their independence. Many live alone or in small social circles, and games play a key role in connecting with friends, relaxing after work, and expressing creativity or humor. These players may not have the time or energy for long sessions or complex competitive games, but they enjoy games that are easy to pick up, socially engaging, and emotionally uplifting. Our game offers the perfect balance of low-pressure collaboration, bite-sized missions, and charming aesthetics, making it ideal for casual play sessions or weekend gatherings.
- **Streamers & Content Creators**
  This group includes content creators who stream gameplay on platforms like Twitch, YouTube, and TikTok. They often play games professionally or semi-professionally, with the dual goal of entertaining an audience and growing their online presence. For streamers, a game must not only be fun to play but also engaging to watch. Our game's lighthearted chaos, unpredictable interactions, and emphasis on teamwork and humor make it ideal for creating viral, shareable content. The co-op structure also encourages collaborative streaming, cross-promotion between channels, and recurring gameplay content.

2.2 Player Mindsets

- **Playful & Social**: Players are not just focused on winning—they want to laugh, collaborate, and improvise.
- **Expressive & Creative**: The game allows for individual style through movement, roles, and interactions.
- **Relaxed but Goal-Oriented**: Players enjoy missions and puzzles, but without punishing mechanics or high stress.

2.3 Why This Game Appeals

For Young Adults:

- Drop-in/drop-out co-op design supports flexible schedules.
- Emphasis on teamwork and humor builds social connection.
- Puzzle-solving and stealth require communication, but without being overly difficult.
- Light tone and visual charm offer a fun break from more competitive or intense games.

For Streamers:

- Simple rules and fast pacing make it easy to showcase live.
- Stealth fails, chaotic teamwork, and cutscenes create moments perfect for clips and audience reactions.
- Collaborative play encourages multi-streamer sessions and shared storytelling.
- Cute art style and expressive animations help build memorable characters and content.

2.4 Replayability

- Multiple levels, secrets, and optional objectives create variety.
- Team roles and dynamic threats make each session feel unique.
- Perfect for repeated group play, whether casually or as a streaming series.

The game offers an inviting mix of **social stealth, playful chaos, and cooperative fun**. Whether players are creating content or just spending time with friends, the experience is built around laughter, bonding, and surprising moments—making it appealing for both casual players and creators alike.

3. TECHNOLOGY

3.1. Development setup

3.1.1. Development hardware and software

Hardware

The development team should use mainstream hardwares to ensure a smooth development process, namely MacBook Pro 2021 or later equipped with Apple Silicon SoCs. The team should also have a variety of hardwares to be able to perform different tests over different environments including low-end and high-end machines with all three major operating systems (Windows, macOS and Linux).

Software

The latest operating systems (**macOS 15 Sequoia and Windows 11**) will be used to ensure the up-to-date development environments. Backward compatibility should also be considered but supporting the newest will be in a higher priority.

Godot 4.4 (GDScript version) will be the game engine / main development tool. Godot is an open-source game engine with MIT license, so there is no surcharge for using Godot and publishing commercial game products. Godot is also cross-platform so the development team is able to solve platform-specific problems if any occurs.

The development team should use GDScript across the development process rather than .NET. GDScript is the recommended scripting language by Godot and it is usable out-of-box. Avoiding .NET environments can further avoid potential problems introduced by external dependencies.

GitHub will be used for repository management and development collaboration. The repository should be private and commercial use is allowed within the terms of services of GitHub.

Local git clients can be individual choices of likes in the development team.

3.1.2. Development procedures and standards

In the development team, there should be one team leader and several programmers. The team leader is responsible for assigning tasks to each programmer as well as connecting the art team and ensuring a good user experience. The team should have a cycle of two weeks. Within the cycle the team will decide what to develop and deliver. Different tasks should have different branches in the repository to avoid conflicts. All branches should merge into the main before the end of the cycle.

All scenes and assets in the project folder should strictly follow the naming conventions from Godot. All nodes in the Godot project should also strictly follow the naming conventions.

The team should use only GDScript for scripting for the game. When writing GDScripts, the programmers should strictly follow the GDScript style guide for naming conventions, formatting and code order to ensure consistency across the team, readability and maintainability.

Here is the project folder structure from what we have done in the demo:

```
.
├── assets # general reusable assets
│   ├── audio
│   ├── original source
│   └── Pixelify_Sans # font
│       └── static
├── build # output from project export
```

```
├── item # item scene and its assets
├── level # level scenes and their maps with assets
│   └── map
├── navigation # navigation polygons
├── npc # npc scenes and their assets
│   ├── npc1
│   ├── npc2
│   ├── npc3
│   └── officer_clawson
├── player # player characters and their assets
│   └── cats
│       ├── Bob
│       ├── Kiki
│       ├── Rupert
│       └── Tuna
└── ui # UIs and their assets
```

Most assets should go with their own scenes' parent folders. Only reusable assets are located at the assets folder.

3.2. Target hardware

Since our game is a 2D flat map multiplayer game, it should be able to run on slightly older hardware to cover a wider range of target users. And because we are using Godot as our game engine and we do not use any proprietary APIs on different platforms, cross-platform ports on major PC and Mac operating systems are all supported including Linux. Here are the reference sheets for minimum and recommended hardwares. The users would also be expected to have a local network (like a router in the house) to be able to play locally with friends. If they wish to play over the Internet, at least one of them should have a public IP address.

Windows and Linux

*Requires a 64-bit processor and operating system

	Minimum	Recommended
OS	Windows 10 or later	Windows 10 or later
Processor	Intel Core2 Duo 2.4Ghz	Intel Core i5 2.8Ghz or better
Memory	2 GB RAM	4 GB RAM
Graphics	Integrated graphics	Nvidia 600 series GPU or better
Network	Broadband Internet connection	Broadband Internet connection
Storage	400 MB available space	500 MB available space

macOS

	Minimum	Recommended
OS	OSX 10.12	Latest macOS
Processor	Intel Core i3 4th Gen or higher	Intel Core i5 4th Gen or better

Memory	4 GB RAM	8 GB RAM
Graphics	Integrated graphics	Intel Iris Plus Graphics 640 or better
Network	Broadband Internet connection	Broadband Internet connection
Storage	400 MB available space	500 MB available space

3.3. User interface

3.3.1. Menus

3.3.1.1. Start menu

Figure 6: Start menu

The start menu is the first view that the player will see after the game is loaded. The player can choose to start playing the game by pressing the start button, or go to settings, or quit the game.

3.3.1.2. Lobby (Network connection and player list)

Figure 7. Network connection (top) and player list (bottom)

After the player has pressed the start button, the network connection view will be shown. The player can either choose to host the game themselves or join others by entering the IP address. The player can also decide their display name during the game by entering the name here in the connection view.

Then the player should enter a player list view if the connection is successful where they can see all the currently joined players' names. In the player list view, only the host can press the start button and bring everyone to the next view. The player can also choose to leave the team if they press the cancel button and they will be redirected to the start view.

In the future version of the game, there should also be a public team list in the network connection view where all the players can see all the public teams and they can join a team just by selecting them.

3.3.1.3. Map selection

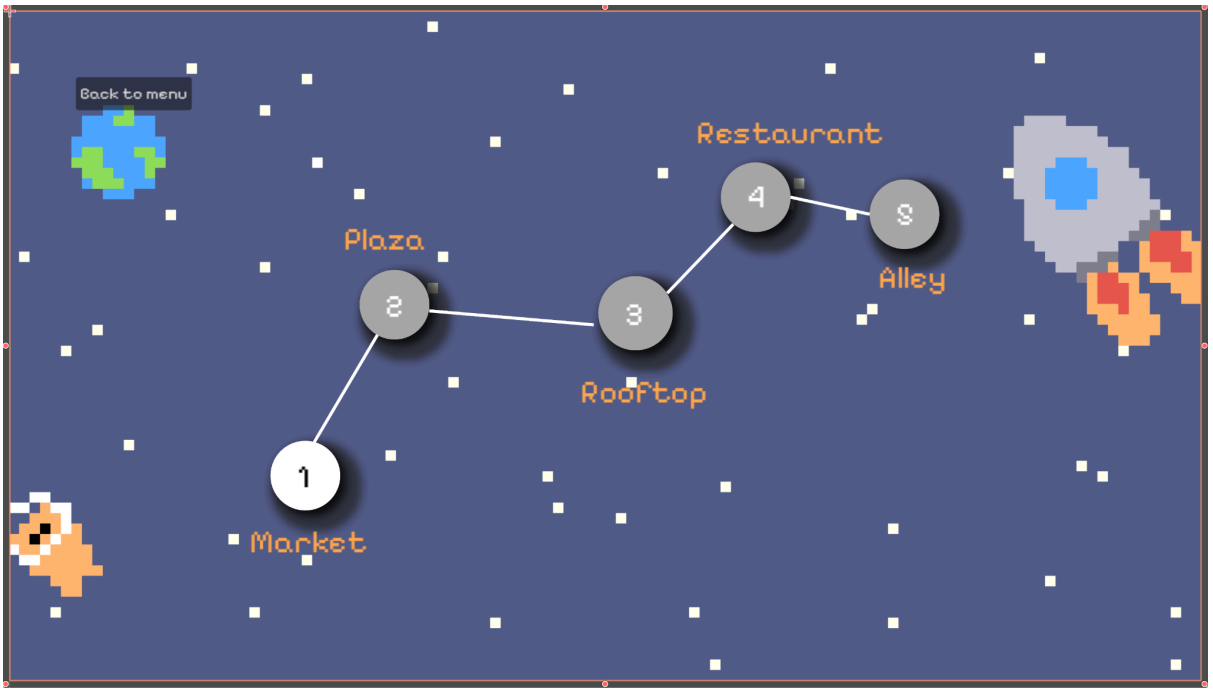

Figure 8. Map selection

After a team is successfully formed and the host has pressed the start button, the map selection view will be displayed to all players. Only the host can select which map to play. The first map is always selectable and the other maps can only be selected depending on the team's game progress. The progress will be dependent on the lowest one in the team.

3.3.1.4. Level selection

Figure 9. Level selection

After the host has selected a map, the level selection view will be displayed to all players. Only the host can select which level to play. Each map has three levels to choose and only the first one is always unlocked, and the other two will be unlocked after the player has succeeded the previous level. After the host has decided on a level and pressed the play, the game will start for all players.

3.3.2. HUD

3.3.2.1. In-game HUD

Figure 10. In-game HUD

On the left top corner there is the item count/progress display. The left one is for counting Scarpa's items (regular items). There is a face of Scarpa to indicate that those are for him. There is a percentage right next to Scarpa's face which will indicate the progress of the overall collection of those regular items. The column next to it is for counting the spaceship items (special items).

3.3.2.2. Tutorial overlay

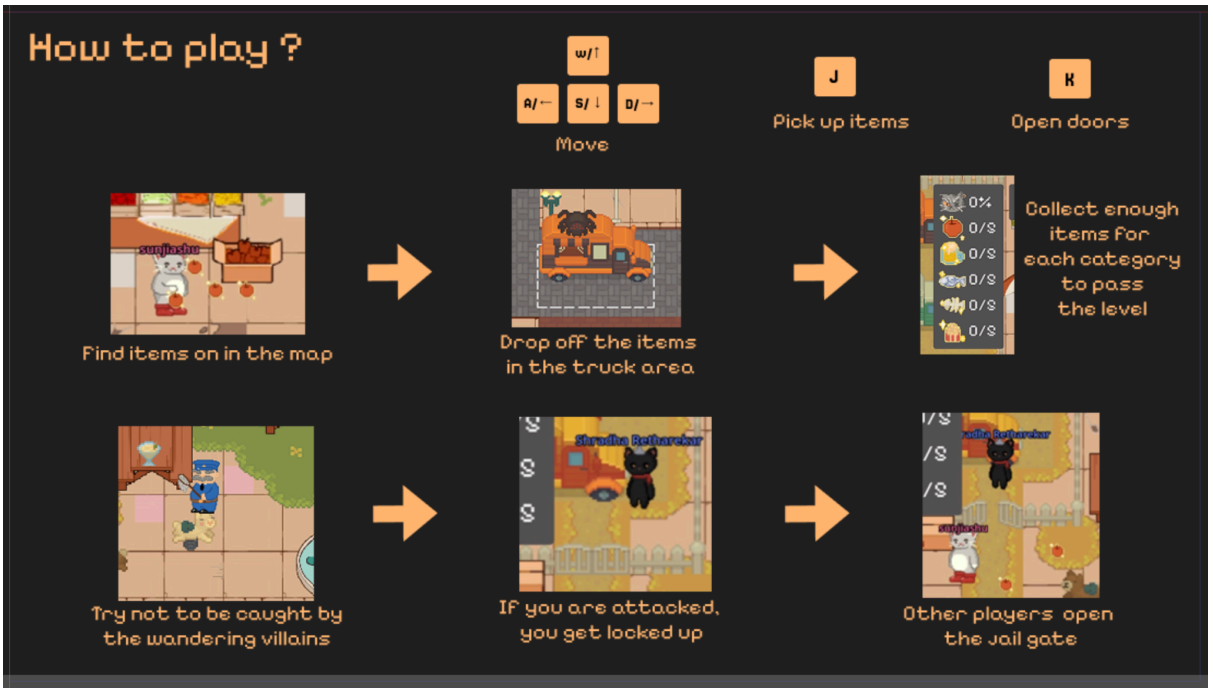

Figure 11. Tutorial overlay

The tutorial overlay shows the player all the controls. The tutorial view also shows the player what they are supposed to do during the game, including what to do to win the game and what to avoid to lose the game, which are the basic mechanics of the game.

3.3.2.3. Pause overlay

Figure 12. Pause overlay

The pause overlay is whenever one player in the team hits the ESC key, and the game will pause for everyone. One can choose to leave the game and go back to the menu, which will cause the game to end for everyone. One can also resume the game for everyone by pressing the resume button.

3.3.2.4. Scoreboard overlay

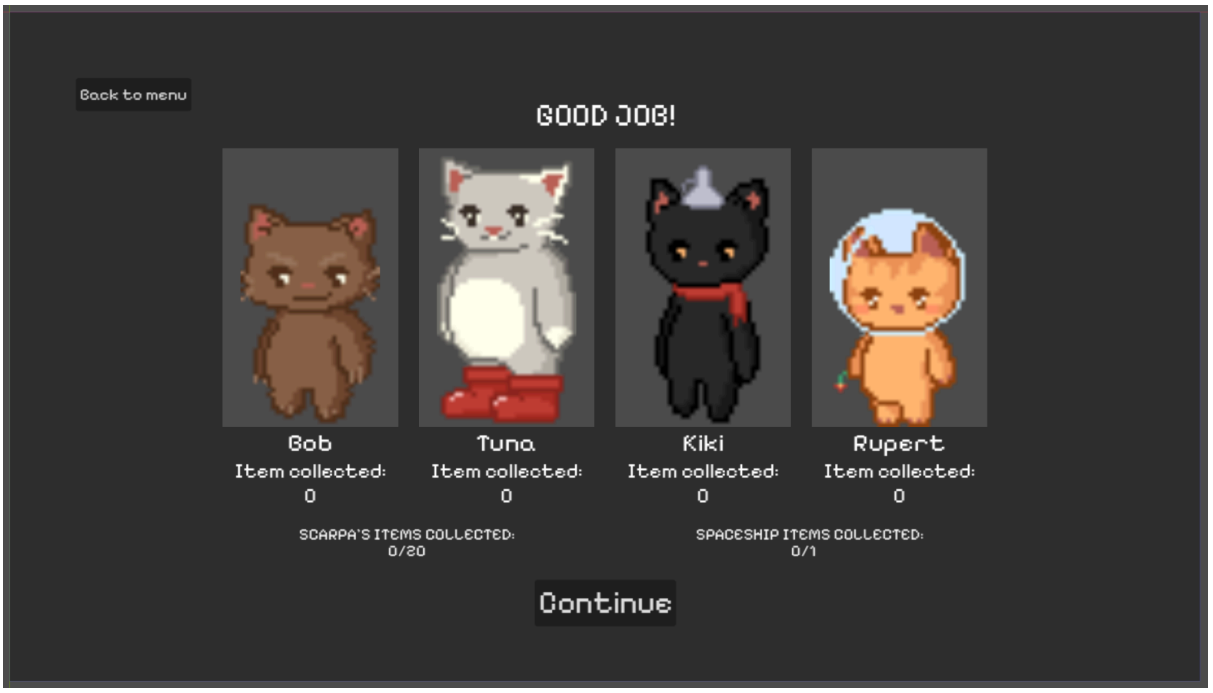

Figure 13. Scoreboard overlay

The scoreboard overlay will be shown when the game ends. If the players have succeeded at this level, the top title of this view will be positive words. The individual points as in this case, the individual collection count will be displayed. The total amount of items for both categories will also be displayed.

3.4. Network

The game is designed to be played by 4 people at the same time. We use the high-level multiplayer functionalities provided by **Godot's high-level networking APIs**. We do not need low-level control since we won't take advantage of fine controlled networking, and we want to keep the development as simple as possible to lower the cost as long as it suffices our needs for networking.

The network model we choose is **server-clients** where the server is also a client. One player should be the host (server) of a team and is responsible for selecting the maps and levels during the game. Other players who wish to play with the host will need to enter the IP address of the host. If all players are in a local network, they only need the IP address of the host in the local network. If some players wish to join a team over the Internet, the host will need to expose the port using the NAT ability of the router to forward the connection to the Internet, and then the other players can enter the host's local network's public IP address on the Internet to join. If they do not have a public IP address provided by the broadband carrier, they will have to find third-party forwarding services.

During the game, all major game logic including selecting a map and a level, starting a game, player spawning, item collection and counting and end game are all controlled by the server (host player side). This ensures that one game will only have one truth of what is actually happening. Syncing the data including all those mentioned above plus the player characters' movement, npcs' movement and items' movement are done by using **remote procedure calls (RPCs)** provided by the high-level networking APIs in Godot. For those which will change the data of the game for everybody, any client can call a request function to the server, and the server will handle the logic changes and then call the corresponding authority-only RPC function on all clients. For those which are supposed to be controlled by a client, any client can call the function on all clients to sync the changes. Player spawning is done by using the **MultiplayerSpawner** node provided by Godot. This node ensures that whenever we instantiate a node under s specific node, all clients will do the same. And for player, npc and item movement

data we use the **MultiplayerSynchronizer** node provided by Godot. This node ensures that selected properties of those nodes will be synced over the network whenever possible.

In the future iteration of this game we could consider providing a central server that will forward all players' connections without having players entering IP addresses or using third-party forwarding services. The central server could also provide a public lobby service where players can find strangers to form a team.

3.5. Player Controls

3.5.1. Player character movement

The player can control their characters by using WASD or arrow keys. There is an Input node under the player node that will receive updates from keys every frame. The direction will be calculated and normalized so the player will have consistent speed in every direction.

3.5.2. Item interaction

The player can press the key J to attempt to grab an item when the player's collision box overlaps with the item's Area2D node' collision box. The player should hold the J key when moving to let the item move with the player, essentially "carrying" the item. Whenever the player releases the J key, the item will no longer move with the player, essentially "dropping" the item.

3.5.3. Other interaction

For puzzles, gates, doors on the map which are all "interactable", the player can press the K key to interact with them if the player's collision box overlaps with the object's Area2D's collision box. Depending on the type of object the player interacts with, different effects will be triggered. For example, for a gate or a door, whenever the player is within the interactable zone, the gate or the door will open or close. This interaction does not apply if the player is being locked up.

3.6. NPC behaviour

3.6.1. States

There are four states for the NPC node: wandering state, chasing state, attacking state and returning state. During wandering state, the NPC will only be walking within a certain patrol area. If at any points where a player is near enough, the NPC will enter chasing state and start to chase the player. When chasing, if the player is close enough to the NPC, the NPC will attempt to attack and enter the attacking state. If the player is far enough from the NPC, the NPC will begin the returning state and return to the patrol area.

3.6.2. Pathfinding

The pathfinding of all NPCs are done with the navigation APIs provided by Godot. Each NPC will get a **NavigationAgent2D** and we use **NavigationRegion2D** to assign areas where the NPCs can navigate within. On each map, we have a global navigation region that covers all the walkable areas on the map, and we also have different smaller navigation regions designed for different NPC's own areas, called the patrol navigation region.

Each NPC has a different patrol navigation region based on level design, and the NPC walks around the patrol region regularly if no player is near. The wandering of the NPC is done by randomly selecting a different target point within the patrol region for an assigned time interval.

When chasing, the NPC will set the target player's position as the pathfinding target. When returning, the NPC will find a nearest point in the patrol navigation region to the current location as the pathfinding target.

3.6.3. Player detection

The player detection is done for each frame, the NPC will check the distance to each player. If the distance is smaller than the chase range threshold, then the NPC will set that player as the target. This detection is constantly running so in any state of an NPC, if another player is closer than the current target, the target will switch.

The NPC will ignore any players who are locked up.

3.6.4. Attack and effects

For each physics frame, if the NPC is chasing a player and the distance to the player is smaller than the attack range threshold, then the NPC will start to attempt to attack the target player. When attacking, the NPC will stop moving so that there will be some time for the player to escape. One round of the attack animation will be played and when the animation is over, the NPC will check if the target player is still in the attack range. If it is, then this attack will be counted as a successful attack and some effects will happen to the player depending on the NPC type. Some NPC types are harmless where they will only stun the player for a few seconds, but some will lock the player up if the attack is successful and the player will be teleported to a locked area.

3.7. Game art

3.7.1. Concept Art

The visual concept of the game emphasizes the whimsical and cartoonish interpretation of the urban Earth through the eyes of a stranded alien cat. The overall style is colorful and vibrant, with a playful but slightly chaotic tone. The characters are cartoonish and exaggerated yet expressive.

3.7.2. Character design & animation

The characters are drawn and animated using the apps Pixel Studio and Procreate, both on the Apple iPad Pro 11” (2020) using the Apple Pencil (2nd generation).

All characters are drawn on a 32 x 64 pixel canvas, although some animations needed a canvas up to 64 pixels wide, and, with the characters’ heights and widths varying depending on their design. All character designs were created with their personalities in mind.

Figure 14. Animating Bob, in Pixel Studio

Each character is animated frame by frame, all drawn by hand. Every character has an idle and walking animation. The playable characters also have carrying animations for holding items, and knocked-out animations for when being attacked by NPCs. Officer Clawson has an attack animation for catching the cats, and the grandmas have a knock-out animation. In total, that makes 28 animations.

3.7.2.1. Bob

Bob is a little older than the other cats, and has a relatively short figure with messy fur and a smirk. He doesn’t wear any accessories, and is designed to give an impression of being a veteran. His main palette is brown, with details in dusty pink.

3.7.2.2. Kiki

Kiki is tall and slim, with black as her main color and accessories in red. She wears a funnel as a hat, and has a scarf around her neck.

3.7.2.3. Rupert

Rupert is small and cute, with a palette of orange and pink. His eyes sparkle, and there’s a slight blush on his face. Rupert wears a space helmet made out of glass. In his right hand, he holds a red flower.

3.7.2.4. Tuna

Tuna is both tall and wide, with a gray body and white spots on his stomach, paws and his left ear. Tuna's front teeth are showing, and he wears big red boots.

3.7.2.5. Officer Clawson

Officer Clawson wears a blue uniform, a blue hat, a black tie, a brown belt and black shoes. He has big, bushy eyebrows that cover his eyes, and an even bigger mustache that covers his mouth. Officer Clawson carries a hand net.

3.7.2.6. The three grandmas

The three grandmas all gave the same character base but with a different color palette. Grandma one has a brown, beige, black and red palette, grandma two has a blue, yellow and brown palette and grandma three has a purple, black, and pink palette. They have big round glasses that cover most of their face, and a short hairstyle.

3.7.3. Map

The components of maps are drawn using the app Procreate, on the Apple iPad Pro 11" (2020) using the Apple Pencil (2nd generation).

Since the map layer cells of tilemap are set to 32*32, each image is drawn with 32*32 as the minimum unit. Depending on different requirements, there are various sizes such as 64*64 and 32*64.Some assets from internet are used to decorate the scene.

Figure 15. collection of map components

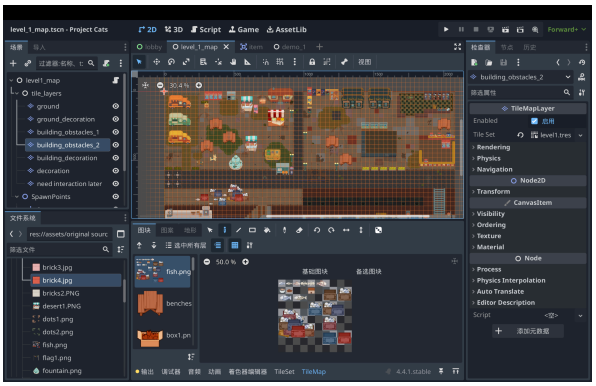

Figure 16. Stitch map in godot

To maintain the consistency of the visual style and the unity of the gameplay, and for the convenience of adjustment, the form of drawing the smallest unit block materials and splicing them is adopted.

The splicing part uses the tilemap function in godot to ensure the stability of the style.

Multi-level layering is used to achieve a hierarchical effect.

The scene in the demo is level1: market in the game. The overall style is based on a cute and mischievous tone, with the main color being a warm tone of medium to high saturation. To match the tone of the story, dilapidated elements such as cracked tiles, perforated flags, and stains on the floor were added. To match the characteristics of the cat protagonist, elements of a fish market and a seaport city have been added, such as puddles, containers for holding fish, and roadside eateries offering fish-flavored dishes

Figure 17. part of the map

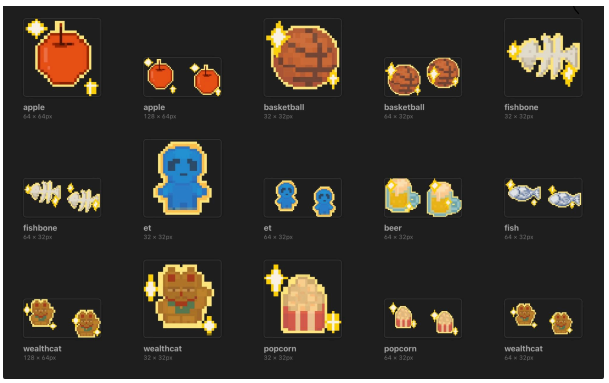

Figure 18. collection of items

3.7.4. Miscellaneous

Items to be collected are drawn and animated using the app Procreate, on the Apple iPad Pro 11” (2020) using the Apple Pencil (2nd generation).

The items are all drawn in a size of 32*32 to match the character's picking animation. To fit the story, the items that can be taken in the first level include fish, fish bones, etc. To make the accessible items more eye-catching, two frames of up and down floating animations were made for each item. At the same time, bright color outlining and floating star effects were done on the edges.

3.7.5. Cut scenes

For now, we have one cut scene that is shown before the first level, and it gives the backstory of the game. It consists of a series of still images and text, and is meant to give a comic book feeling.

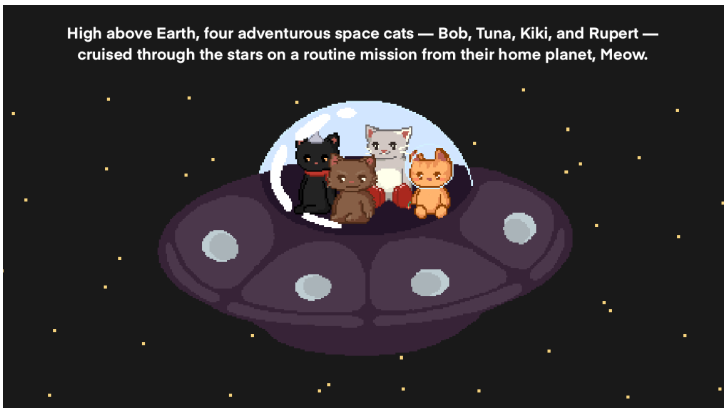

Figure 19. Cutscene 1, panel 1

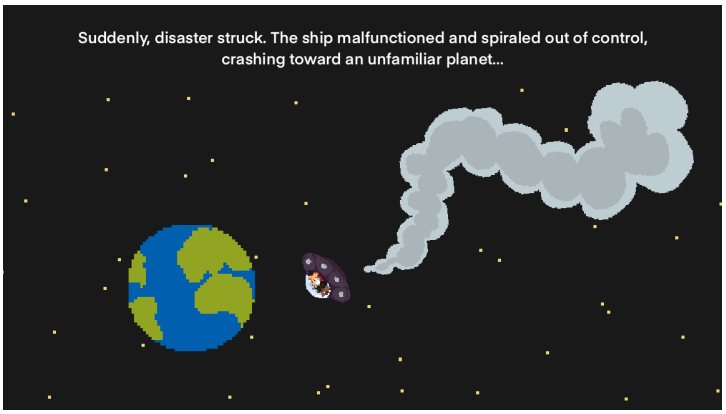

Figure 20. Cutscene 1, panel 2

Figure 21. Cutscene 1, panel 3

Figure 22. Cutscene 1, panel 4

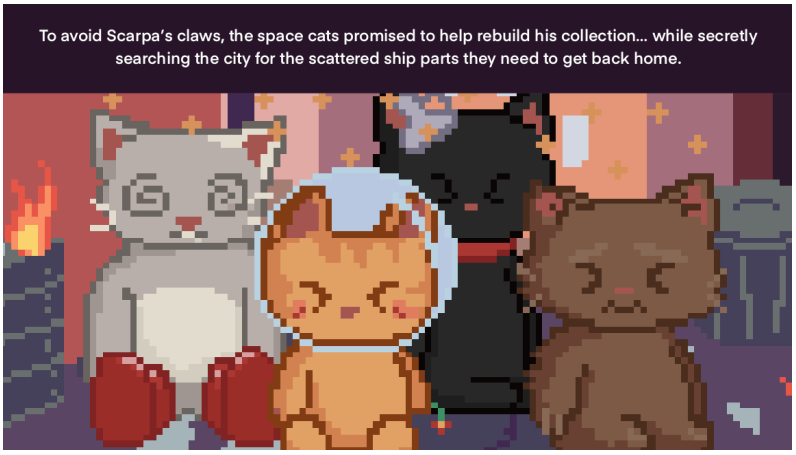

Figure 23. Cutscene 1, panel 5

3.8. Audio

For the music, the genre would be in an 8-bit, cute, and goofy style. Some elements might be changed to reflect the different conditions of each level. For the sound effects, in addition to enhancing the overall interactivity of the game, we specifically selected sounds with space and cat elements to better match the game's story and lore.

All the audio files are originally from online material libraries. All the music and sound effects used comply with the licenses specified by the publishers, including permissions for commercial use and for editing and modification.

The audio editing tools used include Audacity and SuperCollider.

Below are the details of the music and sound effects we have implemented in the demo.

3.8.1. Music

File name	Purpose	Source	License	Modification
ingame_coreloop.wav	Background music when players are in a level	https://amachamusic.chagasi.com/music_retrogamecenter3.html	https://amachamusic.chagasi.com/terms.html	Slowed down the tempo to make it not too sharp. Make it loopable

being_chased.wav	Background music when players are being chased	1. https://amachamusic.chagasi.com/music_picopicomarch.html 2. https://pixabay.com/sound-effects/whistle-84607/	1. https://amachamusic.chagasi.com/terms.html 2. https://pixabay.com/service/license-summary/	Fastened the tempo to make it more intensive. Add higher pitch whistles

3.8.2. Sound Effects

File name	Purpose	Source	License	Modification
picking_up.wav	Sound effect for picking up items	https://pixabay.com/sound-effects/cute-alien-noises-291369/	https://pixabay.com/service/license-summary/	Sliced
door_close.wav	Sound effect for door interactions	https://pixabay.com/sound-effects/door-close-100117/	https://pixabay.com/service/license-summary/	Removed redundant silence
item_collected.wav	Sound effect for objects are successfully collected	https://pixabay.com/sound-effects/coin-257878/	https://pixabay.com/service/license-summary/	
got_hit.wav	Sound effect when players get attacked	https://pixabay.com/sound-effects/cat-meow-loud-225307/	https://pixabay.com/service/license-summary/	

4. BUSINESS

4.1. Executive summary

The team should see the popularity of the game as the most important goal. If this game can be a good promotion for the team on SNS and then attract more public attention.

For the business plan, we should start by identifying the estimated budget and potential costs. Then we consider the price and estimated sale volume to ensure that the game could at least break even. Next, we should analyze the needs of our target audience and compare our strengths and weaknesses with those of other competitive games to develop a sales plan.

4.2 Budget and estimated cost

4.2.1 Salary

We assumed the development of the whole game would take 6 months in total. The estimated salary per month for each position is from Glassdoor (median salary in Stockholm, Sweden):

- Developer (game developer): 43000 SEK, 215 SEK/hr
- Artists (graphic designer): 36000 SEK, 180 SEK/hr
- Musician (sound designer): 39000 SEK, 195 SEK/hr
- Level designer (game designer): 38000 SEK, 190 SEK/hr
- Marketing (marketing): 42000 sek, 210 SEK/hr

Overall, the estimated salary for 6-month development is **1188000** SEK

4.2.2 Server

We assumed the game would be hosted on an on-demand server and the total play time might take about 300 minutes. The estimated cost of hosting the game on Amazon EC2 server for players to finish the whole game is 2.26 SEK. However, we need to take into account the potential cost of idle or unused server time. We would charge 5 SEK per sale to break even this cost.

4.2.3 Steam charge

As we plan to sell this game on Steam, we need to consider that Steam charges a 30% fee on each sale.

4.2.4 Marketing

We plan to do some marketing events for 6 months after the game is in its early access. The estimated cost for executing these marketing plans is 44137 SEK.

4.3 Market analysis

We aim to sell this game to young adults who like co-op games and enjoy chill games, and streamers who'd like to collaborate with other streamers.

To better understand the audience's considerations when choosing co-op games and the key factors behind the success of similar competitors, we conducted a SWOT analysis.

4.3.1 Competitor analysis

We did competitor analysis of games that have similar target groups and have designed similar play behaviour. We have chosen five games that are suitable for both young adults and streamers: **1.R.E.P.O.; 2 Lethal Company; 3.Moving Out; 4.Overcooked (Switch); 5.Untitled Goose Game.**

R.E.P.O. (9,75€)			
Young adults		**Streamers**	
Strengths (S)	**Weaknesses (W)**	**Strengths (S)**	**Weaknesses (W)**
Cute characters, easy to play, fun to tease friends	Scary for some people, can cause motion sickness	Fun physics engine, multiplayer lowers entry barrier, mod support	Incomplete game features
Opportunities (O)	**Threats (T)**	**Opportunities (O)**	**Threats (T)**
Meme culture, social media popularity, active Steam community,	Similar games appearing	Unpredictability from teammate interactions	Similar game environments and components

ongoing development with player feedback			

Lethal Company (9,75€)			
Young adults		**Streamers**	
Strengths (S)	**Weaknesses (W)**	**Strengths (S)**	**Weaknesses (W)**
Fun group experience, roleplay and team-based coordination	Scary for some people, can cause motion sickness	Multiplayer lowers psychological barrier, strong team coordination (need a commander)	Gets repetitive after learning all monster types
Opportunities (O)	**Threats (T)**	**Opportunities (O)**	**Threats (T)**
Good for social gaming after hours, popular among friends	Burnout after repeated plays, newer games entering the scene	Community hype, entertaining unpredictability between streamers	New similar games, community interest fading

Moving Out (22,99€)			
Young adults		**Streamers**	
Strengths (S)	**Weaknesses (W)**	**Strengths (S)**	**Weaknesses (W)**
Easy to play, not scary	Requires friends to play (no public lobbies)	Well-connected levels, clear progress map, slightly challenging cooperation	Hard-to-move objects, unclear role division, limited player freedom
Opportunities (O)	**Threats (T)**	**Opportunities (O)**	**Threats (T)**
Willingness to replay the game	Similar games, difficulty of completing levels	Stream-friendly format, quick progression through multiple levels	Competing moving games, hard-to-clear levels

Overcooked (Switch) (15,99€)			
Young adults		**Streamers**	
Strengths (S)	**Weaknesses (W)**	**Strengths (S)**	**Weaknesses (W)**

Easy to play, encourages discussion, not scary, high replay incentive	Difficulty varies significantly depending on player count	Visually chaotic and fun, encourages streamer banter, cooperative stress is entertaining	Difficulty varies greatly depending on player count
Opportunities (O)	**Threats (T)**	**Opportunities (O)**	**Threats (T)**
At the time, no similar game on Switch	At the time, no similar game on Switch	Great for streamer collabs, fun to watch and rewatch	Market saturation with similar co-op chaos games

Among the games we have chosen, overcooked also include Switch version which players play with game controllers and can connect the game to TV. We aim to include games with different hardware interactions among our competitor analysis.

Untitled Goose Game (18,99€)			
Young adults		**Streamers**	
Strengths (S)	**Weaknesses (W)**	**Strengths (S)**	**Weaknesses (W)**
Cute, chill, relaxing, fun, freedom in solving tasks, easy objectives	Guidance can be unclear, low replay value	Wholesome chaos, meme-friendly, sandbox-style mischief	Short campaign, limited replayability
Opportunities (O)	**Threats (T)**	**Opportunities (O)**	**Threats (T)**
Goose meme popularity	Similar games appearing	Goose memes: viral potential, relaxing change of pace in streams	Limited content, few expansion paths, similar quirky games

4.4 Sales plan

4.4.1 price and estimated sale volume

We started by calculating the price and estimated sale volume to break even the costs.

Price (SEK)	Projected sales	Projected net Sales (After Steam's 30% Cut)
120	10267.80833	14668.29762
130	9477.976923	13539.96703
140	8800.978571	12572.82653
150	8214.246667	11734.6381
160	7700.85625	11001.22321
170	7247.864706	10354.09244
180	6845.205556	9778.865079
190	6484.931579	9264.18797
200	6160.685	8800.978571

Price (SEK)	Projected sales	Projected net Sales (After Steam's 30% Cut)
120	10267.80833	14668.29762
130	9477.976923	13539.96703
210	5867.319048	8381.884354
220	5600.622727	8000.88961

After considering the price and estimated playing time of this game (300 minutes), we decided to set **150 SEK** as the regular price of this game.

We plan to have early access to attract more customers and hear players' feedback before the official release. During the first month of the official release, we will have a new release discount. Following this period, the game will be sold at the regular price.

- Early Access (1 month): 20% off (120 SEK)
- New Release Discount (1 month): 10% off (135 SEK)
- Regular Price: standard retail price thereafter. (150 SEK)

4.4.2 Marketing plan and strategy

Our marketing plan and strategy are a part of the road map to approach customers and create interest for players.

1. Pay streamers. Use their streamer platforms and pay them to join our discord.Pay them to regularly share blogs, record videos. Join our discord channel. And record videos and upload them on YouTube. Use Slack and notion.
2. Plan to attend game forum and promote for us. Join platforms to share relevant game development news. News release and update regularly.
3. Collaborate with other start-up games to promote for each other.
4. Join game association eg for women? Women game association. Promote game industry job with women. (We are a team of 4 women)
5. Run social media platform on TikTok, Instagram, Facebook, and LinkedIn. Post snaps or arts from game twice a week to gain attention. With upcoming events. Updates, game association news, email subscriptions etc
6. Build our own website. Let players have a channel for more of our game news and updates.