Pitch & Planning Documentation

Supporting Document

ADVANCED PROTOTYPING : GDEV70003

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Project Title: **Advanced Prototyping – Formula and Flask**

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1. Project Description

Introduction

Formula and Flask is a first-person potion factory production game that focusses on procedural combination generation, fuzzy logic (Zadeh, 1965), as well as automation and efficiency driven gameplay. This project replaces the traditional finite resource-based crafting, seen in factory and shop owning games, with numeric combination experimentation that encourages players to test, learn, and create optimised and efficient systems rather than just recycling the same recipes.

Game Description

Formula and Flask is a first-person potion factory prototype where the quality of the output potions is determined through numeric ingredient combinations that are evaluated using fuzzy logic (Zadeh, 1965) and degrees of perfectness. Each potion consists of a predetermined set of ingredients with the ideal numerical value for each generated daily, and hidden from the user. Players attempt to work out the correct combination through trial and error with feedback given in the form of the potion output scores which are based on how close the current combinations are to the correct ones. These are saved to give each potion multiple degrees of perfectness, determining how good the potion is. In the game, players can purchase and place different factory stations including the cauldron, buy points, sell points, and conveyors to set up their ideal production layout. As players level up, they unlock new potions with different combinations and much greater sell points.

Key Features

- Procedural Potion Ingredient Combinations
- Fuzzy Logic and Degrees of Perfectness
- Factory Set Up and Automation
- XP, Levels, and Progression

Game Genre

The genre for this project is first-person factory management simulation.

Platform

The platform for this prototype is PC. Adding console controls could be done in the future.

Target Audience

This game is aimed at PC players aged around 18-35 who enjoy system-driven, laid back, experimental, and automation focussed gameplay. This game would require mid-range hardware typically seen in regions such as Europe and North America. It is designed as a short-form, easy to pick up experience that is centred around efficiency, logic, and optimisation rather than narrative or competitive gameplay.

Playthrough Video

https://youtu.be/wXoo731O6DI

Forum Link

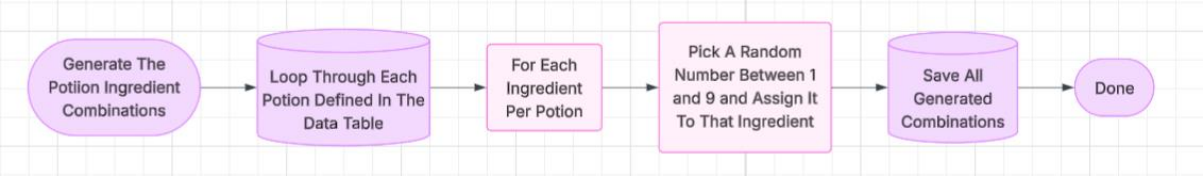
https://daf.staffs.ac.uk/topic/82793-slaski-jack-s013671m/#comment-1127690

2. Development Process

Sprint 1

The first sprint of this project was centred around testing the concept of the procedural combination system before turning it into a 3D game concept. Initially, I wanted to test if the core idea and system could work before taking it further. The initial idea for this project was to find a different and unique way to do a crafting/making system in a game that differs from the classic idea of getting ingredients/items that are consumed/used-up to make a product.

The main positive outcome of this sprint is the fact that I was able to determine that the combination system could be a viable and interesting system that could potentially work if translated to a full game concept. I was also able to do research into Fuzzy Logic (Zadeh, 1965) which became the main idea behind the reason for this working. Fuzzy Logic (Zadeh, 1965) stands as the base for this project, and I believe it was initially well implemented with this idea.



However, one main negative that appeared from this sprint was that I was lacking in ideas of how to correctly translate this into a game concept whilst keeping the focus on the core system, and making sure it is fun, as well as making it within scope.

Next time, I could have spent more time researching and planning out a game idea, rather than just a small system concept. Although the concept was good and worked well, translating the idea to a game was difficult and rather tedious. Furthermore, the concept was only UI based and it also had no game loop meaning that there were no reward systems or player satisfaction. Testing how the idea could impact player satisfaction should have been an early priority.

https://youtu.be/iTAKHgYp_Is

Sprint 2

For sprint 2, my main goal was to complete the basic game concept, disregarding polish and extra additions. I wanted to get the basic idea of having a cauldron that takes in ingredient combinations that can then be sold for profit.

In terms of what went well, I was able to achieve my goal of getting a working playable prototype done. With this, I was able to see that the fuzzy logic (Zadeh, 1965) worked well and made for a somewhat enjoyable experience. During this sprint I was also able to make a concept that I call “Degrees of Perfection", which ties in with the fuzzy logic (Zadeh, 1965). This is basically stating that potions can be produced no matter what and can always be sold for money, however, whilst they can all be sold, different versions of the same potion with different combinations are more perfect than others. I believe that I was able to implement this well and very efficiently.

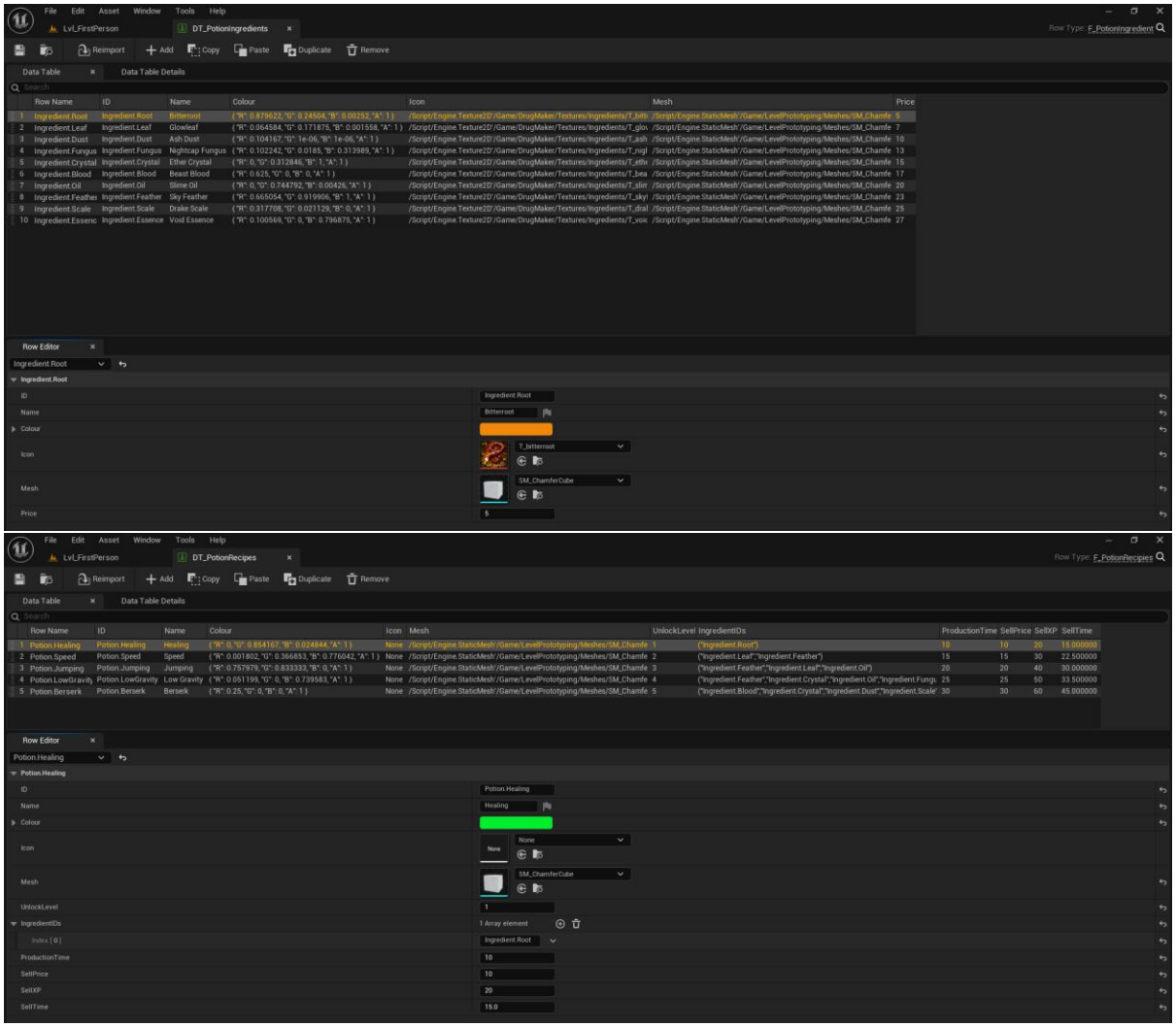
Ingredient Combination Score Calculation

Distance From Perfect	Rating	Score
Exact Match	Perfect	3
+/- 2	Very Close	2
+/- 4	Wrong But Not Far Off	1
>/= 5	Very Wrong	0

Potion Effectiveness Score Calculation

Rating	Effectiveness
0/3	0.4
1/3	0.6
2/3	0.8
3/3	1.0

Another positive of this sprint was the modularity and efficiency that I was able to implement some features with. The use of data table for the potions and ingredients meant that I was able to make it so that new potions and ingredients could be added extremely simply, with the rest of the data being auto generated for them.



However, one major downfall of this sprint came in the form of peer playtesting. After some playtesting done in week 3 it was clear that the game was not only under scoped, but also, not very enjoyable. Although the concept worked, and it worked well, there was not a strong enough game loop to keep players engaged and wanting to come back. With this in mind, I decided to change the genre of the game. Initially, the game was based off of simulation and crafting games such as Schedule 1, or maybe even Shoppe Keep. However, after assessing the mechanics contained in the project, I realised that the game may be better suited to being more similar to the tycoon or factory manager genre. Games such as Satisfactory could provide a much better formula to follow for this prototype.

In terms of future improvement, it was clear that the scope and genre of the game needed to be altered in order to be properly enjoyable. This once again links back to the poor planning at the start of the project that caused issues in creating the game and game direction. Once again, improved planning from the early stages would have improved the gameplay.

https://www.youtube.com/watch?v=n2jMJ3elQcU


Healing Potion
E78

Sprint 3

Sprint 3 was by far the biggest sprint. Because of the scope of this sprint, I created a new MoSCoW diagram to easily balance out and manage the goals and plans:
Must Have:

- Build Mode
- Factory Management Gameplay
- Conveyors and Appraisal Point

Should Have

- Potion Consuming
- Automation For Each Station

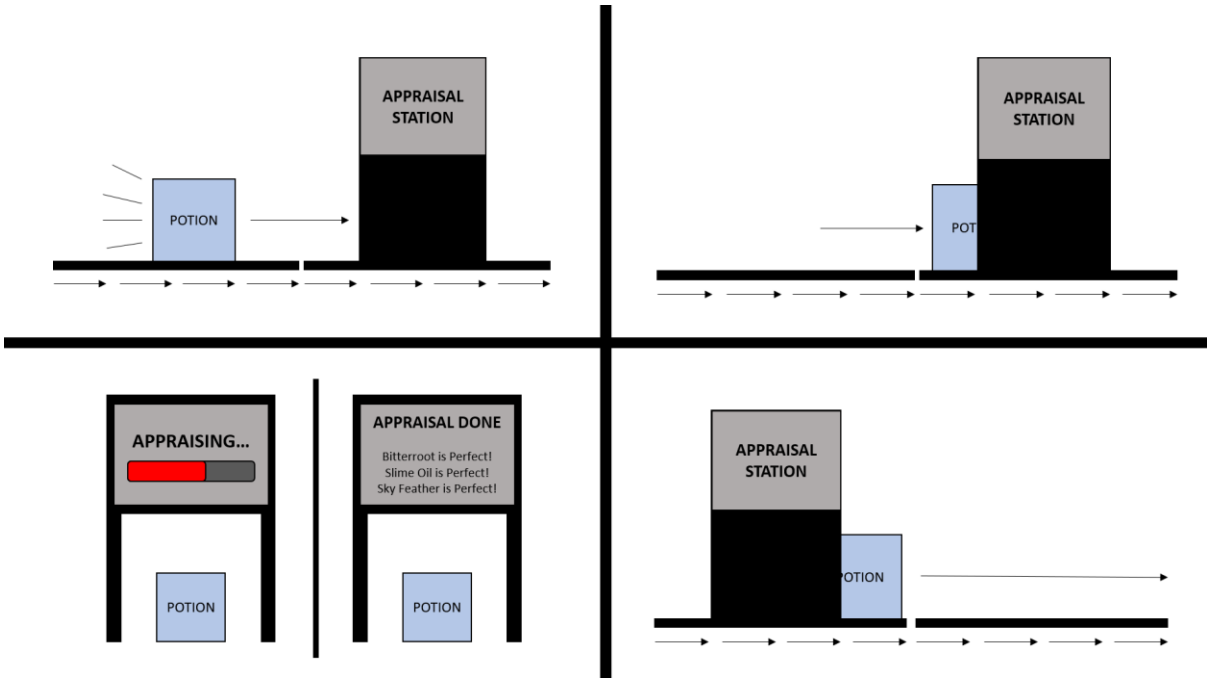
Could Have

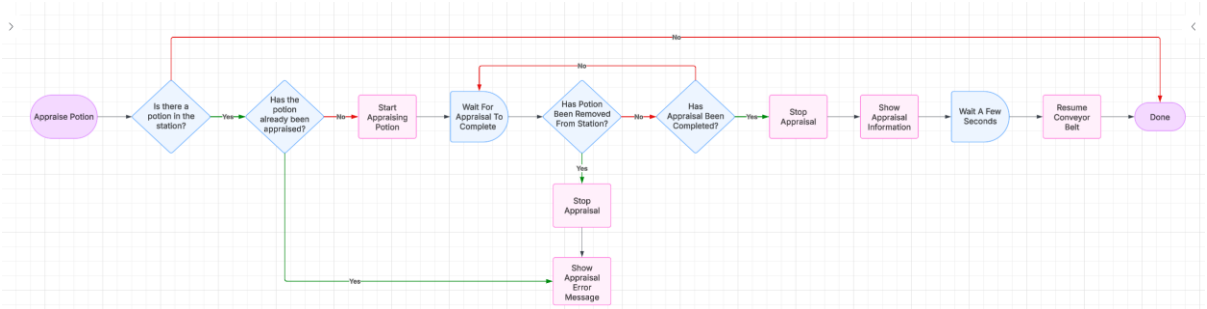
- Notification System
- Game Assets

Won't Have

- Different Types of Conveyors
- More Than 5 Levels of Potions

Once I had this MoSCoW, I was able to start planning out much of the project. This included diagrams, flowcharts, and data tables meaning that when it came to development, everything was laid out far better.





Degree of Perfectness	Sale Multiplier	Sale Example (10 Coins & 20 XP)
Not Appraised	0.2%	2 Coins and 4 XP
0/3	0.4%	4 Coins and 8 XP
1/3	0.6%	6 Coins and 12 XP
2/3	0.8%	8 Coins and 16 XP
3/3	1.0%	10 Coins and 20 XP

There are many areas of this sprint that could be deemed as a success. Firstly, I was able to complete everything on my MoSCoW diagram aside from adding game assets and obviously the things from the “Won’t Have” section. I believe this is because my planning for this sprint was far better than the other two. For this sprint, I really looked and what went wrong for the previous two sprints and made sure to improve my work flow to avoid similar problems. Another positive is the fact that I completed a lot of research for this sprint too. I researched *Satisfactory* as an inspiration for building and factory management, *Garry’s Mod* for notification inspiration, as well as many other relevant articles and theories to make sure my work was fully backed by research.
In terms of issues and failures, there really wasn’t much that went wrong during this sprint. The work was planned well, all of the main goals were achieved, and everything was grounded in research. However, one issue that did arise was during the playtesting. As the game concept and mechanics are fairly original/new, a lot of play testers struggled and became confused over the mechanics. To fix this, I made a tutorial document that guides players through the game's mechanics, and once this was made, the playtesting became a lot smoother. Although, if I had more time, I would ideally add a guided in game tutorial to make learning the game much easier.
With that being said, the improvements for this sprint could include slightly better time management in order to be able to complete a few more features. Such as adding a tutorial or adding assets to the game.

Playtesting & Feedback

For playtesting, I did an informal peer review of my game whereby I asked multiple of my peers to play the game and give me verbal feedback without the use of a survey or questionnaire. This was useful as it prompted discussion with my peers that delved into deeper aspects of the game that a survey would not have.

In terms of feedback received, there were multiple flaws and issues discovered. Firstly, there were both technical, and design flaws found regarding the “auto-” machine features. One design flaw was that to turn the “auto-” feature off, the player would have to wait until the production had finished and tick it quickly before it disappears again. To fix this, I made the “auto-” buttons permanently present on the UI. The technical issue that was found was that the “auto-” features would cause the progression of the machines to occasionally restart, I was able to fix this with a bool check pretty quickly. Another design limitation that was discovered, was that there was some confusion over the

ingredients for potions with players frequently becoming confused with the images and names. To do this, I added the name above each ingredient in cauldron as well as adding each ingredients icon to the appraisal results section to make it very clear what ingredient is needed and should be the focus. There were also a whole host of other bugs and issues that appeared during the playtests. For the most part, I was able to most of these issues, however there were a couple that I was not able to fix in time.

Overall, there was one thing that became very clear from the playtesting that needed to be addressed. It is very clear that in the future, this game could strongly benefit with an integrated tutorial. Some of the concepts of this game are too far from the norm that it can make picking up and understanding the game very difficult. Although I made an in-depth tutorial document for people to follow, the game can still be confusing. A detailed in game tutorial and walkthrough would be very helpful in the future.

Tutorial Document

Development Conclusion

I believe that the development process for this prototype was largely successful. I was able to complete each sprint with what I had planned for it, as well as creating a prototype that I feel is exciting and that helps to answer the questions that I had set out to answer. Although I did initially under scope, I would rather be in a position where I have to extend the scope of the project instead of one where I am having to remove planned features due to being over scoped. Furthermore, the end product is something that I am very happy with and it is also much better than I had initially imagined. I also feel that my development processes and methods are of high quality. I made the project as modular as possible using data tables that automatically generate content, helping to make the project very easily expandable. I made good use of interfaced and events, as well as ensuring that my code is as efficient as possible without taking shortcuts. Although prototyping is supposed to be rapid, I believe that it should be done in a way that allows future expansion and work on the project to be done as easily as possible whilst ensuring that the code is good enough to expand upon without having to redo it due to efficiency issues. My files are also well organised, with each blueprint also having clear comments, with colours for specific functionality, as well as having clear functions and components.

However, with that being said, there are definitely areas that could be improved and better planned for next time. Firstly, my initial planning of the project ideas and scope was not strong enough. I had ideas that I wanted to complete and questions I wanted to answer, but I feel they were prioritised over the actual game plan and game idea. In the future, all areas should be more carefully planned out. Additionally, I wish I was able to conduct playtesting that was more formal (with a survey or questionnaire) as well as more often. During the development, I never felt that my game was in a good state for proper playtesting, and with time constraints, I wanted to focus more on the development. If I was able to conduct more playtesting, I would have been able to gain better insights into how the game translates to new players earlier on.

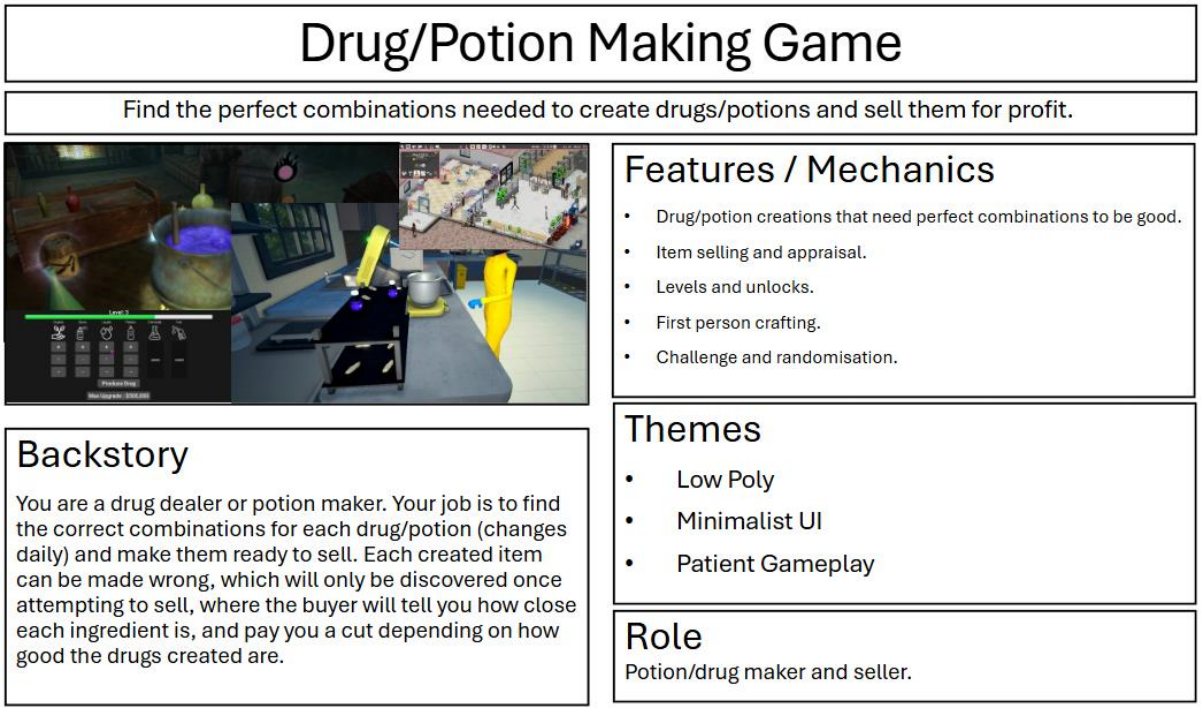
Overall, I feel that my development process has been mostly successful, with just some issues that can be taken as lessons to learn and improve for next time.

3. Evaluation of Work Produced

I am very satisfied with the work I produced in this project. I set out to create this project that is a bit different and deviates from the more normal game ideas in order to answer some questions and test out new ideas. I wanted to test if there was a different way to create product/potion making/production system in games that differs from the typical style of having an ingredient or item be put in a machine or crafting object that gets used up to have an output product. I also wanted to discover if I could find a new way that was not only different, but also fun and engaging. With the little time available for this project, I feel that I was able to create something that could genuinely answer those questions if given the opportunity to be tested more widely and extensively. Furthermore, the prototype that I created is also fairly original with ideas and inspirations used throughout, but with a core that I have not seen present in another game. I was also able to explore the concept of Fuzzy Logic (Zadeh, 1965) and Uncertainty in Games (Costikyan, 2013), which I feel helped to make something that is interesting at the very least.

Relevance to the brief

At first, the project was created following the initial brief. However, during the project after some playtesting, issues with the game emerged forcing a change in game genre in order to make something that is more engaging and exciting. Initially, the prototype was planned to be a drug and potion making game similar to something like *Schedule 1*, where the player can make varying drugs with different machines and ingredients and eventually sell or consume them. However, with the features that I had, playtesting discovered that this was not entirely enjoyable, requiring the genre change.



This genre change was the right decision and helped to create a much more enjoyable experience. Although this prototype did differ from the initial brief and idea, the game that it became still lies withing a similar area and is not actually too far away from the original idea. The new genre idea was more of a factory management game such as *Satisfactory*, however, this game does share similarities to *Schedule 1* such as needing good planning, efficiency, and product making. All in all,

although the project did change, the change was necessary, and the end product still has many similarities with the initial idea.

Furthermore, this project is also highly relevant to the module brief which prompts 'unique interaction and playful experiences' as this prototype contains a unique way of creating potions within a factory management game, whilst also encouraging playfulness and experimentation within the gameplay.

Creativity & Scope

The core mechanic of this prototype of having randomly generated potion combinations that use fuzzy logic (Zadeh, 1965) and degrees of perfection provides a 'unique interaction' for those who play. From play testing, the interaction was so unique that it required a tutorial document in order to guide players on how to play as that mechanic is very different from things they have experienced before. Furthermore, the ideas of creating different factory layouts as well as being able to consume the potions provokes a playful experience with lots of chances to experiment.

Contextualising your work within a wider theoretical practice

Within my project there are plenty examples of a relationship between theory and practice. Firstly, my core idea of degrees of perfection and potion combinations stems from the idea of fuzzy sets and logic by Lotfi A. Zadeh (1965), with a strong emphasis on the idea of Uncertainty in Games (Costikyan, 2013). Furthermore, the idea of consistently getting the combination wrong, and retrying until getting it right stems from the ideas of Juul (2013) and the 'art of failure', and how it can be a driving force for engagement and motivation, further linking with research done by Ryan & Deci (2000) on motivation and self-determination. This is further supported by the idea of having 'Hard Fun' by Nicole Lazzaro (2019) which states that the opportunity for challenge, mastery, and feelings of accomplishment all help to provide fun for the user. Finally, design research was also done outside of the main game loop for extra features that help to improve the fun, engagement, and understanding for the game and its features. For example, Don Norman (2013) helped to provide strong research for why notifications and providing more information to the user is crucial, whilst Fullerton (2024) gave reasoning for extra gameplay features outside of the basic game loop.

Game research was also completed during the project. Research on *Satisfactory* provided a good inspiration for how a factory management game should be done, whereas *Garry's Mod* gave a solid example of how extra information can be passed through to the player with its notification system.

More game design theories that could make the game successful could include ideas from Steve Swink and Keiran Hicks to improve the game feel of the prototype. Although the ideas and concept work well, the prototype is quite far away from being a full fun, and engaging game. Adding juiciness, game feel, and polish, would go a long way in helping the game stand out more.

Overall, design research was done often and consistently throughout this project and had a huge impact on why certain things were done in certain ways.

Further Work

In terms of future work on this project, there would be multiple areas that I would start with. Firstly, I would like to fix any remaining bugs that I was not able to fix before the deadline. Then, I would make it a priority to have an in-game tutorial and walkthrough as the game and its concepts can be

very confusing for new players to pick up. Finally, I would also like to add models and materials to the project to make it visually appealing.

Furthermore, because I have developed this project in an efficient and modular way, future expansion of this project is very easy. Adding more buildable objects, more potions, and more ingredients is all very simple

4. References

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