Game Design Document (GDD)
Algorithmic Inventory Sorter

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> **Key Notes**
>
> - These days, GDD's tend to be shorter, not longer. Challenge yourself to explain features concisely, use visuals, and leave some parts open to the team, sometimes less details are better, especially if the scope of your game is large (No one wants to read a 100 pages long GDD).
>
> - Pictures are worth a thousand words.
>
> - Make this as you visualize your game: Even if it doesn't feel like you'll be able to gather a full team to take on all the necessary tasks, plan as if you have a full team, afterwards you can scale it to size and prioritize elements. If you feel like you want a feature like that in your game, put it in here.
>
> - If one of the sections doesn't make sense for your game, feel free to delete it from the final document or use "Not applicable".
>
> - Make sure the final version is coherent; re-read it several times and send it to friends first. If other people understand it with a simple read, then you're doing great.
>
> - Have fun!

Contents

1 Introduction

Important! Some terms like queue and queueing algorithm, among others, have been used in an arbitrary way to make this document more understandable.

A GitHub repo is already up with information regarding the development of this project. https://github.com/frankoldfield/algorithmic-inventory-sorter

1.1 Scope of the document

This document is intended for anyone involved in the production of the video game or any related products such as research papers or podcast episodes. Specifically, researchers at the Creative Computing Technologies lab at University of The West of Scotland. It will also be part of the handoff documentation, for anyone that might be involved in the development of this game in the future. Or annexed as part of a research publication.

1.2 Elevator pitch

Sortica - Algorithmic Inventory Sorter is an immersive Serious Game (SG) where users will have to solve 10-20 minute levels in simulated scenarios while learning about queueing algorithms. It will be intended to be used as a learning tool in undergraduate courses, alternative to traditional methods like lectures or problem solving. By using novel immersive technologies, we aim to have a higher engagement and knowledge retention for students with or without additional educational needs.

2 Game Overview

2.1 Game concept

The player will play as a robot, part of a restoration crew, in an enterprise called Sortica, whose main goal is the restoration of the planet. Particularly, their sorting crew's goal is the complete restoration of Sorting Street, home to several local businesses. To achieve this goal the players will have to solve puzzle-like simulations in different settings, (e.g., a restaurant and a factory). Every time the player completes the puzzle, that level will be considered completed, and the corresponding building will be completely restored.

The main objective is that the players learn about queuing algorithms while enjoying the game and showing an improved learning progress compared to more traditional means. For this, it is important that the **level of difficulty is well suited and not arbitrary for each user**.

2.2 Audience

The people who'll play the game are undergraduate students from degrees like computer science. Some will play this game as a part of a test study, to figure out the impact on their knowledge, these participants will also be subject to a stealth game-based assessment. Others will play this game as part of the learning process in lessons related to queuing algorithms. They will be 18 years or older.

2.3 Genre

Simulator / Puzzle solving.

2.4 Setting

Sortica takes place in a post apocalyptic world, after a climate disaster, but some special chapters may take place in other fictional environments, this can act as a way of implementing new levels, without them being too repetitive, special chapters can show the perspective of other restoration crews destined in other areas of the planet. Having a setting this typical helps link the game world with the main goal.

2.5 Game structure

Sortica will initially have 5 levels, one will act as a tutorial, and the other 4 will be completed linearly, each time a level is completed, the corresponding building will be restored, and the next level will be unlocked.

2.6 Player

The game will be single player. The player's goal is the restoration of Sorting Street. While doing this, they will have to move through levels, completing the proposed puzzles. To solve these puzzles, the player will first visualize a tutorial explaining how a certain queueing algorithm. Once the level starts, they will have to apply said queueing algorithm.

2.7 Game flow summary

As previously mentioned, the game will revolve mainly around Sorting Street and the different levels. Sortica Headquarters will act as a lobby/menu. In Figure 1 we have a flowchart describing the main gameloop.
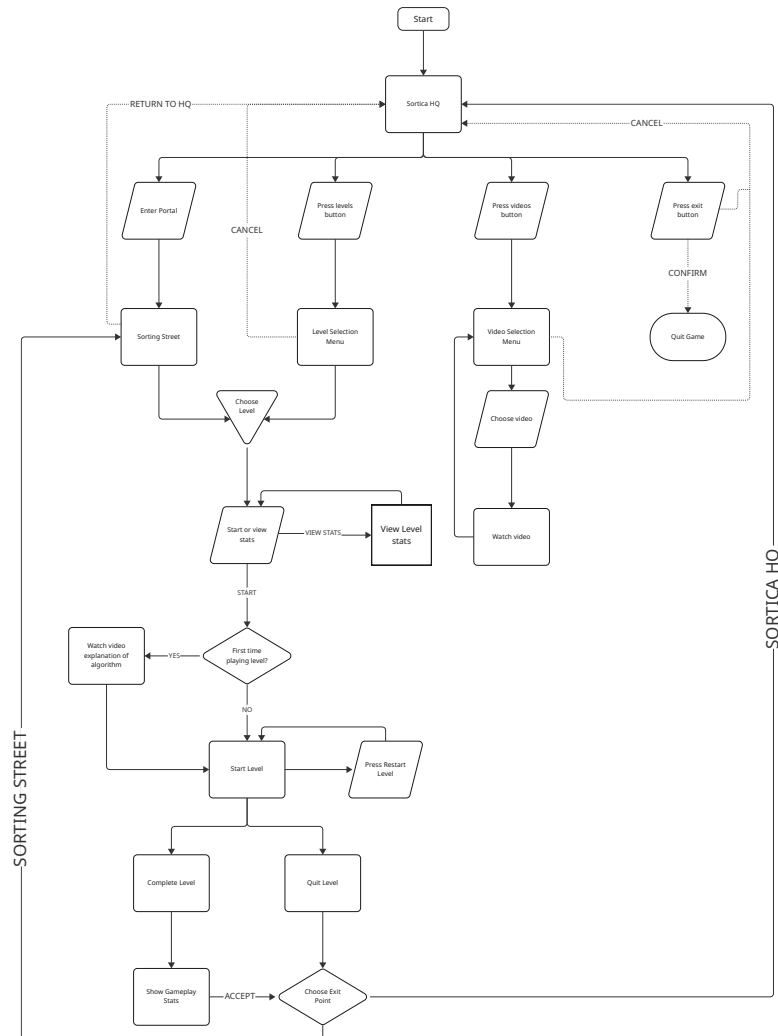
Figure 1: Game flowchart

The actions the player can perform are:

- Select level.

- See stats about level.

- Start level.

- Restart level.

- Exit level.

- Walk or run.

- Jump.

- Interact with NPC.

- Grab object.

- Drop object.

- Select queue history object.

- Place queue history object.

2.8   Look & Feel ●

We want the game to be fairly simple, the goal is to make it feel a bit like Portal but less technical/cold, with a warmer feel. We don't want the game to be distracting. **I think in this matter, Luke's guidelines might help me.**

The game will have two main locations, Sorting Street, where the levels are located, and Sortica Headquarters, which will act as a base/main menu.

3   Gameplay

3.1   Objectives

The main objective for the player is beating all the levels and completing the reconstruction of Sorting Street. Secondary objective is completing all the levels in the hardest difficulty.

3.2   Progression

The goal in each level is to optimize queueing processes, in each level they will have one or more incoming queues of objects, a set of instructions to sort the objects on their way out, and a set of outgoing queues, once the player has successfully sorted these objects, they will have optimized the queueing process in that level. Completing a level will unlock the next one.

3.2.1   Challenge structure

The first level after the tutorial will be a basic level, one queue and FIFO algorithm, the second level will explain the concept of stack, using a LIFO algorithm. After the first two levels, the difficulty will be increased, first, by adding a priority input queue to the FIFO algorithm. On the last level, another input queue will be added, and a Round-Robin algorithm will be used.

3.3   Play flow

After selecting a level, if it is not their first time playing it, the level will start right away. Otherwise, the player will have to view a short video explaining the queuing algorithm they will be using beforehand. After viewing this short video, the level will start. After completing the level, the stats from their gameplay will be shown to them. Finally, they will return to where they choose, Sorting Street or Sortica Headquarters.

3.4   Difficulty

Initially, a difficulty setting for each level was going to be implemented. But it would be redundant, if we already have a learning curve produced by increasing difficulty among different levels, it becomes unnecessary, and it would probably make the game feel more repetitive and less immersive. The difficulty of the levels will be adjusted with both the number of queues and the queueing algorithm to be used.

4 Mechanics

4.1 Rules

The player can't modify any assets from the game, they can only move the objects it has to queue and interact with other assets, in a determined way. When an object arrives from an input queue, the player must grab it, and then move it to either an output queue, or to an auxiliary desk. If the player thinks he has made a mistake, he can fix it by reordering the small items displayed on the queueing history board, these represent the items he has already put on an output queue..

4.2 Game universe

Each level, Sorting Street, and Sortica Headquarters, will be different scenes, managed by a master script, when the player performs an action that will take him to another location, the master script will be in charge of saving the state of the current scene, load the new scene, and start it.

The game will keep all the items to be sorted out of sight, and will provide them to the player through the input queue. Once the player puts an item on the output queue, its identifier will be added to a data structure that will store only the order of the items, the items will then be deleted. Every time the player modifies the order using the queueing history board, the game will modify the data structure that stores the order to reflect the output queue correctly. The game will check if the items on the output queue are in correct order every time the user either reorders them using the board or adds an item to the output queue. In case the order is correct, the level will have been completed.

4.3 Physics

Realistic physics. The only remarkable thing to mention is that the user levitates (in reality it's just that his character is floating, it can't fly or move vertically if it doesn't jump), this is only for aesthetic purposes, this way, we can make the player smaller and more appealing, without its camera being too low.

4.4 Queueing history

This asset allows the player to visualize the order they have introduced the objects into the output queue in, and change it after making any mistakes. For example, in Figure 2, the player would have to select the item number 2, and then the item number 1, the two would swap spots, and the order would then be correct.

Figure 2: Queueing history board

4.5 Auxiliary desk

This desk acts as a buffer, it allows the player to store objects and reorder them without putting them into the output queue, for example, in a LIFO queueing algorithm, the player will have to put every object on this desk, and then start putting them into the output queue in reverse order.

4.6 Economy

Initially, we had thought of implementing an economy, to make completing levels more appealing, but users would only be able to buy cosmetic items, we think that this could prompt the users to engage in the game in a more repetitive way, that could halt the learning process. Because of this, we have decided not to implement an economy system.

4.7 Character movement

The player can move around every location, some will have visible barriers (Every level, and Sortica Headquarters), and others will have invisible barriers (Sorting Street).

4.8 Player interaction

The player can interact with the helper NPC at all times. In Sorting Street, the player will be able to select the level they want to play, or read information about it. During levels, they will be able to interact with the objects they have to sort, with the queues, and with other elements such as the auxiliary desk and the queuing history board.

4.8.1 Game menus

The two main menu options are alternatives to Sortica Headquarters, in early stages of development, these will be used, but they are intended to be replaced with a more interactive version (Sortica Headquarters).
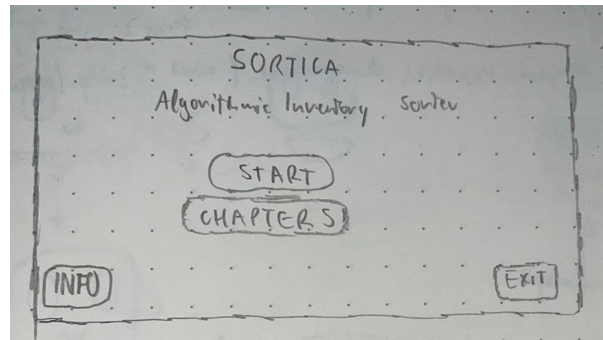
Main Menu option 1
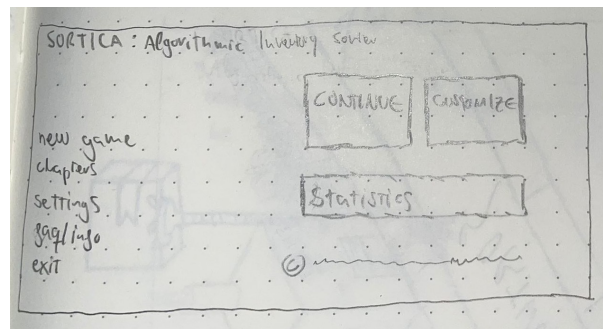

Figure 3: Main Menu option 1

Main Menu option 2

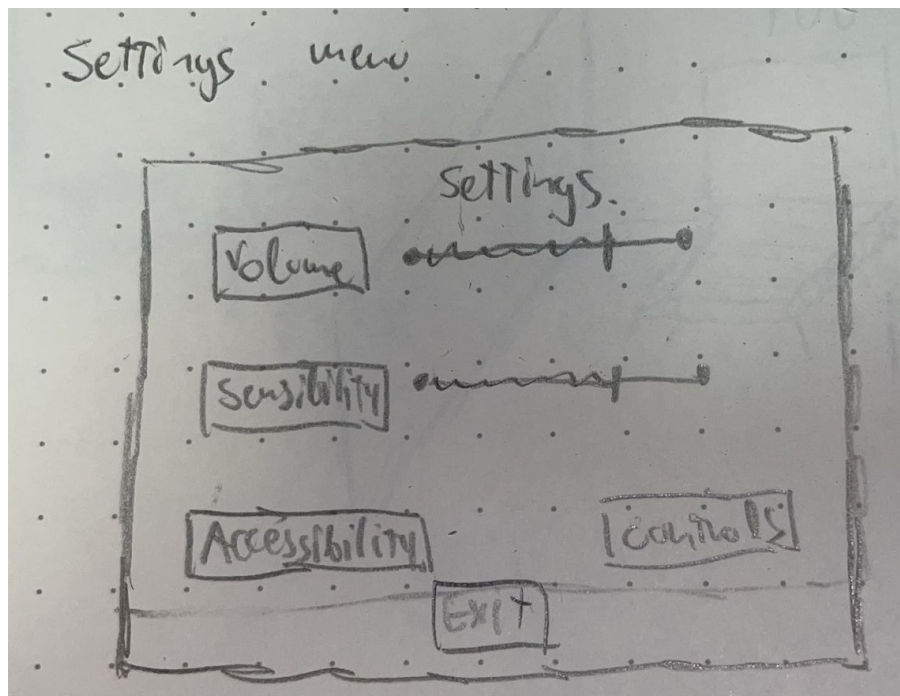Figure 4: Main Menu option 2

Settings menu

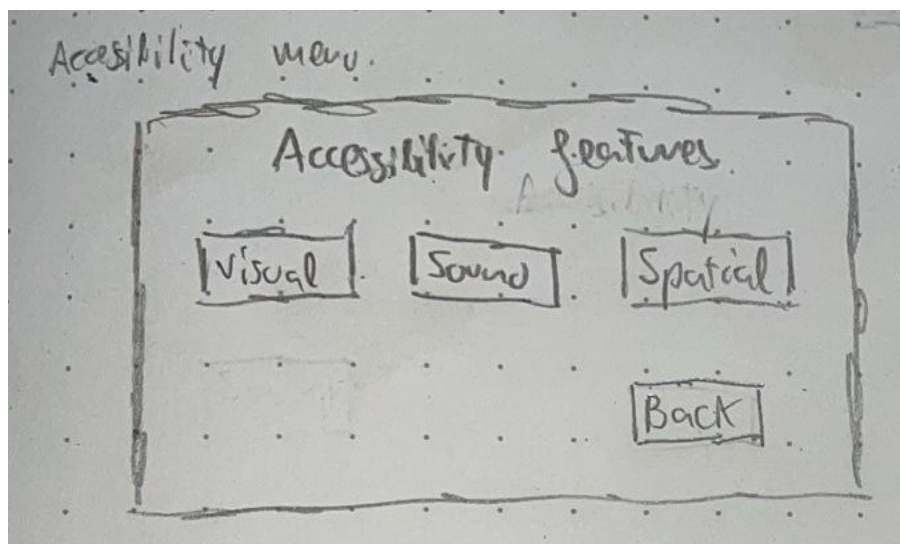Figure 5: Settings Menu

Accessibility menu

Figure 6: Accessibility Menu

Control menu

Typical controls menu, we can make modifications for accessibility, still have to look into this.
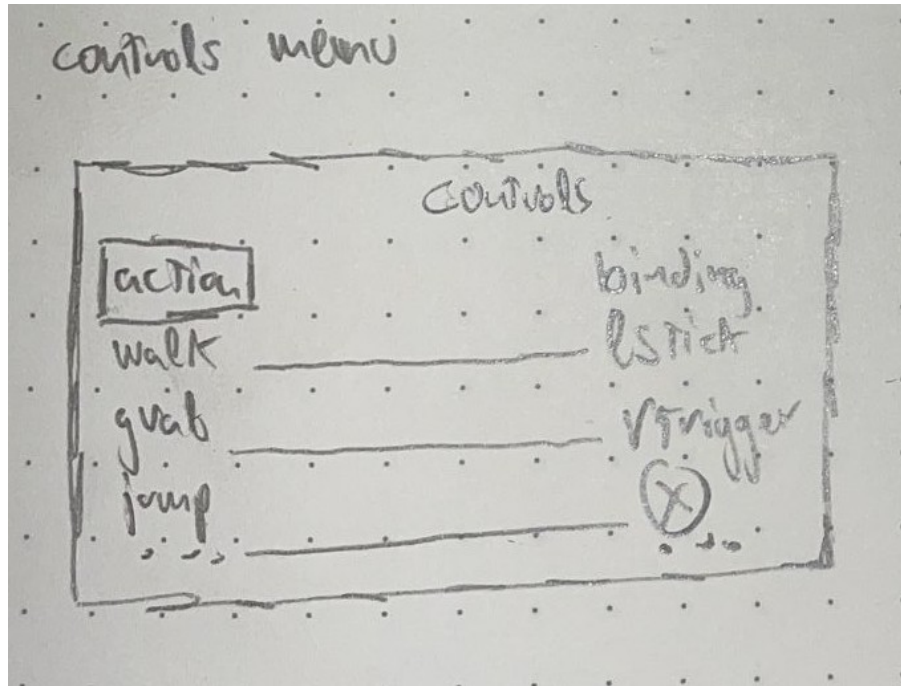
Figure 7: Controls Menu

4.8.2 Saving

Every time the player completes or exits a level the game will save automatically.

4.8.3 Game options ●

The player will be able to use any of the implemented accessibility measures, they will also be allowed to change sensibility and sound volume. The player will be allowed to change the controller bindings to allow for better accessibility. **These still need discussing.**

Visual accessibility features

- Disable complex models (everything turns into basic models)
- Colour filters for colour blindness

Auditory accessibility features

- Disable sounds
- Sound queues signaling next step

Spatial accessibility features

Motor accessibility features

- Controls personalization.

4.9 Assets ●

Still have to discuss sounds. Still have to attach sketches.

4.9.1 Player/Characters

- Player model
- Player textures
- Player animation/movement
- Helper model
- Helper texture
- Helper animation/movement
- Chef model
- Chef texture
- Chef animation/movement

4.9.2 Sortica Headquarters

- Room model
- Terminal model
- Terminal texture
- Panel model
- Panel texture
- Portal model
- Portal texture
- Wall/Flooring/Ceiling textures

4.9.3 Sorting Street

- Street texture
- Sky texture
- Factory model
- Factory texture
- Pastry shop model
- Pastry shop texture
- Warehouse model
- Warehouse texture
- Restaurant model
- Restaurant texture
- Fence model
- Fence texture
- Bush model
- Bush texture

4.9.4 Levels

Test

- Simple Queue model
- Simple Queue texture
- Simple box model
- Simple box texture
- Simple board model
- Simple board texture
- Simple table model
- Simple table texture

Factory

- Factory Queue texture
- Metal rods model
- Metal rods material
- Factory board texture

- Factory table texture
- Factory furnace model
- Factory furnace texture

Pastry shop

- Pastry Shop Furnace Queue model
- Pastry Shop Furnace Queue texture
- Pastry model

- Pastry texture
- Pastry Shop board texture
- Pastry Shop table texture

Warehouse

- Warehouse Queue texture
- Warehouse box texture
- Warehouse board texture

- Warehouse table texture
- Warehouse truck model
- Warehouse truck texture

Restaurant

- Restaurant Queue texture
- Appetizer Model
- Appetizer texture
- Main Course Model
- Main Course texture
- Appetizer Model

- Appetizer texture
- Restaurant board texture
- Restaurant table texture
- Restaurant door model
- Restaurant door texture

5 Graphics and audio

5.1 Visual system

It is a 3D minimalistic game. One of the reasons why it is minimalistic is to reduce distractions. The shapes and textures will be simple, similar to games like "Fall Guys", "Firewatch", "Outer Wilds" or "Roblox".

5.1.1 Player camera

VR First person view.

5.1.2 Landscape

Landscape will only be actually applicable in Sorting Street, it will be an infinite street towards both ends of the street, and a cloudy sky (See Figure 8).
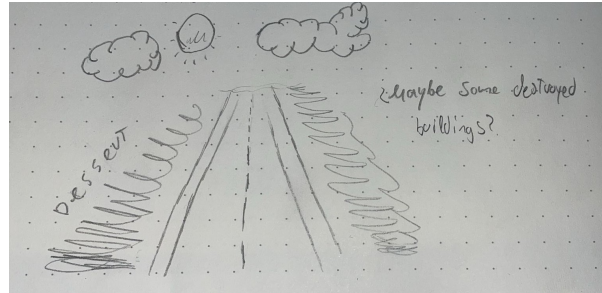

Figure 8: Landscape
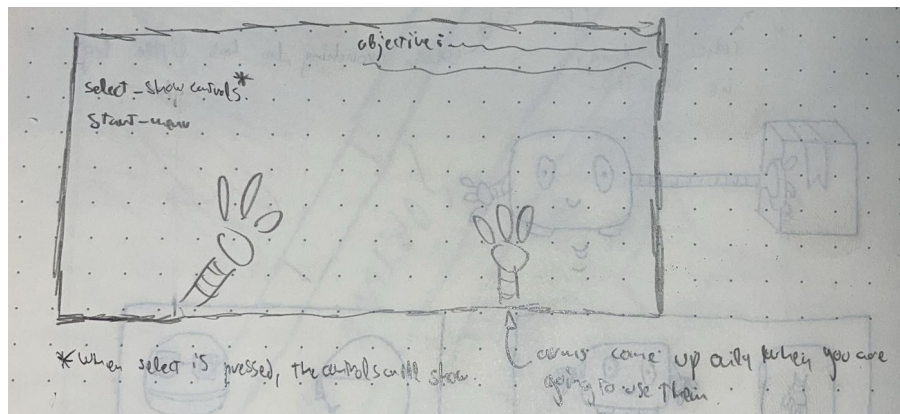
5.2 Interface

5.2.1 Game HUD

Figure 9: Basic user hud

When pressing select (placeholder) the controls will show on screen. When pressing start (placeholder), the pause menu will pop up. The option to have the controls show on screen is mainly for accessibility purposes, because some people find it harder to remember controls, it is important to facilitate the way they can double check. This way, they will be less distracted from the game.

5.3 Audio system

5.3.1 Game music •

If the game has any music, it will be background, relaxing music, we need to avoid complex music to reduce distractions and disorientation. (**Still need to discuss the use Music Therapy**)

5.3.2 Audio look & feel

We want the audio to feel simple and robotic, yet a bit comical. Again, it can't be distracting, there shouldn't be any strong noises.

6 Story and narrative

6.1 Backstory

This backstory is told by our robot coworker. The world is set in a post apocalyptic setting caused by an environmental disaster. After several years of having to live underground, Sortica INC was founded, with the goal of making the surface habitable again, one of its divisions is the Sorting division, whose objective is making sure every process that takes place on the surface is optimized, to ensure no resources are wasted.

6.2 Main plot

We are part of a restoration crew at Sortica INC, in the Sorting division. Our goal is to complete the restoration of Sorting street, by optimizing the way the restored businesses/buildings manage their processes (applying queuing algorithms). If we are not successful in our duties, we will be considered an unfit model and will be destroyed and replaced by newer models.

6.2.1 Plot progression

The supporting character will inform us on how the completion of each level has impacted the restoration of Sorting Street.

6.3 Cutscenes

We will have cutscenes that explain the algorithms that will be used in each level.

7 Characters

7.1 Main character - Sortie

His full name is Levitating Sorting Restoration Robot version 13.9.2.

7.1.1 Backstory

The main character (You) is a robot from a restoration crew, whose goal is to restore the buildings in sorting street.

7.1.2 Personality

The main character doesn't talk too much, it has a naive personality, and just smiles and nods at everything it is told to do.

7.1.3 Appearance

Small rounded rectangular prism, with stretching arms and little legs. When the character is crouching, it has little legs, when it isn't, it levitates.
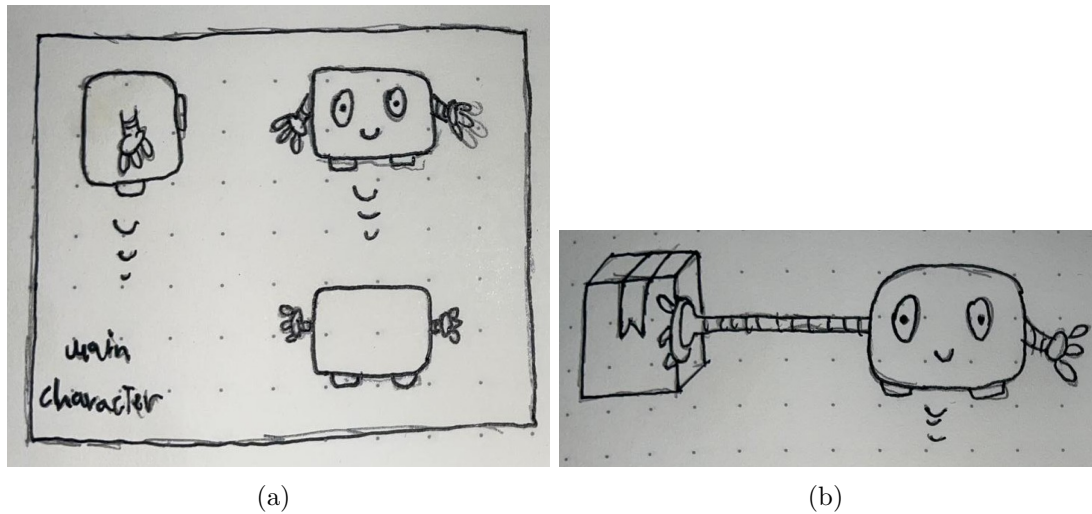

Figure 10: (a) Sortie - Views (b) Sortie - Arm extended

7.1.4 Abilities

It can levitate, and grab objects from afar with its extendable arms.

7.1.5 Relationships

It is new to the job, other employees treat him just as a regular new employee.

7.2 Supporting character - Rollie/Roller/Scrollie

His full name is Rolling Sorting Restoration Robot version 5.9.

7.2.1 Backstory

The supporting character is in this case an older model of restoration robot, it is now retired of his restoration duties and is dedicated to instructing and teaching newer models.

7.2.2 Personality

It is more apathetic than the main character, it takes his job very seriously.

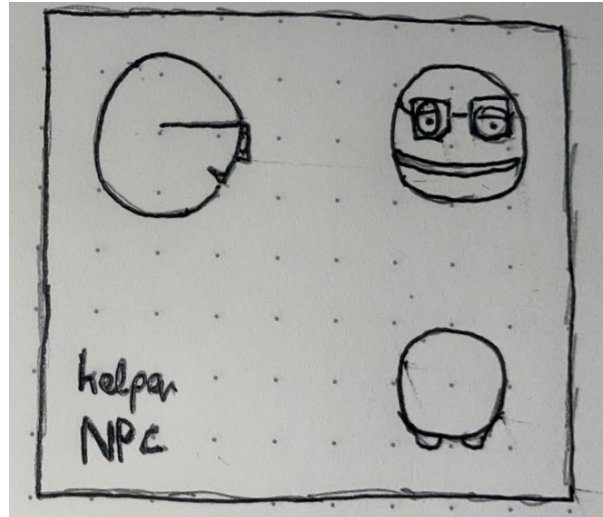### 7.2.3 Appearance

Sphere with eyes, glasses, and mouth.

Figure 11: Rollie - Model views

7.2.4 Abilities

It rolls and it teleports, it is omnipresent.

7.2.5 Relationships

It is the supervisor of the main character.

8 Game world

8.1 Look & Feel of the world ●

The parts of the world that are out of reach or have not been restored have look old and tore down, the parts of the world where we move around and have restored have to look modern, simple and clean.
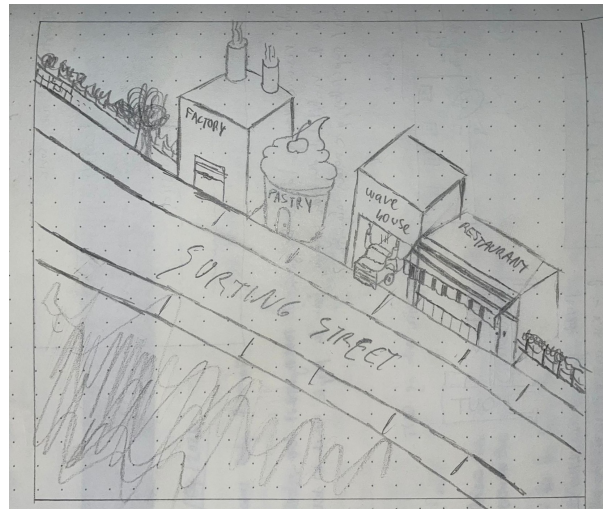
8.2 Locations

8.2.1 Sorting Street

Figure 12: Sorting Street

Connection to the plot

Main location, this is the street the player will have to restore, in this street, each building located in Sorting Street is a level.

8.2.2 Sortica Headquarters

This location acts like a main menu, here, the player can choose between going to Sorting Street, viewing old videos, replay specific levels, or going to the appearance store (TBD).
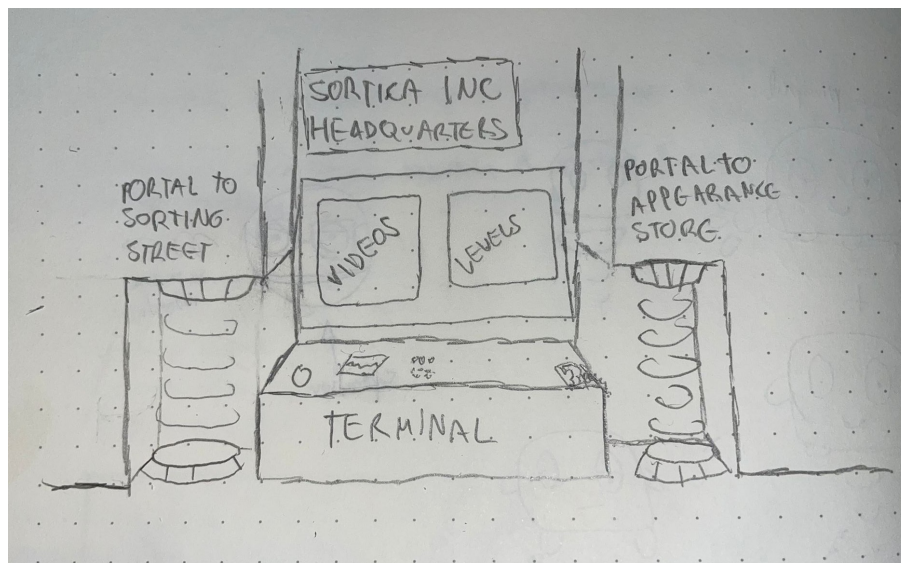

Figure 13: Sortica Headquarters

Connection to the plot

The headquarters of the restoration company.

8.3 Levels

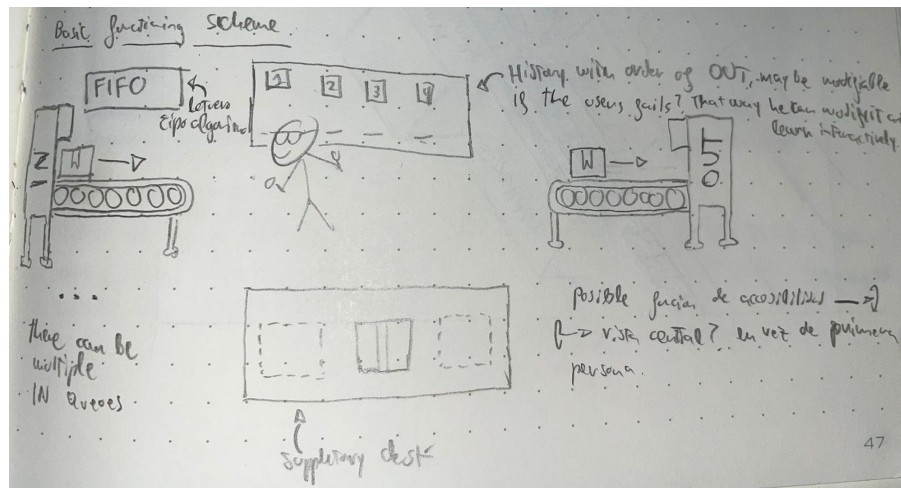The levels will follow the same structure, this facilitates design, reproducibility and escalation.

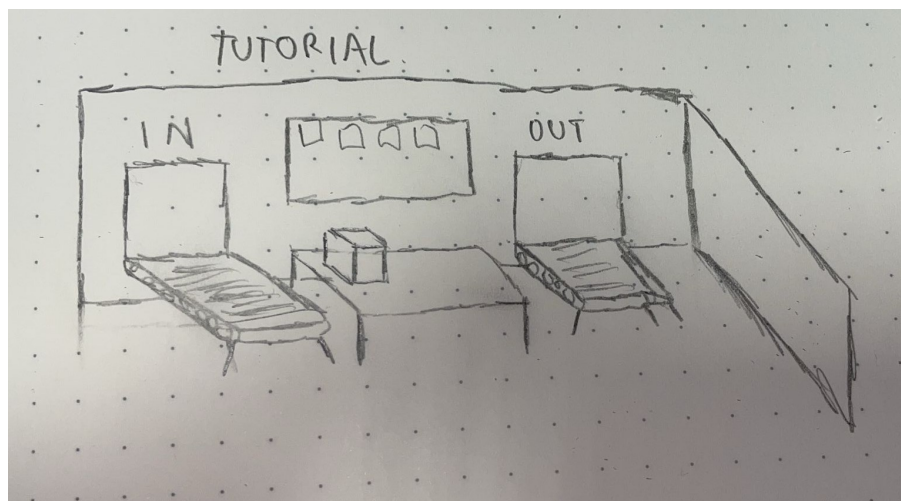Figure 14: Basic Level Design

8.3.1 Tutorial level

Figure 15: Level 0 - Tutorial

- Queuing Algorithm: FIFO

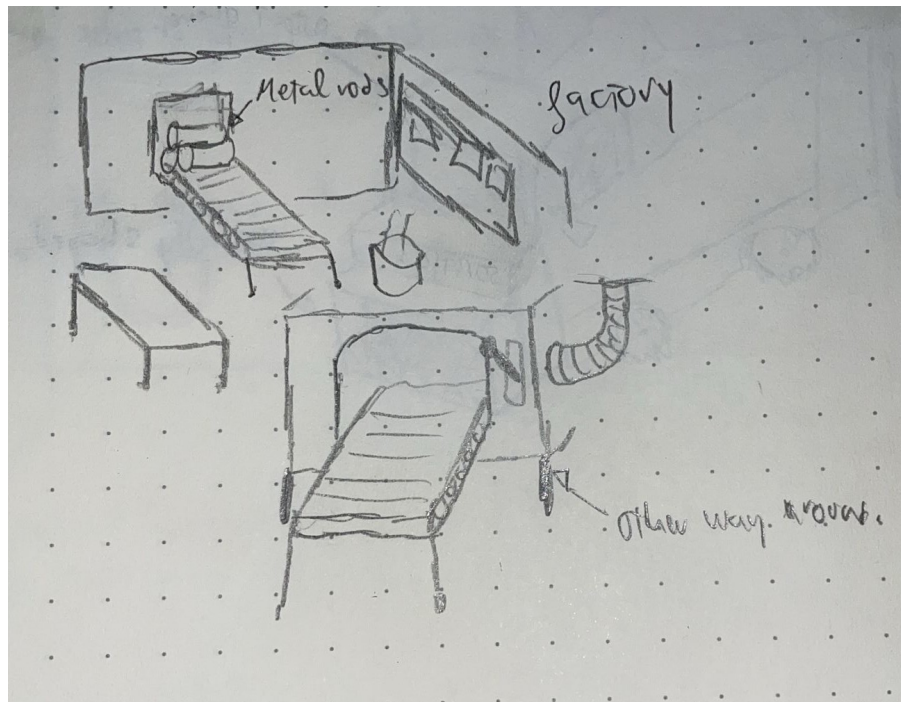- Input queues: 1

- Output queues: 1

8.3.2 Main levels

Factory

Figure 16: Level 1 - Factory

- Queuing Algorithm: LIFO (Explanation could be they want to retain newer customers with lower fabrication times)

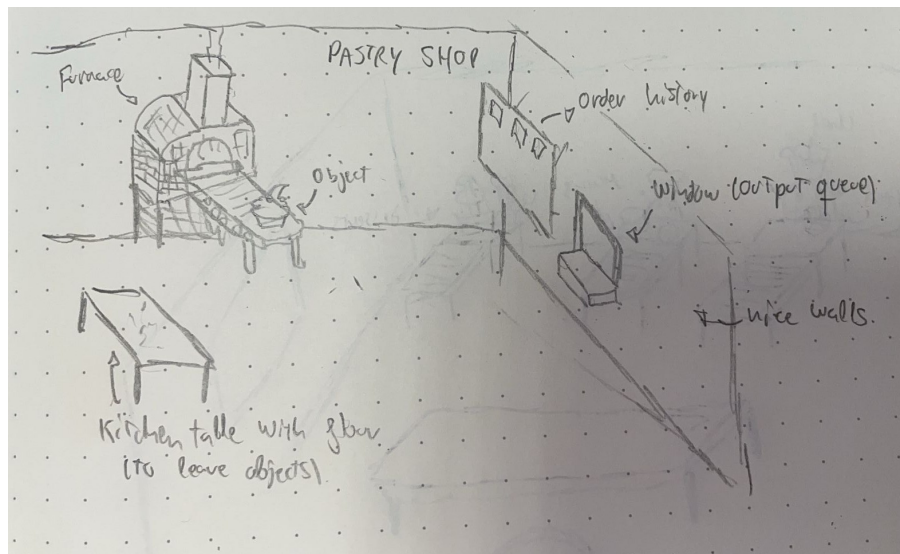- Input queues: 1

- Output queues: 1

Pastry shop

Figure 17: Level 2 - Pastry Shop

- Queuing Algorithm: FIFO

- Input queues: 1

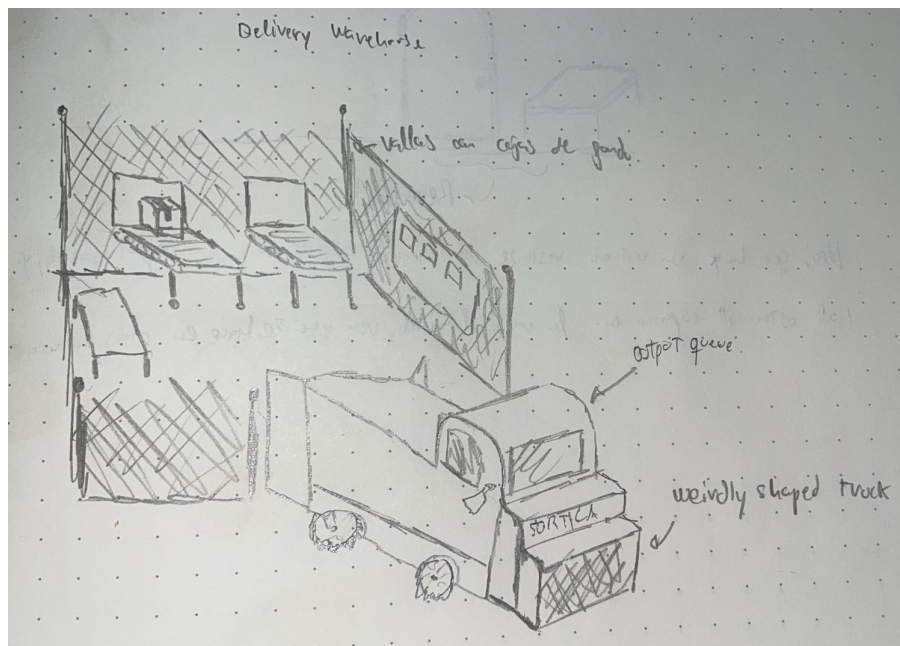- Output queues: 1

Delivery warehouse

Figure 18: Level 3 - Warehouse

- Queuing Algorithm: FIFO with multiple queues with different priorities.

- Input queues: 2 (Premium user and normal user)
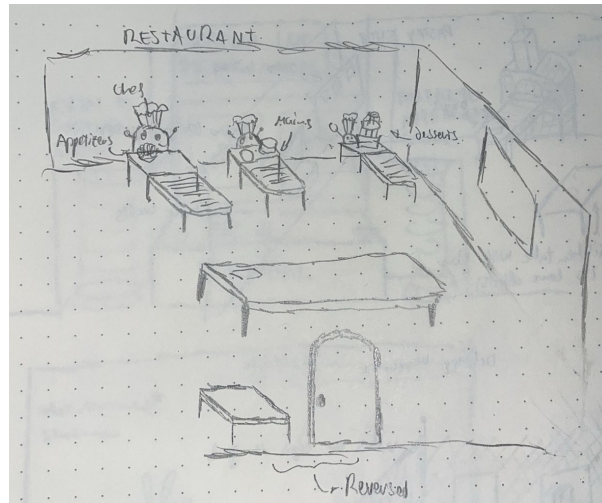
- Output queues: 1

Restaurant

Figure 19: Level 4 - Restaurant

- Queuing Algorithm: FIFO, weighted (time) priority algorithm

- Input queues: 3 (Appetizers, main courses, desserts)

- Output queues: 1 (The harder difficulty can have 2 output queues, one for take-out, and one for dine in)