REPLAY AFTER DEATH

An Exploration on Replayability Design for a Rogue-like Top-Down Shooter

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Abstract

In this thesis I investigate how to develop interesting player upgrades for rogue-like video games. Rogue-likes as a genre of games are generally defined by the player replaying the same relatively short gameplay loop several times, making the concept of replayability of utmost importance to the genre. I investigated by looking at existing research into the subject of replayability, and by analyzing three popular rogue-like games, what makes rogue-like replayable. One way of generating replayability is by providing a variety of content, which can take different shapes, namely aesthetic (how it feels) and mechanical (how it plays). Krall and Menzies (2012) presented six aspects of replayability, namely replaying for social, challenge, experience, mastery, impact and or completion related reasons. These aspects roughly correlated to similar models, that were proposed in the context of what motivates people to play games overall. With this in mind I set out to investigate several questions regarding how player upgrades affected the gameplay experience, if they enhanced replayability, and what considerations players had when choosing between different upgrades. In order to find potential answers to these questions I developed a small rogue-like top-down shooter, with which I performed two qualitative experiments. Both experiments involved 4-5 participants, who played the game and answered interview questions afterward or talked about their experiences and thoughts while playing. The results showed that having a variety of player upgrades did indeed make the game more replayable, but it was mostly the mechanical variety, which allowed the players to explore different playstyles and tactics, that was mentioned as a motivating factor for replaying the game. When comparing two types of weapon upgrades, one which replaced the players' equipped weapon, and another which instead modified the players weapon, players had different preferences to which version they would rather play, but there were no indications that one of the two versions were strictly better than the other. When players were deciding what upgrades to pick, they performed internal value calculations which highly favored whichever upgrades they perceived would grant them the biggest advantage in the game. This was usually a comparison of the value they would get from the upgrade, and how often they expected to get that value, with upgrades that were

always active being slightly preferred to the upgrades that were only active under specific circumstances.

Contents

Abstract 1

1. Introduction 5

Video Games, Experience Design and Qualitative Research 5

Problem Formulation 6

2. Replayability 9

Variance In Rogue-Likes 13

A Closer Look: Hades 17

Summary of Replayability 20

3. Player motivation 20

Self-Determination Theory 20

Player Typologies 22

4. Development 26

Prototype Build 28

Basic Gameplay Loop 28

Feel and Polish 30

Prototype Playtest 31

Game-loop Build 32

Character selection 33

Game Loop 33

Weapons and Upgrades 38

Difficulty 40

Experiment 41

Sandbox Build 41

The Sandbox 41

Weapons 44
Upgrades 45
Summary of Development 49
5. Experiment Designs 49
Game-loop Experiment 50
Procedure 54
Sandbox Experiment 54
Procedure 55
6. Results 55
Game-loop Experiment 56
Participant A - Archeo Engineer Playthrough 56
Participant A - Weapons Expert playthrough 56
Participant B - Weapons Expert playthrough 58
Participant B - Archeo Engineer playthrough 58
Participant C - Weapons Expert playthrough 59
Participant C - Archeo Engineer playthrough 60
Participant D - Archeo Engineer playthrough 61
Participant D - Weapons Expert playthrough 62
Is one variant better than the other? 63
Sandbox Experiment Results 64
7. Analysis 67
8. Conclusion 73
References 75

1. Introduction

The core area of investigation in this thesis is how to develop interesting player upgrades for a rogue-like video game. This thesis describes the practical development of a small video game, which was used in two qualitative experiments on the subjects of player upgrades and replayability within rogue-like games. In this introduction I introduce the underlying motivations, the relevance of the subject in relation to experience design, and why I chose to work with a practical project instead of a theoretical one. This is followed by the specific problem questions I aim to investigate in this thesis. In the following chapters I investigate existing literature relevant to the thesis, namely the subjects of replayability and player motivation, followed by a description of how the game used for gathering data was developed, along with the two experiments performed and the analysis of the results from those experiments.

Video Games, Experience Design and Qualitative Research

Video games are popular pastime with an estimated 3.22 billion gamers worldwide (Grand View Research, 2023). Games require a large degree of active participation from the consumers, making them good subjects for Experience Design projects, as ultimately designing games means designing experiences. When a person buys a game, they do not buy it for the strings of code or the audio-visual assets it contains. The game itself is not the experience but simply what facilitates and enables experiences within its players (Schell, 2020, p. 11). This is a core idea of the field of Experience Design. What we are physically or digitally designing and developing is not in itself what is important. What is important are the individual experiences that games facilitate and these are not something which can be created directly (Schell, 2020, p. 11). This makes game design a very ephemeral subject, as the end product, a personal experience, is to a higher degree than other creative media much more dependent of the person experiencing the game due to the much greater degree of interactivity that games offer (Schell, 2020, p. 12). In game development the only clear way of measuring how successful you as a designer have been in facilitating those experiences is by learning how to listen to the people involved with your game, whether that is yourself, your team, or your audience (Schell, 2020, p. 5). This is very similar to performing qualitative research. Christensen, Johnson, & Turner (2015, p. 68) describe

qualitative research as interpreting a variety of qualitative data in an attempt to understand the data from the participants' subjective perspectives (p. 68). This is a useful approach in game development, as it gets into the players personal experience playing the game and can help you better understand how your current design affects the players' unique experiences, and whether it supports or works against the desired experience you as the designer wants to evoke. All this means that a qualitative research approach is very well suited for exploring problems within the subject of game development. Of course, a qualitative research approach does have its limitations. Unlike quantitative research designs, qualitative research designs are unsuited for hypothesis testing because the results are particularly difficult to generalize to a broad population (p. 70). But when designing a game, you are not trying to discover things that are universally true, or support/reject a hypothesis, you just need to discover how the current designs affect the player experience, and ideally get a good enough understanding of it to predict how any changes to the design might affect player experience. For these reasons, I am working with a quantitative research approach.

This thesis is structured as a practical project first and foremost. It builds on the principles of the Aalborg model of problem-based learning (PBL), which assumes that students learn best when applying theory and research-based knowledge in their work with an authentic problem (Aalborg Universitet, 2015). A large part of this means that what is learned is transferable in a wider context than that of the project itself, and especially in future professional contexts. I myself have an ambition to work with video game development. So, while I could make this a purely theoretical and analytical thesis, analyzing and performing tests using existing games, that does little to help me become a better game developer when compared to practicing actual game development myself. For this reason, I specifically develop a game and use that game as a basis for investigating my problem formulation.

Problem Formulation

The overall subject I want to investigate in this thesis, is the subject of player upgrades in rogue-like games. Rogue-like games are traditionally designed around replaying a single relatively short game loop (a *run)*, starting over from the beginning each time. To keep these games from becoming stale, they need to be designed with *replayability* in mind. One

popular method many games use to provide replayability is by allowing the player to choose between different randomly presented upgrades throughout the game (as described in chapter 2). I have previously worked on a game development project as a designer on a system for procedurally upgrading a gun in a rogue-like shooter. One purpose of this system was to increase the replayability of the game, by allowing the player to upgrade their starting gun into distinctly different weapons throughout each run, thereby generating variety in the play experience of each playthrough. During this process the primary problem that came up was the one mentioned in the beginning of the introduction, how do we develop interesting player upgrades? How much should an upgrade change for it to be interesting? Is it better to have both mechanical and aesthetic changes after receiving an upgrade, or is it simply enough for it to be mechanical in nature? Is it strictly better for an upgrade to majorly impact how the player plays the game, or is there also value in smaller incremental upgrades? These are all interesting and important questions that one as a game designer developing player upgrades will have to find their own answers to. There are a lot of potentially viable answers, as can be seen in the variety of different implementations of player upgrades in existing rogue-like games (as described further in chapter 2). So, first we need to dissect the problems of player upgrade development and simplify it into something that can be realistically investigated in this thesis. We have two overall subjects that need investigation, that being *player upgrades* and *replayability.*

First all we need an understanding of the concept of replayability, and what it specifically means for something to be replayable. Because we are specifically working in the context of rogue-like games, we might structure this part of the problem as the following question: *What is replayability and what makes a rogue-like game replayable?* To answer this question, I look into existing research that mentions replayability, and analyze how three existing rogue-like games are designed to support replayability. I then compare these findings to the results of my own experiments, in order to reach my conclusion.

This leads into the topic of player upgrades. Player upgrades in this context are things which increase the players' power in the game. This might take the form of picking up better weapons, upgrading existing weapons, getting new abilities, increasing base statistics such as health, speed, damage and so on. There are an endless number of ways to both structure

and design player upgrades in games. So, to better understand how to design player upgrades, we need to understand how they affect the player's experience playing the game, leading to the following question: *How do different types of upgrades affect the gameplay experience?* This question I will investigate primarily through a practical experiment, in which several participants are asked to play two different variants of the same game. This means that I am essentially only investigating two specific types of upgrades and how they affect the gameplay experience, but those upgrades represent common design patterns amongst a lot of existing games.

Looking at the concepts of player upgrades and replayability in relation to each other, we might ask if and how the two concepts influence and are influenced by each other: *Do player upgrades in rogue-likes enhance replayability, and if so in what ways?* To answer this question, I compare the results of my own practical experiment with the findings of my background research.

Finally, player upgrades are often implemented in ways where the players must choose between different upgrades. Getting a better understanding of what makes a player chose one upgrade over another could help in designing upgrades in a way that presents more interesting choices to the player, leading us to the question: *What considerations do players have when choosing between different upgrades?* This question I attempt to answer through a practical experiment, where several participants are asked to play in a small sandbox game, where they can repeatedly select different upgrades, and think aloud their decision-making process.

In summary, in this thesis I want to investigate how to design and develop interesting player upgrades for a rogue-like shooter. I attempt to do this by investigating possible answers to the following questions:

- **What is replayability and what makes a rogue-like game replayable?**
- **How do different types of upgrades affect the gameplay experience?**
- **Do player upgrades in rogue-likes enhance replayability?**
- **What considerations do players have when choosing between different upgrades?**

In the next chapter I seek to answer the question of what replayability is, at least in the context of this thesis (as there are several answers to that question). To do so I investigate existing research papers that have references to replayability in the text. As replaying a game can be seen as an extension of playing a game, it is also important to consider why people play games. Therefore, I also look into what motivates people to play games in general. Following that I take a closer look at popular examples of rogue-like games and try to contextualize some of my findings in the context of those existing games.

With an understanding of replayability and the motivations that might drive it, I set out to develop the experiments and the game I will use in those experiments. Developing a game is an intricate process with many steps and thousands of decision points. As such I will only be painting a picture using broad strokes as many of the technical details are beyond the scope of what is actually relevant in answering the questions posed in this thesis. This is naturally followed up by the results of the experiments themselves which I analyze and interpret in an attempt to answer the questions posed earlier.

2. Replayability

To investigate replayability, we need to understand what it is, and what aspects of a game can serve to increase it. In order to find preliminary answers to those questions I looked at the current research on the topic of replayability. In my research I searched for the term replayability by itself, as the term is, to my knowledge, exclusively used in the context of games. I narrowed down the search parameters by limiting the results to scientific articles, master's theses, and books. I narrowed it further down, by only including results that were tagged with one or more of the following terms: Computer and Video Games, Games, Video Games, Game, Computer Games, and Serious Games. I selected these terms, as they were the relevant terms which were present in the results, I got from searching for replayability. I looked at the abstracts of the first 100 results (out of 223). Every result after about the first 40 results consistently did not mention replayability and were concerned primarily with other aspects of games studies. As the list was sorted after relevancy, I determined that it was unlikely that there were any other relevant texts further down the list. I found 32 texts that mentioned replayability, were in a language I could read, and were about video games.

One paper collected player opinions on Replayability and provided methods with which to analyze the data (Krall & Menzies, 2012). In their paper they also define the terms Playability and Replayability as follows:

> "Playability is the property of any activity that indicates if the activity can yield enjoyability. That is, a binary measure of whether the game can be enjoyed or not. Replayability is a quantifiable measure to the enjoyability of a game. That is, a measure of how long a person can enjoy a game before it becomes boring." (Krall & Menzies, 2012, p. 461).

One of the key takeaways that they concluded from their research, was that in regard to Replayability in games, it is very difficult to make broad generalizations, as what is true for one genre of games, is unlikely to also be true for another genre, or even specific games within the same genre (p. 459). That notion is quite relevant to this thesis as it supports the idea that any results that come from within the context of the game are unlikely to be broadly applicable to other games in the same genre, and even less so for games in other genres.

Krall and Menzies (2012) divide the act of buying, playing, and quitting a game into Four stages (p. 461). *First Glance*, where the player first becomes aware of the game and decides to buy it. *First Play*, where the player plays the game for the first time. During this stage the playability of the game is of greatest importance (p. 461). In the third stage *Game Play* the question becomes how to keep the player in the game. Here playability is still important but replayability is even more so, as a player will eventually become so accustomed to the game that it loses its freshness and stops being exciting (p. 461). The goal of designing for replayability is to delay the final stage *Quit* for as long as possible (p. 461). In this final stage the player stops player the game. During the time of them not playing, the game might regain some of its freshness and regain replayability again further down the line (p. 461). Further they define six aspects of replayability (p. 461-462):

- *Social*: Playing for social reasons and to connect with other people.
- *Challenge:* Playing to overcome obstacles as this produces euphoria.

- *Experience:* To enjoy memorable experiences. Stated as the same reason people read books and watch movies.
- *Mastery:* Playing in order to master what the game has to offer. To learn and become better at something, potentially as part of some sort of competition.
- *Impact:* To have an impact on and control over the game world. Enjoying being able to affect the game world.
- *Completion:* To complete something for the accomplishment of having completed it. Also covers uncovering all aspects of a game, and seeing what happens next / how it ends.

These aspects are useful in and by themselves. They neatly categorize some of the commonalities between games, which can increase the degree of replayability. I will be referencing these throughout this thesis but will overall be omitting the social aspect in relation to this thesis. That is not because the social aspect is not important, but because it is generally something which would be more relevant in multiplayer games or games with a focus on narrative, neither of which are focuses of this thesis.

I also found several other papers with different definitions of what replayability is. One approached replayability as something which is added to a game after its release, as it gains updates, patches, and DLC (Hall, Stickler, Herodotou, & Iacovides, 2020). This is not in line with my understanding of what playability is in the context of this paper, as replayability in this sense is not something a game can innately have but is instead something which is added later to pull back people who have already stopped playing the game. Replayability has also been presented as whether it is possible to replay the game or not. “Researchers of single-player digital games and other unchanging, replayable game artifacts can archive and revisit games to produce more play experiences as needed.” (Montola, 2012). In this context a replayable game is one that does not change, and where a specific playthrough can be directly replicated multiple times. This is not the definition of a replayable game I am going to be using, as in this case the definition is more of a categorization of games, and not an aspect of games that can be evaluated and measured.

One thing which is often cited as increasing replayability is having a large variety of different game content. Some of these specifically investigate or work with procedurally generated content, such as procedurally generated levels, which is argued to increase replayability at a lower production cost than it would take to develop that content manually (Lazaridis, et al., 2022; Brewer, 2017; Petrovas, Bausys, Zavadskas, & Smarandache, 2022; Brown, Lutfullin, Oreshin, & Pyatkin, 2018; Smith, 2014). Procedural generation has its own pros and cons, but working with procedural generation is outside the scope of this project. Similarly, to the procedural generation of content, there are also several projects which seek to develop systems which procedurally present or modify content during gameplay, in which replayability is often a main concern of the system (Utsch, Pappa, Chaimowicz, & Prates, 2020; Porteous, Ferreira, Lindsay, & Cavazza, 2021; Soule, Heck, Haynes, Wood, & Robison, 2017; Estupiñán, Andkjaer, & Szilas, 2018; Utsch, Pappa, Chaimowicz, & Prates, 2020). The common argument for procedural systems increasing replayability is usually that variety and uniqueness improves replayability. In the context of variance replayability has also been named as a goal in the design of novel types of AI for games (Lent, Reidl, Carpenter, McAlinden, & Brobst, 2021), in which having AIs with more varied behavior types is argued to increase the replayability of the game, again through variation of gameplay experiences. Replayability has also been named as a key design challenge in developing learning games that can adapt the difficulty level to the player (Benton, et al., 2020). This paper also designates variance as one of the primary factors of replayability (p. 1873). Likewise, another similar project named encouraging replayability as important in educational serious games (Almeida & Machado, 2021).

Within the context of narratives in video games there are also examples of studies concerning replayability (Gamito & Martinhi, 2021; Imbierowicz, 2021). Imbierowicz (2021) specifically looks at the distinction between the tellability of a story and the replayability of a game. While this is relevant for the overall game design, especially for rogue-lite games that include a narrative aspect, this project does not touch on those narrative aspects of the game meaning that the tellability and replayability of the narrative is outside the scope of this project. Further in the context of narratives replayability has been named as a key factor in allowing players to be creative in games (Hall, Stickler, Herodotou, & Iacovides,

2020). This was specifically in the context of non-linear games which allowed the player to make choices that affected the narrative, as well as having different content to explore (p. 18). Again, the narrative aspects of replayability are not of particular importance to this project.

To summarize, a commonality amongst many of the sources involving replayability focuses on different ways of generating variance, or ways of easily producing additional content at run time (through procedural methods). Out of the six aspects of replayability proposed by Krall & Menzies (2012) most of them are supported by having a high degree of variance in the game.

- *Challenge:* More challenges of varying difficulty.
- *Experience:* Providing a variety of unique experiences.
- *Mastery:* Having a variety of playstyles and gameplay to master.
- *Impact:* Providing the player with a variety of meaningful actions that the game reacts to.
- *Completion:* Havin a large amount of content to complete, goals to reach, and things to discover.

With that in mind, we can take a look at some popular existing rogue-likes and analyze in what ways they provide replayability, in order to identify if variance is a meaningful contributor.

Variance In Rogue-Likes

I am using three different rogue-like games as examples of how existing rogue-likes have been designed for replayability. I have chosen these three games specifically because of their overall popularity, and how they each implement different upgrades and weapon choices in distinctly different ways, while operating within the same genre and overall gameplay loop. The games are Hades, Risk of Rain 2, and Dead Cells. As for their popularity each of the three games having above a 95% positive review scores, which puts them in them all in the top 10 of highest rated Rogue-likes on steam (SteamDB, 2023), making them good examples of successful games within the genre as a whole.

- **Hades**: A top-down isometric dungeon crawler.
- **Risk of Rain 2**: A third person shooter.
- **Dead Cells**: A 2D roguelike-Metroidvania action-platformer.

In each game an average run takes anywhere between 20 and 60 minutes to complete, provided you don't die early that is. Common for all three games is that in any single run you will not be experiencing everything the game has to offer. On repeated playthroughs a part of the content will be things you have experienced before, but other parts of the content will be new or at the very least experienced in a new context. Each of the games utilize different methods of creating replayability, that might be categorized as follows:

1. Randomizing levels and or content in levels between each run, by either having a large pool premade content to pull from, or by procedurally generating entirely new content throughout a run.

- Hades has a pool of pre-made rooms that contain randomized enemies and rewards. There is also a narrative which evolves both during and between runs.
- Risk of Rain 2 has large fixed levels that are randomly selected for each run. Each level is then randomly populated with enemies, loot and other interactable objects.
- Dead Cells have procedurally generated levels, that contain some pre-made areas in between the generated parts. New areas will be gradually unlocked as the player progresses through the game.

This plays to the experience aspect of replayability, by changing the overall experience and aesthetics throughout a run.

2. Letting the player choose between a variety of loadouts and or characters before each run. This includes giving the player a choice between different abilities, weapons, distinctly different characters, and or game modifiers.

- Hades lets the player select a variety of starting equipment, passive powers, and difficulty modifiers before each run.

- Risk of Rain 2 lets the player choose between a variety of unique characters, some alternate abilities for those characters, and a series of unlockable game modifiers.
- Dead Cells lets the player choose one of several different game modifiers, and their starting equipment from a set of randomly presented options.

This plays to the impact and mastery aspects of replayability, as the player makes decisions before starting a run that meaningfully affects the rest of that run, and by allowing the player different options for playstyles and strategies to learn and improve at.

3. Giving the player choices of new upgrades, tools, weapons, and abilities during a run, either entirely at random or by letting the player choose between a set of randomly selected options:

- Hades presents the player with choices of upgrades that enhance, give them new, or modify their existing capabilities and abilities. These upgrades are divided into several distinct categories, and the player has both a choice of which categories and which specific upgrades they want (from a random selection).
- Risk of Rain 2 gives the player a large number of stackable items which affect their capabilities in a wide variety of ways. Most of the time these are entirely random, but sometimes the game allows the player to choose between a selection of upgrades.
- Dead Cells lets the player pick up new unique weapons and skills that can be exchanged for other ones later, and a limited number of passive abilities that are unlocked at specific points throughout each run.

This potentially supports all the aspects of replayability (excluding social aspect). Several upgrades are so unique in their function that using them might be a unique experience in itself. Learning and mastering the game to such a degree that you know which upgrades to pick in the right situations supports both the challenge and mastery aspects. The completion aspect is supported by there be a large variety of different options to discover, and the aspect of impact is supported by the upgrades themselves meaningfully affecting the players effectiveness in different contexts.

This is not by any means a comprehensive list of what these games do to provide replayability, but it does support the idea that variety helps generate replayability. In order to contextualize this idea of variance we can try taking a look at established frameworks for understanding games. One of these frameworks is the Mechanics, Dynamics, and Aesthetics (MDA) framework proposed by Hunicke, LeBlanc, and Zubek (2004).

- *Mechanics*: describes the particular components of the game, at the level of data representation and algorithms (p. 2). For example, the mechanics of a gun in a game describe the time between shots, the damage of the projectiles, and how the gun can be fired, but also the visuals and audio of the weapon itself.
- *Dynamics*: describes the run-time behavior of the mechanics acting on player inputs and each other's outputs over time (p. 2). For example, using different tactics when fighting different enemies with different weapons.
- *Aesthetics*: describes the desirable emotional responses evoked in the player when they interact with the game system (p. 2). That is, what the player experiences when playing the game.

This is a fine framework for contextualizing the relationship between what the developer creates (mechanics), what gameplay that leads to (dynamics), and the specific experience that is evoked (aesthetics). But all the elements that makes up the design of, for example, a weapon is found within the mechanics group, that being the weapons stats, functions, visuals, and sounds. Essentially, we have two ways of creating variations of weapons, that being by changing the weapons stats and by changing its aesthetics (looks, sounds, feel). In this framework both of those types of changes are described by the same concept. Another framework for understanding the different elements that make up games is that presented by Jesse Schell (2020). In this framework every game is built from four basic elements, these being:

- *Mechanics*: The procedures and rules of the game. These describe the goals of the game and how the player can try to achieve those goals and what happens when they try (p. 53).

- *Story*: The sequence of events that unfold in the game, whether linear, pre-scripted, branching, or emergent through gameplay (p. 54).
- *Aesthetics*: How the game looks, sounds, smells, tastes, and feels. Everything in the game that the player experiences is through its aesthetics (p. 54). This is overall the element that is most visible to the player.
- *Technology*: Technology is what makes the game possible. It allows the game to do some things and prohibits it from doing other things (p. 54). This is overall the element that is least visible to the player.

All these four elements are presented as equally important and tightly interwoven in regard to how the game is designed. This framework is a lot more fitting for contextualizing weapon design in the context of this paper, as we can use it to clearly differentiate between mechanical design variation and aesthetic design variation. So, when looking at variance in weapon design, we can have variance in aesthetics that being how it feels to use the weapon, and variance in mechanics, that being how the weapon functions in the game. So, when referencing the mechanics or aesthetics of the game, these are the definitions of those words that I am using.

A Closer Look: Hades

The rogue-like top-down action game Hades is a good example of a game which utilizes a few unique weapons that can be upgraded and modified in a wide variety of ways to facilitate an experience which is highly replayable. Hades provides several different loadout options before starting a run, that are all unlocked through playing the game. Arguably the most impactful option is the choice of weapon which determines the effects of your normal, special, and dash attacks, these being your most used actions during combat.

Figure 1: The six weapons of Hades

There are six weapons that are unlocked one by one, and once all weapons have been unlocked the player will then further be able to unlock hidden aspects of each weapon, that are variants on the mechanics and aesthetics of each weapon. This plays on several of Krall and Menzies (2012) aspects of replayability. First of all, discovering and unlocking each of the weapons plays to the aspect of completion. Learning to use and master a specific weapon plays to the aspect of mastery. Choosing which weapon to use in a given run plays to the aspect of impact, as lastly attempting to overcome increasing challenges with each weapon, as the player takes on more difficult runs plays to the aspect of challenge.

The attacks on each weapon can be measured on several mechanical variables, such as damage, attack speed, range, area of effect, how it affects movement, if it has knockback, if it can be charged up, if it has a combo move and several more. These mechanical differences combined with the aesthetic differences make the attacks of each weapon feel and play distinctly differently from each other.

During a run each weapon can also receive up to three different weapon upgrades, that specifically modify the function of that weapon, or increases its basic effectiveness in certain circumstances. Likewise, both the basic, special, and dash attacks can receive bonusses from boons (only one can be applied to each type of attack at a time), which grants additional functionality such as applying damage over time, debuffs, or a chance of dealing additional damage.

All of these factors combined serve to give the game a lot of replayability, through the players choice of weapon, as even on repeated runs with the same weapon the different upgrades can give the player a different experience from the last. Each of these upgrades serves to provide the player with what is essentially a variant of that weapon. The weapon increases in effectiveness through added or modified features but is identifiably still the same weapon. This is in large part due to most of these upgrades only being mechanical in nature, with a few exceptions that modify the style of the particle's effects on the different attacks.

Figure 2: Weapon variations (aspects) for one of the six weapons in Hades.

Lastly, each of the weapons also have different aspects which can be unlocked through gameplay. These aspects provide either a basic stat boost, such as the top aspect on Figure 3, modifies one of the weapons attacks such as the two middle aspects on Figure 3, or gives the weapon an entirely different move set, such as the bottom aspect on Figure 3.

Now theoretically the actual number of variations on any given run in Hades is a huge number, even when we look only at the players' choice of weapon, and how it can be upgraded. But obviously, not every single one of these variations is going to be different enough from every other variation to be entirely unique. For example, the first aspect in figure 3 simply increases the players attack and movement speed by 15%. Which might be effective, but it's hardly something that changes the player's strategies for using the weapon.

But any given experience does not need to be entirely unique within the overall context of the game, it simply needs to be different enough from the latest runs that the player still has in their memory, as Krall and Menzies (2012, p. 461) stated, replayability can be regained over time. Hades works with this by incentivizing the player to use different weapons, by giving the player a boost to the number of resources they gain during a run, if they use a specific weapon that they haven't used in a while.

Summary of Replayability

Replayability is a measure of how long a game can be played before it becomes boring (Krall & Menzies, 2012). A games replayability can stem from what is described as aspects of replayability and can be enhanced by having a wide variety of content in your game. But of course, regardless of how much variance there is in a game, the player will be unlikely to replay a game if they are not motivated to do so. So next we take a look at another concept that is innately linked to the concept of playability, which is the studies of motivation and specifically player motivation. In the next chapter I look at an existing motivational theory along with specific player motivation theories.

3. Player motivation

Another concept that is innately linked to the concept of playability and replayability is that of motivation, as without any sort of motivation, a person will be unlikely to engage with a game whether to play or replay it. Regarding motivations there are two angles I want to cover. The first one is motivation as a general part of the human experience, and the second is motivation for playing games and engaging with specific types of content in those games.

Self-Determination Theory

Games largely offer much less linear experiences than other media, and the player has a much greater control over how they themselves play and experience the game. This makes games uniquely good at providing the player with feelings of having freedom to make their own choices and learning and mastering something new. Both of which are important psychological needs (Ryan & Deci, 2000).

For the first angle we have self-determination theory (SDT) as proposed by Ryan & Deci (2000). SDT proposes that people have three innate psychological needs, those being the needs for competence, autonomy, and relatedness. When these needs are met it leads to increased self-motivation and mental health, and when thwarted it leads to diminished motivation and well-being (p. 68). Related to these needs are the concepts of intrinsic and extrinsic motivation. Intrinsic motivation is the inherent tendency for people to seek out novelty and challenges, to extend and exercise one's capacities, to explore and to learn (p. 70). In contrast to this is extrinsic motivation which refers to the performance of an activity in order to attain some separable outcome and not for the inherent satisfaction of the activity itself (p. 71). Ryan & Deci proposes that extrinsic motivation can vary greatly in its relative autonomy, meaning how internalized that motivational force is to the person (p. 71).

> For example, students who do their homework because they personally grasp its value for their chosen career are extrinsically motivated, as are those who do the work only because they are adhering to their parents' control. Both examples involve instrumentalities rather than enjoyment of the work itself, yet the former case of extrinsic motivation entails personal endorsement and a feeling of choice, whereas the latter involves compliance with an external regulation (Ryan & Deci, 2000, p. 71).

This is important to keep in mind when designing experiments that involve playing games. Often, but not always, a person playing games for fun will be doing so because they are intrinsically motivated. So, if in an experiment we measure the results of people playing a game, when they are not intrinsically motivated to play, we risk getting misleading results as the experiment does not properly reflect reality.

A lot of games fulfill these needs in a variety of different ways. The need for competence is often fulfilled by providing a variety of challenges for the player to overcome and different things to learn and master. The need for autonomy is often fulfilled by letting the player make decisions and showing them the results thereof. The need for relatedness differs a lot depending on whether the game is single or multiplayer. In multiplayer interactions the need can be fulfilled through interactions with other players, whereas in single player games

it can be through interactions with non-player characters, or similar narrative aspects. Of course, this is by no means a comprehensive list.

If we relate these needs back to the six aspects of replayability, as defined by Krall & Menzies (2012), we see some clear similarities. The social aspect very clearly correlates with the need for relatedness. The challenge and mastery aspects correlate with the need for competence. The impact aspect correlates with the need for autonomy. This leaves the experience and completion aspects. While they do not directly correlate to one of the needs, they are related to the description of intrinsic motivation, specifically the notes on seeking out novelty, exploring and learning, which are concepts that also show up in the next second angle of motivation that I want to cover, that being motivation specifically in relation to playing games.

Player Typologies

Motivations for playing games have been explored through the idea of player-typologies. These typologies investigate the reasons for why people play games and why people interact with specific parts of games. Following this they attempt to develop player types or traits that in broad terms describe players' interests and motivations within the context of games (Tondello, Arrambide, Ribeiro, Cen, & Nacke, 2019; Tondello, et al., 2018; Birk, Toker, Mandryk, & Conati, 2015; Nacke, Bateman, & Mandryk, 2015; Vahlo, Kaakinen, Holm, & Koponen, 2017; Vahlo & Hamari, 2019; Bartle, 1996; Bartle, 2005; Yee, 2006; Yee, Ducheneaut, & Nelson, 2012). Now, the idea of player types is flawed in many ways, as humans can seldom be categorized and grouped together as easily as player typologies would suggest (Hamari & Tuunanen, 2014, pp. 44-45). But the underlying motivational factors that have been discovered and suggested as being a defining factor for specific player types tell us something more broadly about why people play games. As such this underlying data is useful in the context of this investigation. These studies do not differentiate between playing a game (playability) and replaying a game (replayability), so any results could potentially be descriptive of both states of play.

Hamari & Tuunanen (2014) performed a meta-synthesis on the available player typologies that existed at the time. They found six common concepts amongst the review papers (p. 44), these being types and motivations based on:

- Gaming intensity and skill
- Achievement
- Exploration
- Sociability
- Domination
- Immersion

Of course, these concepts are based on a synthesis of information, and not all the data used to form these concepts would necessarily be directly comparable with the respect of their scope (p. 44). When we look at the concepts in relation to the previous aspects of replayability we also see clear connections but not necessarily direct one-to-one correlations.

Concepts	Aspects of replayability
Gaming intensity and skill	Challenge / mastery aspects
Achievement	Completion / mastery aspects
Exploration	Experience / completion aspects
Sociability	Social aspect
Domination	Mastery / social aspects
Immersion	Impact / Experience aspects

Table 1: Aspects of replayability compared to player type concepts.

Another player typology was developed in 2019, this one being based around identifying and measuring specific traits instead of player types. (Tondello, Arrambide, Ribeiro, Cen, & Nacke, 2019). In their work they identified five unique orientations, along with a set of questions to measure those orientations in a given individual. The five orientations are as follows (p. 390):

- **Aesthetic orientation**: Enjoyment of aesthetic experiences, such as exploration, and appreciating the audiovisuals of the game.

- **Narrative orientation**: Enjoyment of narrative elements and story within games.
- **Goal orientation**: Enjoyment of completing goals, exploring all the options, and finding all the things.
- **Social orientation**: Enjoyment of playing with other people in multiplayer games.
- **Challenge orientation**: Enjoyment of challenging and difficult games.

Again, we see clear similarities between these proposed orientations, and the proposed aspects of replayability, although just as before without a clear one-to-one correlation.

Orientation	Aspects of replayability
Aesthetic	Experience aspect
Narrative	Impact aspect
Goal	Completion aspect
Social orientation	Social aspect
Challenge orientation	Challenge / mastery aspects

Table 2: Player orientations compared to aspects of replayability.

Another typology which is relevant to look at is the Quantic Foundry Gamer Motivation Model (Yee & Ducheneaut, 2023). This model was developed on existing research and presents 12 distinct motivational factors for why people play games (Yee, 2015). These motivations are grouped into six categories, as seen on Figure 3, which are in many ways similar to the aspects of replayability.

Figure 3: Gamer Motivational Model (Yee & Ducheneaut, 2023)

Factors	Aspects of replayability
Action (destruction)	Impact / Challenge
Social	Social / Mastery
Mastery	Mastery / Challenge
Achievement	Completion Impact?
Immersion	Experience / Impact
Creativity	?

Table 3: Motivational factors compared to aspects of replayability.

The purpose of this comparison is not to show a perfect correlation between these models, because it quickly becomes clear through a cursory glance that while the underlying concepts for why people play games are repeated, there are several different ways of grouping them together. Overall, comparing the different results of these player typologies with the proposed aspects of replayability it seems that there is a lot of similarity between the underlying motivations for both playing and replaying a game. It seems that it would be somewhat safe to say that Krall & Menzies (2012) aspects of replayability are at least in some ways supported by existing research on player motivations. As such going forward, I will primarily be using their aspects of replayability in the development and analysis parts of this paper when it comes to player motivations.

At this point we can propose an initial answer to question first question posed in the problem statement, that being the question of *what is replayability and what makes a rogue-like game replayable?* For the first part of that question, there are of course several different ways of defining the term replayability, in this paper I have chosen to use Krall & Menzies (2012) definition of the term, who defines it as a measure of the enjoyability of a game, and in extension thereof, a measure of how long a person can enjoy a game before it becomes boring (Krall & Menzies, 2012, p. 461).

So, what shared design aspects of rogue-like games serve to increase their replayability as a genre? One answer to this can be boiled down to having a wide variety of content, that support different aspects of replayability. Examples include but are not limited to:

- Having a variety of different challenges to overcome, difficulties to win the game at, and making the game overall difficult to win (providing interesting challenges).
- Supporting and allowing the player to choose between and develop a wide range of different playstyles (giving the player the chance to learn and master the game).
- Giving the player a lot of choices during each run, that the player can actually see and feel the effect/result of (letting the player make their own choices and see the results thereof).
- Having a large amount of content to complete, goals to reach, and things to discover (having a lot of content that must be experienced over multiple playthroughs).

With a foundational understanding of the concept of replayability, and how to potentially design for replayability in rogue-like games, the next chapter concerns the development of the game used to perform the experiments in this thesis. In the next chapter I will describe the development of three versions of the game, a prototype and two builds that were used for experiments as a part of this thesis.

4. Development

In order to answer the remaining questions posed in the problem statement I needed data from practical experiments. As my interest lies not only in analyzing games but also in designing and developing them, I developed a small game with which to perform the practical experiments. Game development is a complex procedure with very different approaches to the process itself. Because of the significant differences between games, the tools used to develop them, and the developers themselves, there is no single method that is applicable for game development as a whole. Overall, I have followed an iterative design method, in which I developed a game build, tested it internally, edited it based on those tests, and when either out of time or satisfied with the build, had it tested by outside participants. Then the process started over from the beginning, with making changes based on the feedback and data from the external test, thereby forming an iterative development loop.

The majority of design decisions, testing and iterations based on those tests were by necessity be based on my intuition and introspection of my own experiences while testing

the designed I had developed. Being a solo-developer on a project like this meant that the only person who was always available to test the things was myself. Introspection and intuition are both imperfect methods both in the field of science but also in design. But throughout the development of the game there were hundreds of small decisions to make, and reaching out to people outside the project in order to test every single version and possible variant of something was not possible. Game development is very messy and chaotic, and with a very limited time frame to work in, means that not every or even most design decisions can be directly supported by existing scientific evidence. Likewise attempting to describe and show every single design in the game and the decisions that led to that design would be a futile quest without end.

Instead of describing everything and all the reasoning behind it, I instead describe the overall designs contained in the builds which I had other people test, and comment on some of the major decisions that led to those designs. The purpose of this is primarily to contextualize the results of the experiments, by showing the type of game in which the results were obtained from. This chapter describes the development of three builds in chronological order, these being:

- The **prototype build** was developed as a proof of concept and tested to see if the basic gameplay loop was playable.
- The **game-loop build** was used in the first experiment, to investigate how different types of upgrades affect the gameplay experience, and if the presence of player upgrades enhanced the games replayability.
- The **sandbox build** was used in the second experiment to test what considerations players have when choosing between different upgrades.

Each build is an iteration on the last one, and as such there are many similarities between them, but as is true with any iterative design process there are also plenty of differences between the builds. Instead of describing every build as an independent thing, I instead focus on describing simply what is new or different in the newer iterations.

The game concept was very simple enough. It would be a top-down shooter set in a non-descript science fiction setting. I chose to develop a top-down shooter specifically because I

had some very good tools already, which allowed me to reach a point in the development which would normally have taken me a year in just a few months. Any other type of game would simply have been unfeasible to develop in time for it to be used for testing in this thesis. The sci-fi setting simply fits very well with top-down shooting mechanics and allows for a lot of creative freedom when developing mechanics for the game. Likewise, I also had previously acquired several asset packs, containing things such as audio files, 3D models, animations and visual effects that were fitting for a sci-fi setting. Again, without these asset packs, developing even the basic prototype build by myself, would have taken for too long for it to be completed and ready for experimenting with in this thesis.

Prototype Build

My development goal for the prototype build was to create a simple level with fixed content that does not change on repeated playthroughs, as a proof of concept. If the base game isn't playable then its not going to be replayable either. When designing the basic gameplay loop, I took inspiration from the game loop in Hades, in which you enter a room, defeat waves of enemies, get a reward, and then repeat in the next room. In this prototype build I did not implement any type of rewards. If the basic gameplay of fighting enemies was for some reason not working or unfun, then giving the player rewards would likely not meaningfully change that fact, and the rewards themselves would likely require as much effort to develop as the basic gameplay loop itself. As such, testing the core of the game before developing more specific systems was an important step in my iterative design process.

Basic Gameplay Loop

1. Enter a room.
2. Defeat waves of enemies until a portal opens.
3. Enter the portal and repeat from 1 in a new room until you finish the game.

As a part of this game loop the player had the following capabilities:

- **Move** around at a fixed speed.
- **Dash** to quickly move out of the way or through enemies and their attacks.

- **Shoot** enemies with two different types of attacks, these being a spread-shot attack that fired a lot of projectiles in a wide arc, and a powerful charged shot that pierced enemies.
- **Interact** with the teleporters to travel to the next room.

All these actions (moving, dashing, shooting, interacting) are very common actions within video games as a whole, and as such it should be fairly easy to pick up for people who have some experience with these types of games.

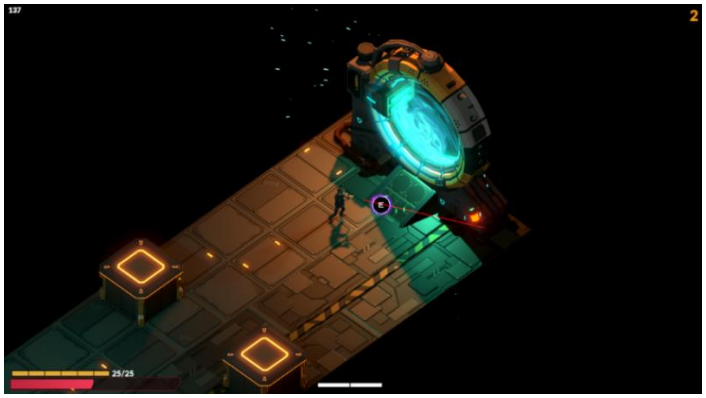

Figure 4: First room in prototype build, after killing enemy and portal opens.

In this game build there were three rooms. Each was specifically designed in a way so as to indirectly teach the player the basic gameplay loop. In the starting room there was a single enemy and a few obstacles. After defeating the enemy, the portal (figure 4) activates and shows a prompt for which button to press in order to activate it. Doing so takes the player to the next room, essentially teaching the player how to progress in the game without holding their hand.

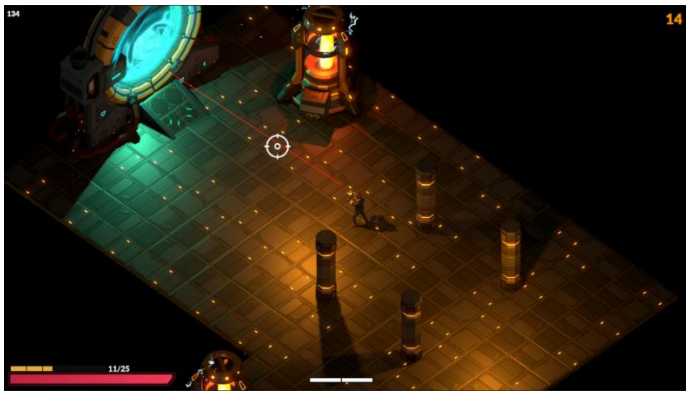

Figure 5: Second room in prototype build.

In the next room (figure 6) the difficulty ramps up a little, as the player has to defeat several waves of multiple enemies in order to proceed. The final room (figure 7) presents a yet harder challenge in a much larger arena. It introduces new more dangerous enemies and exploding barrels. Clearing the final room presents the player with a victory screen with a fitting sound effect making it clear that they beat the game.

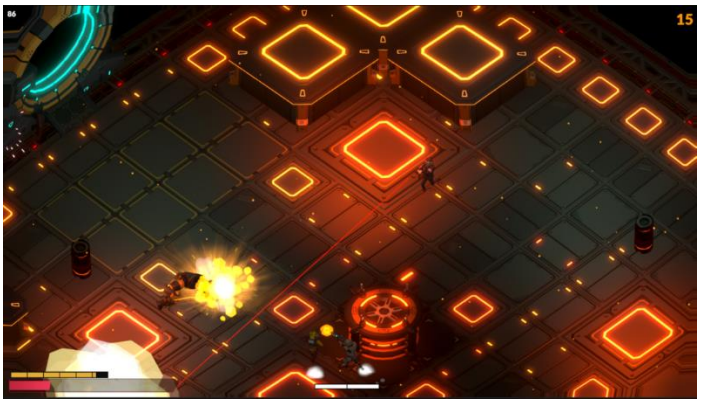

Figure 6: Third and final room in the prototype build.

Feel and Polish

One aspect of game development that is important when developing this type of game is what Swink (2009) describes as *game feel*. Game feel comes from a combination of three things: real-time control, spatial simulation, and polish.

- Real-time control is precise continuous control over a moving avatar (p. 4).
- Simulated space refers to simulated physical interactions in virtual space, perceived actively by the player (p. 4).
- Polish refers to any effect that artificially enhances interaction without changing the underlying simulation (p. 5).

Of these three aspects the one I want to point out in regard to my work on this thesis is the polish. Polish is essentially by Swink's definition anything that only affects the aesthetics of the game. This is something which my game has quite a lot of. For example, looking at only the mechanical parts whenever the player takes the Shoot action a projectile is instantiated at a position relative to the player, and given a direction in which to travel at a specific speed. Then the gun starts a cooldown period before it can be fired again. Alone, without any polish that isn't particularly interesting and does not feel particularly engaging. But

adding polish to the shoot action can do a lot to change that. For example, to begin with we can start by simply looking a real word gun and try to replicate what someone would expect to happen when they pull the trigger. So, we add a fitting sound, a muzzle flash, and some camera-shake to represent the guns kickback. And suddenly we go from a simple instantiation of a moving projectile to hearing a loud crack as the gun fires, the screen shakes with the force of the projectile leaving the barrel, as the air around it ignites and lights up the area around your character. It is difficult to properly put into words the difference polish does for the overall experience of playing the game, but it is in my experience one of the most important things in developing an engaging game. I will not cover any additional instances of adding polish in the service of game feel in this thesis, as there are simply too many instances with too many small details to cover but know that it is something which has been applied all throughout the development process.

Prototype Playtest

The test of this prototype build was a simple playtest and not a scientific experiment. The purpose was simply to test if the basic gameplay loop was enjoyable (playable), and to identify any major failings or problems with the basic gameplay that would need to be fixed or adjusted in order to be playable.

I tested the build with three of my personal friends, so of course I expected there to be some personal bias in the responses, so it was mostly a question of observing their behavior and responses to the game. Each participant was introduced to the control scheme but were told nothing else about what they were supposed to do in the game and was asked to simply stop playing whenever they felt like it. During their playthrough they did not have any trouble figuring out how to play and progress in the game. One player completed the game without dying and then quit. The two others died respectively one and two times without completing the game, but they reached the third room where they died on wave 2/3, after which they put down the game. Talking with them afterwards none of them had any major things they were confused or frustrated about. They all responded that the gameplay was engaging and our fun, despite the limited scope. When asked about potentially playing more (if there were more content), they all mentioned that they would like to play more but that they would be unlikely to want to play for more than 5-15 mins.

With this initial playtest I have developed a simple gameplay loop with almost no replayability, beyond learning how to play the game and then completing it. The next step is to implement additional features in order to give the game more replayability. I describe this process in the next chapter, where I develop additional levels that are linked by a central hub, in which the player gets to choose between different weapons or weapon modifications after completing a level.

Game-loop Build

The purpose of this game-loop build is to find possible answers to the following two of the four questions posed in the problem statement, these being:

- **How do different types of upgrades affect the gameplay experience?**
- **Do player upgrades in rogue-likes enhance replayability?**

This involved expanding the baseline game by introducing additional levels and enemies, but more importantly, in the context of this thesis, adding different types of upgrades in the form of a host of different weapons for the players the choose between and use. This was done to provide motivation both for playing and replaying the game, adding additional variety, and giving the player more choices of how to play the game.

This build was also developed with a specific type of experiment in mind. In order to investigate how different types of upgrades affect the gameplay experience, we need to implement different types of upgrades in the game. From a purely practical standpoint I was able to develop two different types of upgrades, these being more powerful weapons and modifications to a weapon which made it more powerful. In order to only get data on one of these types of upgrades at a time, I decided to split the game into two variants, whose only difference was the presence of these two different upgrade types. I decided to do the experiment using a repeated measures design (Christensen, Johnson, & Turner, 2015, p. 248), where each participant receives both treatments (i.e., plays both variants of the game). I implemented these two variants of the game as a selection of a character expertise.

Character selection

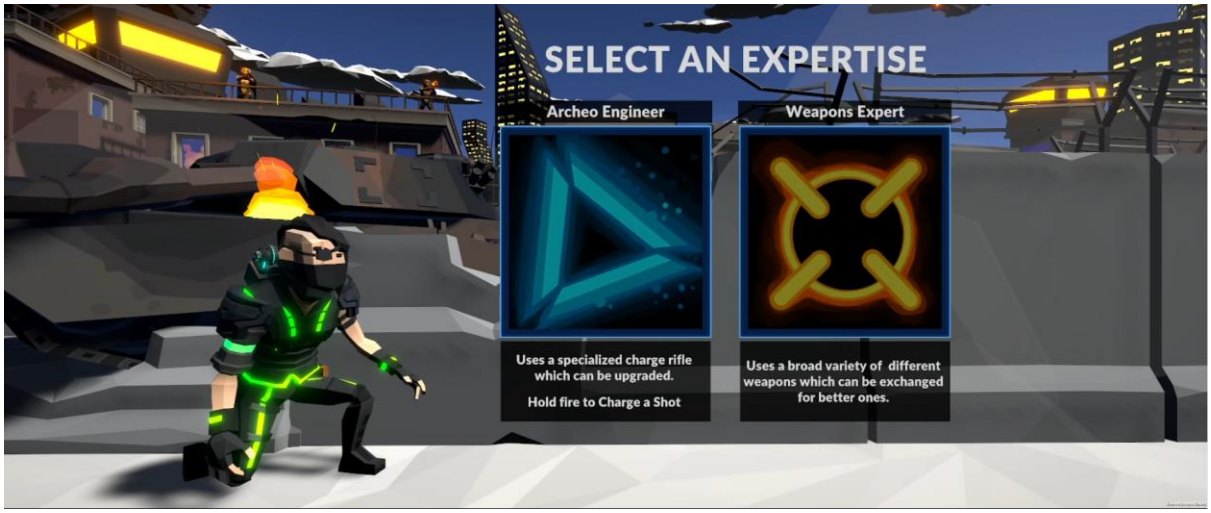

Figure 7: Character selection screen.

The choice between the two variants of the game is presented as selecting an expertise for your character (as seen on figure 7), where has the choice between Archeo Engineer and a Weapons Expert. The Archeo Engineer variant has the player using the same weapon throughout the entire playthrough and upgrading specific functions of that weapon. The Weapons Expert variant has the player using a wide variety of different weapons, as the upgrades simply see them exchanging their current weapon for a better one. Examples of these types of upgrades can be seen in Hades and Dead Cells. As earlier described Hades sees the player pick a single weapon for the entire playthrough, which is then upgraded throughout the run, while Dead Cells simply sees the player exchange their current weapons for different ones that are higher level (and therefore more powerful). Learning the benefits and drawbacks of both these design patterns could be very useful in development when deciding which design to implement in one's own game. For example, developing a lot of different weapons requires more work developing unique aesthetics for each weapon, but might lead to a greater feeling of variety which in turn might translate to better replayability.

Game Loop

The basic game loop is essentially the same, with the addition of a hub area that the player would return to after completing 3 rooms, where they would be able to select a weapon upgrade.

1. Enter a room through a portal.
2. Defeat waves of enemies until the portal reopens.
3. When all rooms in a level have been cleared a portal to the hub level opens up.
4. In the hub the player selects one of three upgrades and proceeds to the next level.
5. When the final level has been completed the player gets shown a victory screen.

Figure 8: First room in the game-loop build.

The very first level serves as a very quick tutorial. A single enemy spawns in and starts shooting at the player. This is essentially the same setup for the first level as in the prototype, because it proved to work very well at easing the player into the game. After activating they enter the next stage which in this case is the Hub.

Whenever the player completes a level, they return to the Hub where they can pick a new upgrade. The hub has a much more relaxed atmosphere than the other levels, which provides the player with a moment of low-tension content, which offsets the high-tension content in the actual levels. This is done in accordance with reversal theory (Apter, 1989), which simply stated suggests that process of moving from a high-tension situation to a low-tension situation serve to elicit feelings of pleasure. By modulating tension and relaxation, the game provides a better context for providing pleasure for the player. The same happens whenever a specific room in a level is cleared, as the music shifts to a more relaxed melody to signify that the danger is over.

Figure 9: Hub room showcasing three upgrades from the Weapons Expert

The choice of new upgrades is presented with three objects on pedestals (figure 9), each with a piece of world-space UI hovering above them which presents the effects of the upgrade. I will go into more detail as to how the upgrades were presented and why in a later chapter specifically on that topic. Behind the upgrades are three portals, of which only one of them is active at any given time. These portals lead to level 1, 2 and 3 respectively.

Figure 10: Second room in the first level.

Thematically, the first level takes place on a spaceship. So, the rooms are relatively small and cramped. This increases the relative difficulty of the levels, as the players' primary way of staying alive is by dodging and dashing the enemies' attacks.

Figure 11: Second room in the second level.

Level two takes place on a desert planet, which forms a strong thematic contrast to the previous level. Mechanically each room was also considerably bigger, and the two middle rooms had some acid pits that would damage anything standing in it, meaning that there is both aesthetic and mechanical variance between the different levels. With each new room the difficulty would also be increasing by spawning more and more dangerous enemies.

Figure 12: Final room in the second level.

The final level serves as a difficulty capstone. Traditionally this level would contain a boss fight, but due to the limited development resources I deemed the prospect of developing a satisfying boss fight in the given time, without sacrificing other more important aspects of the game and the study to be beyond my capabilities.

Figure 13: The final room and level of the game.

I choose to instead make it a large difficulty bump simply by increasing the number of enemies that spawned. This is not how I would design such an encounter in an ideal scenario, but the purpose was simply to give the game a climatic ending and reward the player with a victory screen (figure 14) should they succeed in completing the level.

Figure 14: The victory screen.

Weapons and Upgrades

The upgrades and the design thereof are the core of this investigation. I am working with two types of upgrades. The first type sees the player picking up an entirely new and more powerful weapon than the one they previously had (Weapons Expert), while the second sees the player modify their current weapon in a manner which increases its power (Archeo Engineer). In the next part of this paper, I describe the different weapons and weapon upgrades. All the descriptions are incredibly simplified for the sake of brevity. The purpose of this is simply to showcase the mechanical variety that each of the different weapons have. When it comes to aesthetic variety all of the Weapons Expert weapons have their own unique weapon models, along with unique sound effects for whenever it is fired, while the Archeo Engineer weapon uses the same weapon model and sound effects, with a few exceptions for effects that create explosions and similar effects.

Weapons Expert – Different Weapons

In this variant every upgrade is an entirely new weapon. The player begins with a basic pistol, which can upgrade into any of the 12 different weapons in tier 1 (table 4), which in turn can be upgraded into any of the 13 different weapons in tier 2 (table 5). The tier 1 weapons are all based on real-world weapons, with some creative liberties taken.

Tier 1	Type	Description
G36	Assault Rifle	Projectiles pierce enemies.
SCAR	Assault Rifle	Good stats all round.
G36 (DMR)	Marksman Rifle	Projectiles pierce enemies.
MK 14 EBR	Marksman Rifle	Projectiles pierce enemies and bounce on walls.
Milkor MGL	Grenade Launcher	Projectiles explode.
M249	Light machine gun	Projectiles knock back enemies.
Desert Eagle	Hand cannon	High damage.
Remington 870	Shotgun	High damage, short range.
SPAS-12	Shotgun	High firerate, short range.
Dual MP7	Submachine gun	Extremely high firerate, very low accuracy.
P90	Submachine gun	High firerate.
Barret M82	Sniper	High damage, short charge-up.

Table 4: Tier 1 upgrades for Weapons Expert

Thematically the tier 2 weapons are all made from advanced technology, and as such their aesthetics are based around common sci-fi aesthetics. Several of these weapons are charge weapons. These weapons can be fired normally like any other weapon, but by holding down the fire button the weapon will charge up a special more powerful attack instead.

Tier 2	Type	Description
Lancer	Laser Rifle	Hitscan, very high firerate
Relic	Charge Rifle	Charge shot pierces enemies.
Smart Rifle	Charge Rifle	Homing projectiles (even more when charged).
Tri-shot	Charge Sniper	Tripple shot; charge increases accuracy.
Vortex	Charge Shotgun	Charge shot fires a slow-moving vortex.
Vulcan	Charge Rifle	Charge shot fires several waves of projectiles.
PHYRRIC	Charge Rocket Launcher	Charged shot creates a stationary damage field.
Rocket	Charge Rocket Launcher	Charge to increases damage and explosion radius.
Smart Pistol	Pistol	Homing projectiles.
CAUSE	Shotgun	Bouncing projectiles.
Reaper	Charge Shotgun	Charge shot fires exploding projectiles.
IRIS	Submachine gun	3-round burst, piercing rounds.
VILLAIN	Sniper	Piercing shots, bouncing shots.

Table 5: Tier 2 upgrades for Weapons Expert

Archeo Engineer – Modified Weapon

In this variant every upgrade modifies the base functionality of a baseline weapon. The player begins with a charge rifle, which can be fired normally by pressing and releasing the fire button immediately, or it can be charged up to fire a more powerful shot by pressing and holding the fire button for a second, before releasing the button and firing the charged shot. This means that each tier 1 upgrade can be combined with any upgrade from tier 2, providing a total of 25 combinations.

The tier 1 upgrades (table 6) all modify the weapons basic shots in a variety of ways, providing different playstyles for each upgrade, while the tier 2 upgrades (table 7) all enhance the weapons charged shots.

Tier 1 Upgrade	Gameplay description
Spreadshot	Fire multiple projectiles in a fixed spread pattern.
Explosive	Projectile explodes on impact.
Seeking	Fire three homing projectiles in a burst.
Bouncing	Pierce enemies and bounce on walls.
Dispersal Blast	Fire a cascade of projectiles in a random spread.

Table 6: Tier 1 upgrades for Archeo Engineer

Tier 2 Upgrade	Gameplay description
Heavy spreadshot	Fire multiple projectiles in a wide spread.
Heavy explosion	Projectile explodes on impact.
Seeking shots	Fire two homing projectiles in a burst.
Vortex shot	Fire a slow-moving vortex that damages enemies in its area.
Burnfield shot	Fre a projectile which creates a large stationary damage area that damages enemies standing inside of it.

Table 7: Tier 2 upgrades for Archeo Engineer

Difficulty

The game's difficulty curve is very important, and difficult to get right. If the game is too easy you risk the player becoming bored, and if the game is too difficult you risk the player becoming frustrated or stressed. In my first tests the difficulty throughout levels 1 and 2 were mostly linear. This resulted in my first play tester (who is a gamer with a similar experience level to my own) repeatedly dying in the first level before reaching the second upgrade. Ordinarily in a rogue-like this might not have been a problem because as a genre convention the player is expected to die early and often while learning how to play the game. But, because the experiment essentially required the player to actually reach the second upgrade to get as good data, I concluded that I needed to adjust the difficulty of the first level and reduce the number of enemies that spawned in the first two rooms. The difficulty was somewhat akin to a marathon rather than a sprint. Usually when you died it would be because you had taken small hits here and there over an extended period rather than a lot of damage in a short burst (although that was quite possible as well). This meant that reducing the difficulty of earlier rooms would essentially also lower the difficulty of

future rooms as the player would likely be hit less often in an easier room, and thereby have more health to survive in any future rooms.

Experiment

This was the build that was used for the first experiment. In order to keep development, experiments, and analysis as separate chapters, I will describe the further development of the game, which was used for the second experiment. To see the results of the experiment in which this build was used, you can skip the development of the Sandbox build (the next chapter) and go straight the Experiments chapter.

Sandbox Build

The purpose of the sandbox build is to investigate the fourth and final question posed in the problem statement: **What considerations do players have when choosing between different upgrades?** For the sandbox build, unlike the previous builds, I had more time to develop custom scripts and functionalities, which allowed me to develop a more complex system of upgrades, which could be applied procedurally at runtime, allowing the player to select more than two upgrades during gameplay.

The Sandbox

The second experiment was unlike the other ones, not structured as a game with a beginning, middle and an end. Instead, it was designed as a sandbox where the participants could select, explore, and experiment with a variety of different upgrades and three different types of weapons. There were several reasons for this decision. Firstly, and most importantly, due to some technical difficulties it was not possible to simply reuse the levels I developed for the game-loop build. I believe an update to Unity, the game engine I used to develop the game, unfortunately broke some of the custom shaders I had been using for almost all the objects in those levels, meaning that everything was displayed as entirely pink without any lighting or shadows. This unfortunately happened a while after I had updated the engine, and already had done a lot of work on the new upgrades I would be testing, so I could not simply roll back to one of my previous backups, without losing a lot of my newer progress. So, weighing the relevance of the old levels versus the new upgrades, I deemed the new upgrades to be of greater importance, as they were what I needed to test in the

next experiment, and continued working on them without reverting to the old backup. Secondly, the difficulty of the gameplay in the first experiment meant that one participant barely managed to reach the second set of upgrades. By designing a small sandbox, the player would be able to test out their choices with a variable difficulty that they themselves would be choosing. In addition, by allowing the player to simply pick between upgrades in rapid succession, without having to go through the normal gameplay progression loop each time, we would be able to gather more usable data in a lot less time than it would normally have taken, and the number of upgrades available would not arbitrarily be limited by how many different rooms I had managed to develop in the time allotted. This meant that the individual participant could experience and try out a lot more of the different upgrades when compared to the previous experiment, which required overcoming a fixed number of challenges between each upgrade.

With that said, this type of sandbox experiment primarily makes sense when the participant already has an understanding of what the game entails. If they cannot contextualize what the decisions, they are making in the sandbox would look like in an actual game, then their feedback might be less useful than desired. For this reason, every participant who was invited to this second experiment had played one or more of the previous versions of the game. So, everyone had at least a basic understanding of what the gameplay loop would look like in normal circumstances.

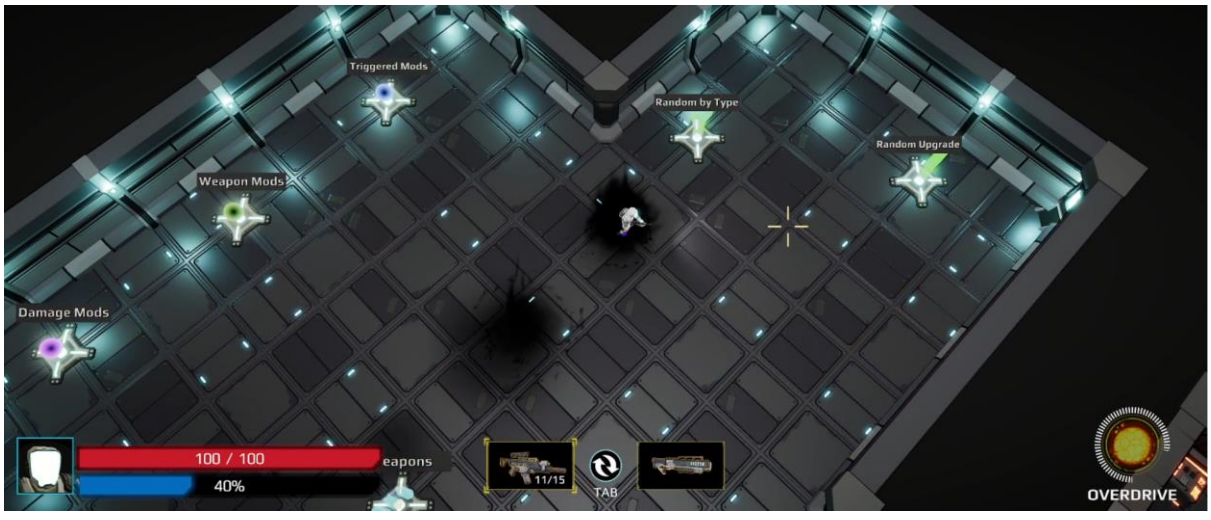

Figure 15: Weapon and Upgrade room in the sandbox.

The sandbox itself consisted of two rooms. The first room contained a weapon picker, and several different upgrades pickers (figure 15). Each picker brings up a full screen UI which shows descriptions of three different upgrades or weapons, as shown on in the Weapons and Upgrade chapters. The weapon picker allowed the player to choose between 3 different weapons, these being an assault rifle, as sniper and a shotgun. Each of these weapons have mechanics that support different playstyles, as described later in the weapons chapter.

There were 5 different upgrade pickers. Two of the pickers contained all of the different upgrades in the build but had different ways of randomly choosing which upgrades to present to the player. The three remaining upgrades each contained about a third of the different upgrades in the game, with all those upgrades being of the same type.

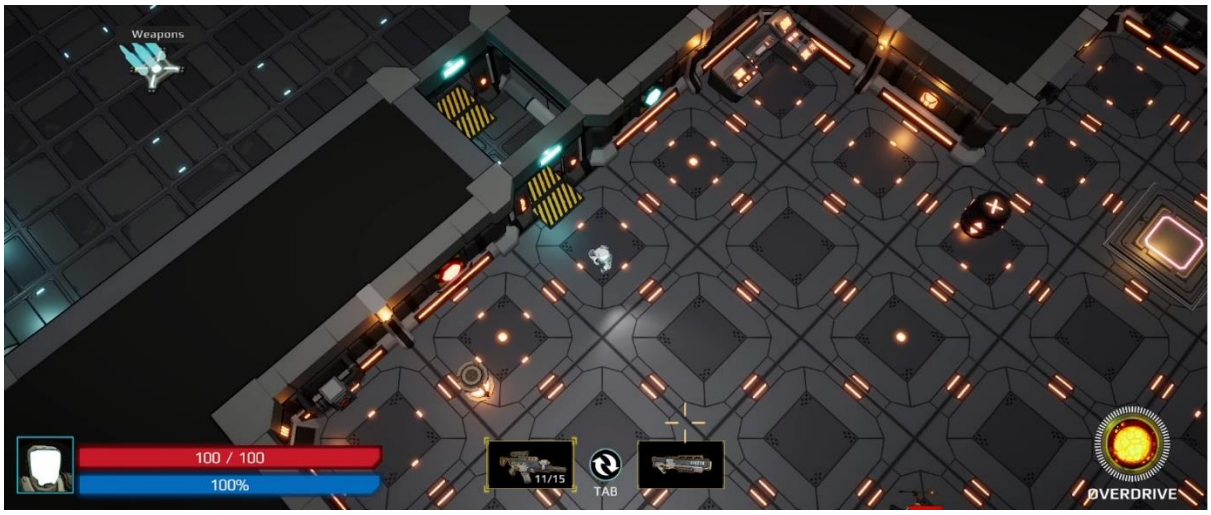

Figure 16: Passage to combat room, with buttons spawning enemies on the walls.

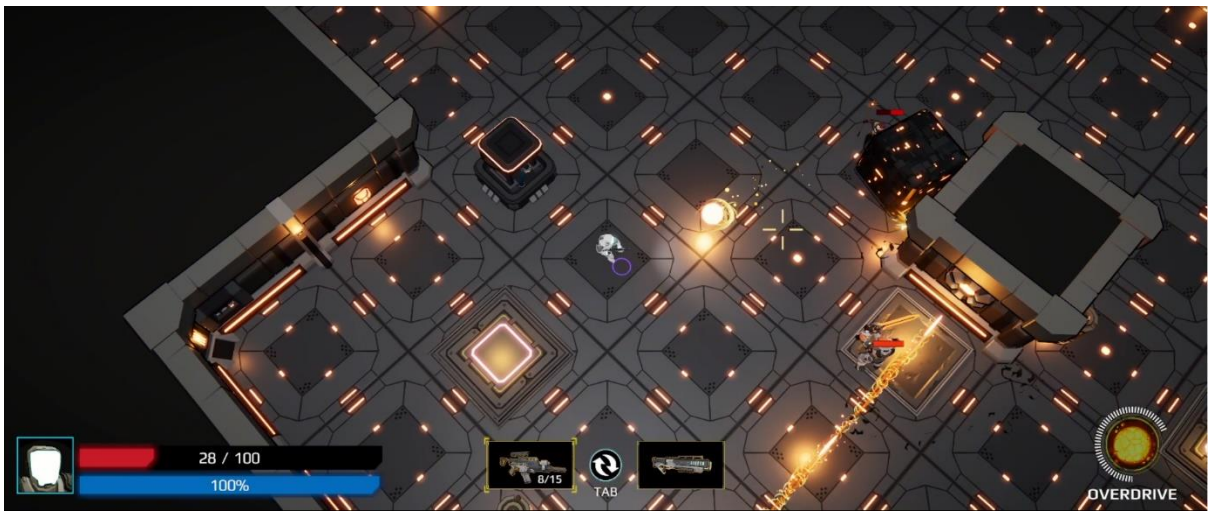

Figure 17: Combat room, showcasing enemies and traps.

The other room contained a collection of destructible and interactable objects, such as exploding barrels, traps, and indestructible cubes (figure 17). At the entrance there were also two buttons (figure 16), one blue one red, which would spawn two and five enemies respectively somewhere randomly within the room. This room served as the battleground for testing the different weapons and upgrades that the player picked in the other room.

Weapons

Each weapon had a critical hit (crit) condition, which when fulfilled would cause the weapon to deal double damage and activate any upgrades that trigger on crits. Every weapon had the same reload time during which it could not be used after expending all the bullets in the magazine. Every weapon also had an Overdrive, a powerful effect which could be activated once every 5-7 seconds, depending on the weapon.

Figure 18: The weapon picker UI, detailing each of the three available weapons.

Assault Rifle. High firerate automatic rifle with a 15-bullet magazine. Crits whenever it damages enemies with less than 35% health remaining. The overdrive fires a single powerful projectile that explodes in a large radius upon collision.

Sniper Rifle. High damage but slow firing sniper with a 4-bullet magazine. Crits whenever it damages enemies that are further than 9 meters away. The overdrive charges up for 2 seconds and then fires a very powerful projectile that penetrates enemies and deals massive damage.

Shotgun. Short range but high damage shotgun with a 6-bullet magazine. Crits whenever it damages enemies that are within a 4-meter range. The overdrive fires three smaller projectiles in a wide spread that explode when they hit something or after travelling a short distance.

These weapons were designed specifically to offer distinctly different playstyles and provide unique synergies with the different upgrades the player could choose between. Some upgrades would naturally be better or worse with specific weapons, which is most often the case in games with these types of choices. This directly support the aspect of mastery when it comes to replayability, as figuring out which weapons and upgrades synergize well with each other is a core part of mastering and learning a game such as this.

Upgrades

There were three mechanically different types of upgrades. These three definitions are solely based on how the modifiers specifically were programmed, i.e., the technology that made them possible, and not the gameplay context for the different upgrades. Every upgrade could be selected multiple times, which would increase the effect of the upgrade in a manner specific to the individual upgrades.

Figure 19: Three examples of damage upgrades.

Damage upgrades. Damage modifiers increase all damage dealt by the player, provided one or more specific conditions are fulfilled. This is essentially the same thing that happens with the different weapons' critical effects.

Figure 20: Three examples triggered effect upgrades.

Triggered effects. Triggered effects provide a bonus or specific effect upon a specific trigger, such as killing an enemy, landing a critical hit, swapping weapons, or dashing.

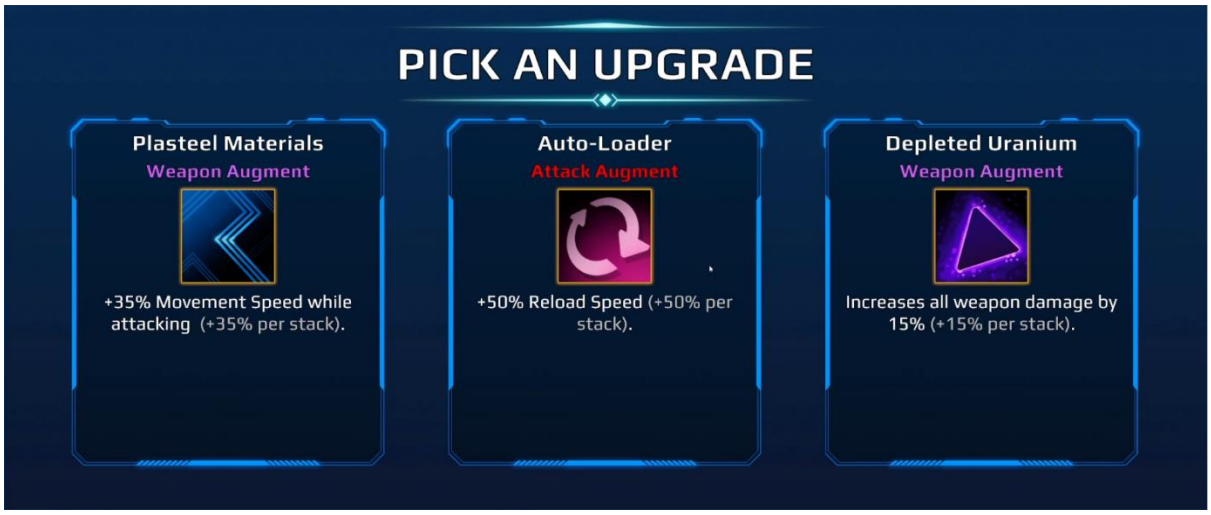

Figure 21: Three examples of weapon upgrades.

Weapon upgrades. Weapon upgrades provided simple straight forward bonusses to the players currently equipped weapon. These bonuses were always active and affect things such as firerate, attack damage, reload speed, and magazine capacity.

The upgrade pickers came in five variants. The first variant was entirely **random**, pulling three upgrades from all categories with equal weight for each individual upgrade. The second variant was **random by type**, in which one random upgrade from each type of upgrade would be presented next to each other. The final three variants would each present three upgrades that all came from the same **category of upgrades**, one that only had

damage upgrades, one that only had triggered effects, and one that only had weapon upgrades.

Damage Upgrade List

Name	Gameplay description
Shroud Gloves	**Alpha Strike:** You deal +60% damage (+60% per stack) to targets with more than 80% health.
Shadow Mask	**Backstab**: You deal +50% damage (+50% per stack) when attacking enemies from behind.
Kill Tracker	**Bloodthirst**: You deal +40% damage (+40% per stack) for 7 seconds after killing an enemy.
Neural Interfacer	**Confident**: You deal +35% damage (+20% per stack) while above 50% health.
Finality Dispenser	**Executioner**: You deal +35% damage (+35% per stack) to targets below 35% health.
Unstable Orb	**Flawless**: You deal +45% damage (+45% per stack) after not taking damage for 10 seconds.
Reactive Cells	**Frenzy**: You deal +50% damage (+50% per stack) while below 50% health.
Targeting Arrays	**Longshot**: You deal +40% damage (+40% per stack) to enemies further than 9 meters away.
Jump Boots	**Panache**: You deal +30% damage (+30% per stack) for 2 seconds after dashing.
Focusing Arrays	**Point Blank**: You deal +40% damage (+40% per stack) to enemies within 4 meters.
Quickdraw Holster	**Quick Draw**: You deal +30% damage (+30% per stack) for 4 seconds after swapping weapons.

Table 8: List of all damage upgrades.

The damage upgrades all provide an increase to the effectiveness of the players attacks, overdrive and other effects that deal damage, whenever a specific condition is fulfilled. Some of these directly match the three different critical conditions of the available weapons, and some of them are entirely unique. In this way, damage upgrades also support different playstyles, which to a high degree are influenced by the available weapons.

Triggered Effect Upgrade List

Name	Gameplay description
Combo Reciever	Every successive hit in quick succession increases your attack damage by 5% (+5% per stack). Resets after second.
Deadlock Accelerator	Every Critical Hit increases your Attack Speed by 25% (+25% per stack) for 6 seconds to a maximum of +100%.
Exhaust Vent	Activating your overdrive triggers an explosion around yourself that deals 50 damage (+50 per stack) to targets within 3 meters.
First Strike Cylinder	Your first Attack within 6 seconds of swapping weapons deals an additional +50% damage (+50% per stack).
Overload Splicer	The first attack within 6 seconds of using your Overdrive fires two additional projectiles (+2 per stack).
Rocket Boots	Dashing twice in rapid succession leaves behind an explosion that deals 50 damage (+50 per stack) to targets within 3 meters.
Rocket Sheath	Swapping weapons releases a shockwave that deals 50 damage (+50 per stack) and knocks back nearby enemies.
Deadlock Accelerator	+300% reload speed (+300% per stack) after killing an enemy.
Tempo Cycler	Every attack increases your Attack Speed by 10% (+10% per stack) to a maximum of +75% (+75% per stack). Resets on reload or after 2 seconds.
Vampire Crown	Every Critical Hit restores 2% of your missing health (+2% per stack).

Table 9: List of all triggered effects upgrades.

The triggered effects are overall more complex in nature than the other two upgrade categories, and their effectiveness is to a high degree dependent on the players' weapons and playstyle. For example, the Tempo Cycler increases attack speed by a small amount whenever your weapon is fired, making it very good for the assault rifle that has a high firerate and magazine capacity already, but a less effective choice for the other two weapons that have relatively slow rates of fire unless specifically upgraded for that. Likewise, both the Rocket Boots and Rocket Sheath requires the player to be close to the enemies for them to be effective, making their effectiveness very dependent on the individual player's playstyle. I noticed afterwards that I had accidentally given two upgrades the name Deadlock Accelerator, which understandably caused some confusion.

Weapon Upgrade List

Name	Gameplay description
Auto-Loader	+50% Reload Speed (+50% per stack).
Depleted Uranium	Increases all weapon damage by 15% (+15% per stack).
Twin Barrel	+1 Burst on your primary Attack (+1 per stack).
Capacity Extension	Increases your Magazine Size by 60% (+60% per stack).
Plasteel Materials	+35% Movement Speed while attacking (+35% per stack).
Rapidfire Chipset	Increases Attack Speed by 25% (+25% per stack).

Table 10: List of all weapon upgrades.

The weapon upgrades are very simple in nature. They provide a bonus which is always active, and that is at the very least somewhat useful on each of the three different weapons. In their relative simplicity and effectiveness, these upgrades also serve as anchors to which the other conditional upgrades can be compared. For example, the Depleted Uranium upgrade increases the players weapon damage by 15%, which is very reminiscent of the different damage upgrades. So, when looking at the different damage upgrades, you can compare how often you think you will be able to fulfill their condition, with their relative effectiveness to the always-active damage increase of the Depleted Uranium. The same is true for some of the triggered effect upgrades which, for example increase attack or reload speed under specific conditions.

Summary of Development

After developing and testing a simple prototype of a top-down shooter, I expanded that to include several types of upgrades, in a build with a proper game-loop and one which was built as a sandbox. The game-loop build was developed with two different variations of upgrades, while the sandbox build was developed with a large variety of different upgrades. For each of the two builds I performed separate experiments, the design, and results of which are described in the next two chapters.

5. Experiment Designs

This thesis follows a qualitative research method. Qualitative research designs are often multimethod, as triangulating data from different methods is believed to provide a better understanding of the phenomenon being investigated (Christensen, Johnson, & Turner,

2015, p. 69). As such each of the two experiments involved several methods of data collection, namely these being observation during gameplay, a think-aloud technique, interviews, and or data collection on specific numerical data points. Not every method was used in each experiment, as the goals of each experiment were different and therefore the methods used to achieve those goals necessarily differed as well.

Game-loop Experiment

The goal of the game-loop experiment was, as stated in the previous chapter, to investigate the two following questions posed in the problems statement:

- **How do different types of upgrades affect the gameplay experience?**
- **Do player upgrades in rogue-likes enhance replayability?**

When it comes to measuring whether player upgrades enhance replayability, it should theoretically be very simple to find an answer to that question. I am using Krall & Menzies (2012) definition of replayability, which states that "Replayability is a quantifiable measure to the enjoyability of a game. That is, a measure of how long a person can enjoy a game before it becomes boring." (Krall & Menzies, 2012, p. 461). This means that answering the question of whether upgrades enhance replayability, would be a simple case of devising a repeated-measures experiment design, in which the player is asked to play a version of the game without upgrades, and a version with the upgrades, and then measuring how long they played each version. This is not what I did, as might be apparent based on the fact that I explicitly described the game-loop variant as having two variants, each with different types of upgrades instead of one with and one without upgrades. That approach would have been more fitting in a quantitative research design, both because the data collected is quantitative in nature (playtime for each variant), and because it would have been easier to simply send out the game build with a set of instructions, and then have the participants report back their playtime. But unless this was combined with a questionnaire, the data gathered from such an experiment would be very surface level, and when it comes to developing a questionnaire, I would personally not know which questions to ask, without first having performed experiments like the ones performed in this thesis in order to get a better baseline understanding of the subject. So, as previously mentioned I performed an

experiment in which the focus instead was on how different types of upgrades affected the gameplay experience. As for the answers to whether upgrades in rogue-likes enhances replayability, I simply worked that into the interviews I would be performing. This would of course be less reliable in a broader context than having a lot more people participating in a quantitative experiment on the same subject, but as has already been established several times, making broad statements about video games is not the purpose of this thesis.

Qualitative experiments are most often conducted in the natural setting in which the investigated phenomenon usually occurs (p. 69). In my experience the reasons for why people play games will naturally tend toward intrinsic motivations, i.e., because it is enjoyable to them in some way. So, for this experiment to mirror those natural circumstances, it was important that the participants participated of their own free will, and not because they were rewarded for it (with anything external to the experience itself at least). I deemed that it would be difficult to get strangers to spend an hour or more participating in my experiment without offering them some sort of compensation for their time. So, I went the easier route of using convenience sampling, asking people whom I knew would be available and willing to participate, as this was both easier, more likely to uphold their agreement to participate, and I believed that they would be more likely to be intrinsically motivated to participate. This of course poses some problems to the validity of the experiments. Any answers they give risk being influenced by their existing relationships to me. This might especially influence any investigations into the quality of the game, as the participants would likely be less likely to give negative responses, and more likely to express positive attitudes towards the game, simply because I was the one who developed it. To work around this problem, I attempted to avoid any investigations concerning quality of the game, favoring instead investigations into the differences between the variants.

As for the physical settings in which the experiments were conducted, some were conducted in-person at my place, and some were conducted online over voice and or video chat. This was mostly a question of convenience regarding where the participants lived (some lived in other parts of the country) and if they had the equipment required to play the game (some of those who lived in the same city did not possess a gaming PC/laptop).

As for the process itself, I used a repeated measures design where each participant played both variants of the game, with an interview after each play session. One of the primary reasons for choosing to use this type of within-participant design is that they require fewer participants, than the alternate between-participant design, as that would require separate groups of people to play each of the variants (Christensen, Johnson, & Turner, 2015, p. 250). Of course, this does pose some problems to the internal validity of the results, due to the experience of the first playthrough affecting the experience of the second playthrough. But this is actually less of a problem in this experiment due to its qualitative nature, than it would be in a similar quantitative experiment. Because one of the things that I want to investigate is specifically any differences between the two variants, and a good way of learning more about that is simply by having the participants play both variants and then asking them for comparisons between the two.

As for the experiment procedure itself, the player is asked to play the game and stop at any time which they don't feel like playing any more. This is followed up by an interview and then the process is repeated with the alternative variant of the game. This approach has a couple of challenges. First of all, I have no idea for how long each player would naturally want to play the game, before deciding to stop. Actually, measuring the replayability would require letting the player play until they no longer felt like replaying. But there might be several other reasons for why a person might stop playing a game other than it no longer having any replay value. The player might be tired or exhausted, they might have other things they need to do, or they might just have temporarily gotten enough of the experience but would gladly return and play more at a later time. Now, the game I developed has a limited amount of content, with a single run taking between 5 and 15 minutes but trying out literally all of the different options in both variants of the game would require at the very least 18 playthroughs (13 unique weapons of each tier in the Weapons Expert variant and 5 unique upgrades in each tier in the Archeo Engineer variant). So, the amount of replay value the game has for a specific player depends heavily on what their motivation for playing is. Someone playing to discover and experience new things will likely have seen all the different levels after completing the game once or twice, but trying out all the different weapons will require considerably more time. So, someone who wants to explore the

mechanical possibilities (the weapons) will have more things to engage with than someone who wants to explore the aesthetic and narrative parts of the game (the levels). So, with all this in mind I decided to limit the playtime for each variant to about 20-25 minutes. As the reasoning for having a longer experiment would be to attempt to measure the actual replayability, but in practice that would be difficult as replayability not necessarily can be measured over a single play session. Also, for practical reasons, with two sessions of playing followed up by interviews, meant that each experiment would already be around an hour long, which could certainly be draining for the participants if it went any longer.

Secondly, if they play through one version until they no longer have a desire to replay it, will necessarily mean that the game no longer has any or very little replay value (although other things can also cause someone to stop playing) for that player. So, by giving them a variant of the same game with only a single changed variable (being that we want to test), that means the variant is very likely to have less replay value for that player, as the gameplay is still mostly the same. Of course, if it turns out that the difference in that variant gives it some additional replayability, then that would support the idea that variance can lead to replayability.

Another important aspect to test is whether the player finds the game playable to begin with. This is a personal preference that can differ from player to player, and as such despite me having performed playtests to get an idea of whether the game is playable or not, not testing the playability could lead to getting answers about replayability from someone who did not find the game particularly playable to begin with. To measure this, I could use a something like the GameFlow model (Sweetser & Wyeth, 2005) which measures the participants state of flow. But because my participants are people, I know in real life there is a good chance that any answers to questions that measure quality would be affected by our pre-existing relationship. Meaning, I would not be able to test the results of the questionnaire. So, I decided to instead rely on the players themselves, deciding not to replay the game if they did not feel like it.

Procedure

What follows is the experiment procedure/interview guide that I wrote up and attempted to follow throughout the experiment.

1. Introduce the participant to the game and the two variants.
2. Based on these descriptions are there one of the two variants that sound more interesting to you?
   2.1. Why? / What about that variant is interesting to you?
3. Assign them a variant. Explain the controls.
4. Tell them to stop when they no longer feel like playing. If they don't stop by themselves, tell them you have a timer and will ask them to stop after it has elapsed (20 minutes).
5. After they finished playing, sit them down for an interview:
   5.1. *If they died*. Why did/did you not decide to replay the game after dying? Refer to and confirm whether their answers match any identified player motivations.
   5.2. *If they completed the game*. Why did/did you not decide to replay the game after completing the game? Refer to and confirm whether their answers match any identified player motivations.
   5.3. *Depending on which variant they are playing:* Did the different upgrades play a role in your decision to replay? Why / why not?
   5.4. *As a finishing question:* Do they want to play the other variant? Why / why not?
6. Ask them to play the other variant, following the same procedure, ask the same questions with the addition of:
   6.1.1. How would you compare this to the previous variant?
7. Finally, ask if they prefer one variant over the other.

Sandbox Experiment

The sandbox experiment was a lot more straightforward than the game-loop experiment. The purpose of the experiment was to investigate the fourth and final question posed in the problem statement: **What considerations do players have when choosing between different upgrades?** The idea behind this question is to better understand what specifically makes for good upgrades and how to design them. I deemed that a good way of doing this in a qualitative experiment would be to use a think-aloud method instead of specific

interviews. This way I could get the player started playing the game and ask them to share their thoughts whenever they were picking an upgrade, and then simply observe them doing so, only asking questions if there was something that needed further explanation or context. The idea behind this was to gather as much information around the subject as possible during the experiment. This would also work really well with the sandbox setup of this build of the game, as that allowed much faster selections of upgrades without any maximum limit like there were in the game-loop build.

Any considerations regarding participant selection from the game-loop experiment were equally true in this experiment, so I will not repeat those here. But I will note that everyone who participated in Sandbox experiment had previously played at least one of the previous two builds (prototype/game-loop), meaning that despite the build not featuring an actual gameplay loop, they did have previous experience with what that game-loop might look and play like.

Procedure

The experiment procedure used in the sandbox experiment was as follows:

1. Introduce the game, the controls, and the sandbox setup.
2. As them to choose two out of the three weapons.
3. Ask them to pick an upgrade and share their thoughts and deliberations on their choices of which upgrades they chose and why.
4. Ask them to go spawn and fight any number of enemies in order to test out their new upgrades.
5. Repeat 3 and 4. When they die or reach a point where they have become too powerful for the enemies to be a threat, ask them to restart the game, and repeat the same process with a new set of weapons.

6. Results

In this chapter I describe and summarize the results of both experiments and put them into the context of the thesis as a whole. The analysis of the results as a whole and how they relate to the questions posed in the problem formulation is relegated to the Analysis chapter. For the sake of anonymization, I will not be disclosing any personal information

regarding the participants, including their gender. Therefore, in the service of clarity, I will be referring to each participant by a capitalized letter (participant A, B, C, etc.), and will be using he/him pronouns when referring to any individual participant. All experiments were held in Danish, and as such any direct quotes have been translated into English.

Game-loop Experiment

The game-loop experiment had four participants. Three out of four participants played until I asked them to stop after the first 20 minutes. The other participant played both versions for about 10 minutes until they stopped. So, in regard to the direct measurable replayability of either version, there does not seem to be any difference between the two versions, at least not in the short term. The transcription of all four interviews can be found in Appendix A. Participants A and C played the Weapons Expert variant first, with participants B and D playing the Archeo Engineer variant first. In all playthroughs all participants chose to replay the game at the very least once, whether after dying or completing the game.

Participant A - Archeo Engineer Playthrough

In the first interview participant A had almost completed the game and retried it several times in the approximately 20 minutes they spent playing the game. When asked why he chose to replay the game he responded that it was primarily because he wanted to explore his options within the game as their primary motivation. “I wanted to try the different upgrades” (see Appendix A, p. 1). Followed up with very secondary desire to also complete the game. “Of course, I also tried to complete the game, but it was more to try out the different options” (p. 1). For participant A the fact that he had no idea what the end goal of the game was meant that he was a lot more focused on just exploring instead of trying to win the game. “I did not know where the game would end, so I did not believe it worth thinking too much about.” (p. 1). After the interview he was then told that the level in which he had died in his last run was actually the final level. This knowledge of where the game ended then affected his next playthroughs.

Participant A - Weapons Expert playthrough

After his second play session, in which he had also chosen to replay the game several times, he stated that like before he wanted to explore the different options, but that he now also

wanted to try and win the game. “It was again to try out some of the different things, but this time I knew where the ending was, so now I had a goal, so it was also to try and complete the game” (see Appendix A, p. 1). He noted that this shift in motivation was largely the result of getting to know the game better and getting a better understanding of his own skills at the game (p. 1). After replaying the game several times, he was confident that he could complete the game, and so he wanted to try and actually do it (p. 1). “I was convinced that I could complete the game now that I knew I was close the last time. And the I wanted to try and do it.” (p. 1)

When asked to compare the two different variants of the game, he had the following to say:

> With [the Weapons Expert] you were just going from one thing to another, so if you had seen the weapon, then you had tried it, and there weren’t so much left. Whereas with the other one you could take a couple of upgrades and try combining them. So, you would want to pick the same thing more times on the one that builds on top of then with the one that just replaces. Because there are more combinations to try out. (see Appendix A, p. 1-2)

For this participant being able to combine different sub-parts of the weapon was more exciting than having a lot of different weapons to try out, because after trying out a weapon he felt they had mostly learned everything about it. There was nothing new to try out and discover about that specific weapon, whereas with the weapon that could be upgraded, he could try out different combinations of upgrades. This gave him a stronger desire to pick upgrades he had already tried before specifically because he could still try out new combinations.

When asked if he wanted to replay the game after completing it, he described his overall approach to playing these kinds of games. “First, I try things out, then I try to complete the game, then I try out other things and attempt to find the playstyle I prefer, and then I try to see how consistently I can complete the game. As long as I enjoy playing.” (p. 2). This in large part encompasses the two motivations they also mentioned in earlier parts of the interview, and also suggests that those motivations can shift and change as the player plays, learns and experiences more of the game in question. His answer here also suggests that

the exploration of different things in the game might serve a specific purpose and is not necessarily simply for the joy of exploration in itself.

Participant B - Weapons Expert playthrough

In his first play session participant B had managed to complete the game during his first run, after which he tried again with another weapon. When asked whether he would have chosen to play had he not been interrupted answered: “I was thinking that I wanted to try one more [run], just to try out another weapon. The one I had at the end was not really optimal, so I wanted to try something else.” (See Appendix A, p. 3) Just like participant A he also named exploring the different choices as his primary motivation for wanting to replay the game. He followed up with the following explanation: “It’s the same enemies and the same things you do. So, when it comes to playing it again there is not really anything other than the different weapons.” (p. 3). So, because there was very little variance in the other aspects of the game, the different weapons took center stage.

When asked specifically why he chose to replay after winning the game, he also mentioned that he wanted to see if he could perform better in the game, were he to repeat it. “I wanted to try the different weapons and see if I could do it better… Play better.” (p. 3). He wanted to improve upon his previous performance after having already won the game, thereby imposing a new goal upon himself. This suggests that for at least some people simply winning the game might only be the initial challenge, and after that they can devise their own personal challenges. It is not uncommon for games to incentivize this type of behavior by implementing achievement systems that give the player what is essentially just a badge of honor for completing some specific objective, that is often unnecessary to the completion of the game.

Participant B - Archeo Engineer playthrough

After his second play session the participant mentioned that his motivations for choosing to replay the game were essentially the same as in his first play session. He wanted to try out the different upgrades that were available, while also mentioning wanting to try completing the game faster and taking less damage in the process. “I think it comes pretty naturally if you play the same thing many times, that… I try becoming better at it, try to take less

damage, complete it in less time." (see Appendix A, p. 3). They stated this as something that comes naturally to them as a result of replaying games that they find enjoyable.

When asked what variation of the game he would prefer to play he said that he prefers the greater amount of variance that the Weapons Expert variant had. "The [Weapons Expert], just because there was more variation when it comes to weapons… More variation overall is probably good instead of the single weapon, even though it has a pretty unique upgrade here and there." (p. 4). This supports the idea that perceived variance in a game can contribute to how replayable it is. Participant B perceived the Weapons Expert as having a greater amount of variance and as such preferred that variant. But he also noted that he would have preferred a combination of both variants:

> "What I would prefer to see was a combination of the two. Keep the different weapons from the one character and then allow you to upgrade them in different ways that pretty fundamentally changes how they work, like with the [Archeo Engineer]. That could give some very good variation, and some very fun playstyles." (p.4)

He liked the variation between different weapons that the Weapons Expert variant provided, but also wanted to be able to upgrade and modify those weapons in the service of having even more/better variation and differing playstyles. Again, this suggests that more variation is good and especially if this variation is also reflected in the choices of how the player can to approach trying to beat the game i.e., choosing a playstyle.

Participant C - Weapons Expert playthrough

In his first play session participant C played for about 10 minutes, during which he restarted the game after dying several times. When asked why he chose to restart he said: "I think I become a bit stubborn and thought that I could learn to be better with some practice" (see Appendix A, p. 5). In extension of this he mentioned that he was inexperienced with this type of game, that being both the rogue-like genre but also the real-time shooter aspect. So, a large part of his motivation for replaying was based around simply learning to play the game. In addition to that, he also wanted to explore the different options the game provided. "Then there was some variation in the different weapons you could choose, which

meant that you could try out some different tactics." (p. 5). This exploration of options was not simply a question of trying different things for its own sake, it was for the purpose of finding something that could fit his specific playstyle. "I felt there was a difference between the different weapons I chose. So, it was interesting to see which options that gave me the best outcome." (p. 5). When asked whether he would still have replayed the game if there were no upgrades to select, he said yes, but: "I would probably still have tried it a couple of times, because of the learning curve... It would not have been as entertaining, because it would be lacking this choice-based aspect that allowed me to define my playthrough." (p. 5). Being able to choose his own path, and having options that allowed for a variety of different playstyles was important to him. Without those options and choices, he would likely still have played the game, but only until he felt he had learned how to play it.

Participant C - Archeo Engineer playthrough

After his second play session the participant noted that his motivations for replaying were the same as before. He wanted to explore the different options and try to overcome the games' challenges. When asked to compare the two variants he noted that the Weapons Expert variant had more inherent variance, but that they actually preferred the relative simplicity of the Archeo Engineer variant, as it allowed him to focus on learning a single weapon that could be modified.

> "The [Weapons Expert] has some more variation in the different weapons' firerates and such that changes between them… Because I am pretty new to the rogue-like genre I actually liked that there was getting to know [the Archeo Engineer] weapon, and then being able to modify it based on what I thought was interesting… [The Weapons Expert] was more chaotic because there was a bigger difference between individual playthroughs." (see Appendix A, p. 6)

So as a very new player the large collection of different available weapons that changed on each playthrough actually proved to be overwhelming and detrimental in helping them learn the game. When it comes to onboarding new players, it might be worth limiting the number of choices in the beginning and allowing the player to unlock new ones as they

progress in the game, which is a design pattern which is seen in all three examples of rogue-likes mentioned earlier.

> "I felt like I had a more linear progression in in how I felt I was improving because I got to know the specific weapon between the two playthroughs I had. So, I felt I had a better chance of becoming better at the game… than when there were these different weapons to choose between." (p. 6)

Having a large variety of content is less valuable if new players are simply overwhelmed by that very same variety. The purpose of the large variety is to give players incentives to replay the game, but if they end up being overwhelmed and therefore quitting the game early then the variety of content does not serve its purpose.

Participant D - Archeo Engineer playthrough

In his first play session participant D chose to replay the game several times after dying, and in their final run they completed the game. When asked why he chose to replay after losing, he responded that he was used to playing games where you are expected to die a lot.

> "I can immediately try again with a new strategy… you gain some experience, and then you draw on that and try something new… I could have chosen to use the same strategy, but I wanted to explore some of the other options for upgrades in order to tailor my character as best I could (to my playstyle)" (see Appendix A, p. 8).

So, for this participant a large part of the replayability comes from learning the game and trying out different ways of playing it. "If I were to try again, I would have taken the third upgrade to try and see what that does and find out if it fits into my playstyle." (p. 8). The exploration is again not simply for its own sake, but to try out different things and see what fits best into their own way of playing, whilst in the process learning more about the game and becoming good enough to actually beat it.

> "…it's a question of personal skill, I can't really make my character better beyond getting a new upgrade, unlike in RPG's where you can just grind enemies in order to level up and then try the boss again." (p. 9)

He also mentioned that after getting more experience with the game, he wanted to go back to one of the upgrades he had picked previously. "…to try again with [my previous upgrade] because now I have more experience, so if I went back to the old build how would that function now that I have a better understanding of how the game functions." (p. 9). So, getting new experience with a game and becoming better at it, can also seemingly put previously experienced content into a new context which might warrant replaying it, despite the only thing having changed is the player themselves. When asked he said that a lack of variety would mean that he would be less likely to replay a game. "…so, it stands to reason that if the game only has three level and nothing else, then you quickly loose the motivation [to replay]. (p. 9)

Participant D - Weapons Expert playthrough

In his second play session the participant played and replayed the game several times, winning some runs and failing others. He said that his reasons for replying were essentially the same as previously. "So, I tried again in order to try out other weapons others and see if I could do it again [complete the game] but with another build." (see Appendix A, p. 9). He wanted to try out a lot of different things in the game and regarded having the ability to do that in a relatively short amount of time as a strength of the genre. "It is a rogue-like so you try different facets of the game unlike something like Skyrim (a much longer game than any rogue-like), where you commit to a build and then that is what you are going with, and it might be difficult to reset it after you have already started." (p. 9). Overall while he definitely thought that there was a difference in how each variant felt to play, those differences did not affect his underlying motivations for replaying.

> "The motivation is in reality very much the same, I don't know if there are any differences as such. Yes, the characters feel different but for me it is a question of what I can do with what I have, that is what the motivation is." (p. 9)

The replayability for him lay in doing and trying out different things, and in doing so learning more about the game and becoming better at it. "But for both of them the replayability lies in discovering what I can do differently." (p. 10). Again, the variance in the different weapons and upgrades is primarily valuable for the different playstyles and tactics they

made available to the player. “So again, it is about becoming better, and that is a motivation in general. And then try out the different (play)styles and discover what fits with my way of doing things.” (p. 10)

Is one variant better than the other?

Each participant was also asked if they preferred one of the two variants over the other. Two participants chose the first variant they played and the other two chose the second variant. So, it does not seem like the order in which they played the variants affected their preferences.

- **Participant A**: “I would definitely pick the one that builds on top of what he already has [Archeo Engineer], that appeals more to my playstyle… But the [Weapons Expert] was also fun in its own way.” (See Appendix A, p. 2)
- **Participant B**: “The first I played [Weapons Expert], just because there was more variation when it comes to weapons… More variation overall is probably good instead of the single weapon, even though it has a pretty unique upgrade here and there.” (p. 4)
- **Participant C**: “I would prefer to play the version where you keep your weapon and modify it [Archeo Engineer]. That is both based on me as a newbie, but I also think it’s a question of flavor for me.” (p. 6).
- **Participant D**: “I would prefer to play the [Weapons Expert] where I can just throw away things, but it isn’t because I think it is a lot better… It’s more a playstyle preference, because the other one was just as enjoyable to work with.“(p. 10)

These answers suggest that neither variant is inherently better than the other. The Weapons Expert variant was preferred because of the greater variance between the weapons, and the ability to simply swap out your current weapon for another. Meanwhile the Archeo Engineer variant was chosen because it appealed more to a specific playstyle, because of its relative simplicity when it comes to learning the game, and as a question of the specific flavor or fantasy that it fulfills. But each participant also noted that their preferences were by a relatively small degree, and that they also enjoyed playing the other

variant. That might be an effect of their personal relations with me and them wanting to avoid stating an active dislike for either version.

Sandbox Experiment Results

The sandbox experiment had five participants, most of whom played around in the sandbox for about 45-60 minutes.

Damage Modifiers			
Upgrade	**Presented**	**Picked**	**Pick Rate**
Shroud Gloves	7	3	43%
Shadow Mask	11	2	18%
Kill Tracker	5	1	20%
Neural Interfacer	9	0	0%
Finality Dispenser	9	2	22%
Unstable Orb	7	3	43%
Reactive Cells	8	3	38%
Targeting Arrays	3	3	100%
Jump Boots	8	3	38%
Focusing Arrays	3	0	0%
Quickdraw Holster	3	1	33%
Triggered Effects			
Upgrade	**Presented**	**Picked**	**Pick Rate**
Combo Reciever	11	1	9%
Deadlock Accelerator (reload)	6	3	50%
Exhaust Vent	4	0	0%
First Strike Cylinder	11	4	36%
Overload Splicer	10	1	10%
Rocket Boots	4	0	0%
Rocket Sheath	6	1	17%
Deadlock Accelerator (crits)	2	1	50%
Tempo Cycler	8	2	25%
Vampire Crown	13	10	77%
Weapon Upgrades			
Upgrade	**Presented**	**Picked**	**Pick Rate**
Auto-Loader	9	2	22%
Depleted Uranium	7	4	57%
Twin Barrel	11	6	55%
Capacity Extension	10	5	50%
Plasteel Materials	8	2	25%
Rapidfire Chipset	10	5	50%

Table 11: Pick stats for every upgrade in the sandbox build.

Table 11 shows a summary of how often each upgrade in the sandbox build was presented as an option amongst the three picks, and how often out of those times it was picked. Appendix B shows each set of upgrades that were presented to the individual participants, with the upgrade they chose marked in bold. Table 11 provides a nice overview of the results, albeit without any of the qualitative data. All the relevant participant answers in from this experiment were transcribed and can be found in Appendix B.

Statistically, all things being equal (which they are not) the pick rate of each upgrade should be somewhere around 33%, with 3 upgrades being presented and one of them chosen each time the player gets a new upgrade. On the above table I have highlighted the upgrades whose pick rates were 13% points above or below the average pick rate of 33%. This number was chosen somewhat arbitrarily. It's primarily to be able to easily discern which picks were more or less popular than the average. Now, these results can by no means be statistically significant in a way that gives us reliable results. By themselves these numbers are not particularly useful, as there simply isn't enough data to draw any meaningful conclusions. This is especially true when looking at something like the Targeting Arrays that have a pick rate of 100% but have only been presented as a choice three times. Simply judging based on these numbers alone will almost surely lead to false conclusions and a low reliability overall. But we can use this data to more easily contextualize the qualitative data that was also collected in the experiment.

Some participants were more talkative with their reasonings for picking each upgrade, and some choices had little to no explicit explanation. But at those points in the experiment, the participants had already explained their reasonings behind choosing specific upgrades over other ones previously, and those reasonings were generally consistent across the individual experiments, and consistent between the participants previous choices. So, while all picks were included in the Pick Stats table, not every single pick was comprehensively explained.

Overall, we see that four out of six of the Weapon upgrades have a very solid pick rate of around 50%. These were specifically the upgrades that increased damage, firerate, burst and magazine size. When the participants picked these options, it was often because they were always active and useful. Unlike many of the other upgrades, the participants did not

have to do anything specific (other than use their weapon, which they would do anyway) to gain value from these upgrades. Many other upgrades required the player to perform specific actions in specific conditions or fulfill some secondary requirement in order to gain the bonus from the upgrade. So, despite the effects of these weapon upgrades being smaller, the fact that they were always active was valued very highly by all the participants. This is a common theme for all the participants. For every upgrade pick, the participants performed an internal evaluation of how much value they believed they would gain from each upgrade. This value was in several cases described as a function of the intensity of the effects compared to how often the effect would come into play. For example, the Depleted Uranium upgrade increased all weapon damage by 15%. Similarly, the Unstable Orb increased all damage by 45% provided that you had not taken damage within the last 10 seconds. So, when one participant was presented with the choice between these two upgrades (and a third they had decided not to take), they performed an evaluation of their own their own skill, current playstyle, and weapon, and the potential damage bonus from the Unstable Orb compared to the Depleted Uranium. In the end, they decided to take the Unstable Orb because they preferred the higher damage potential and believed that they with their current playstyle could stay safe enough that it would be worth it. Another participant performed a similar evaluation but came to the conclusion that they were not skilled enough to not take damage, and thereby would not gain enough value from picking the Unstable Orb. Several different factors were mentioned as being a part of these value calculations, amongst them are the following:

- Current weapons.
- Current health.
- Previous upgrades picked.
- Knowledge of other upgrades that might be picked later.
- Evaluation of one's own skill.
- Current playstyle.
- Preferred/desired playstyle.

Regardless of what the value calculation itself entailed it was almost universally present. No one picked something solely because it seemed more fun if they believed one of the other

upgrades to be more effective. The choices of what upgrades to pick were mechanical in nature. If an upgrade was perceived as less useful than the other upgrades available, then no one picked it.

A lot of the triggered effects, specifically the ones with low pick rates, were consistently evaluated as being too conditional to gain proper use out off. For example, the Rocket Boots and Rocket Sheath both triggered explosions around the player upon dashing twice or swapping weapons. But often the players did not want to get close to the enemies when using the sniper or assault rifle, so these upgrades were working counter to the strategy the player wanted to pursue. But when choosing not to pick these upgrades, they did note that they would be more likely to pick them when using the shotgun, because then they wanted to get close to the enemies, and the upgrades would be supporting that. Likewise, some of the damage modifiers that required having above a certain percentage of health, physically behind enemies, or very close to the enemies had very low pick rates amongst the participants, due to the participants value evaluation of that upgrade being very low as the conditions were deemed too difficult to fulfill.

The upgrade with the absolutely best pick rate, and which was several times picked before even reading the other upgrades, was the Vampire Crown. The Crown was the only thing in the game that allowed the player to regain health, making it easier for them to stay alive and thereby keep playing. This evidently made the value evaluation of the Crown very high in most circumstances.

7. Analysis

In the introduction I had four questions that I would attempt to explore possible answers to in this paper. For simplicity I list them again here.

1. **What is replayability and what makes a rogue-like replayable?**
2. **Do player upgrades in rogue-likes enhance replayability?**
3. **How do different types of upgrades affect the gameplay experience?**
4. **What considerations do players have when choosing between different upgrades?**

In this section of the paper, I attempt to answer these questions based on the collected data and previously covered theories. The first two questions will primarily be discussed using the data from the game-loop experiment. The third question will be discussed using data from both experiments, and the final question will be discussed using data from the sandbox experiment.

For the first question, **what is replayability and what makes a rogue-like replayable?** For the first part of that question, there are of course several different ways of defining the term replayability, in this paper I have chosen to use Krall & Menzies (2012) description of the term, who defines it as a measure of the enjoyability of a game, and in extension thereof a measure of how long a person can enjoy a game before it becomes boring (Krall & Menzies, 2012, p. 461). So, in that context the first question might be rephrased as "**what makes a rogue-like enjoyable over multiple playthroughs?**". To answer this question several of the participants' answers in the interviews come to mind. Every participant, when asked, answered with some variation of wanting to try out the other upgrades that had been offered to them, but which they had been unable to try during their previous runs. This was in most cases directly tied with a desire to explore different playstyles in an attempt to either find something that suited their preferences specifically, or simply to learn more about the game and the different options available. If we put this into the perspective of Krall & Menzies (2012) aspects of replayability we find that there are several aspects that this exploration and selection of upgrades might fit into. I will cover each of the aspects in the context of the different participants.

Challenge aspect. As an example, in his second interview Participant A specifically mentioned replaying in order to try and win the game. This only became a motivation for replaying after he had learned what the final level was and failed to complete it once. In this context it can be said that he was replaying the game in order to overcome a specific challenge which he had previously failed. Participant D specifically wanted to see if he could complete game with a different weapon than the one, he had previously completed it with. Likewise participant B posed himself challenges by trying to beat the game faster or by taking less damage than previously. Similarly participant A mentioned that he generally,

when playing games, would at one point attempt to see how consistently he could complete the games challenges.

Mastery aspect. After having completed the game, Participant A essentially stated that the next step would be to see how well they could master the game, specifically measured by how consistently he would be able to beat the game on any given run. This very clearly follows the mastery aspect of replayability, as it heavily involves learning and becoming as good as possible at the game. Here it is important to mention that this motivation to replay was only triggered for Participant A after he had already learned a good bit about the game. This might be a case of this mastery aspect only becoming relevant after they left the *First Play* stage of Krall & Menzies (2012) four stages and entered the *Gameplay* stage after getting a good feel for the game's mechanics and the specific content. Participant C mentioned wanting to learn and become better at the game, specifically after dying and retrying the game several times. Likewise, he mentioned trying out different tactics by using different weapons and upgrades, which also suggests the presence of an aspect of seeking learning or mastery in the game. Participant D, after winning the game with one weapon, mentioned he wanted to see if they could do the same with other weapons. I also mentioned this under the examples of the Challenge aspect on the previous page, which honestly could be case for a lot of the examples I mention here. The line between when something is done to overcome challenges or to learn and master the game is somewhat unclear, and based on the results of the interview they seem intrinsically linked. Overcoming challenges, especially difficult ones, requires learning and mastering the game. So, in hindsight it might not make sense to divide those two into entirely different categories, when all the other aspects (social, experience, impact, and completion) are rather different from each other.

Completion aspect. As previously mentioned, several participants wanted to try out different upgrades that they had not tried before even after having already beaten the game. So, there certainly is some aspect of completion driving them, although there is no evidence that they wanted to try out every single upgrade or combination thereof. Participant A mentioned specifically after his first play session that they wanted to try and

complete the game. This exploration was in several cases mentioned in the context of trying out different playstyles, thereby being in direct support of the mastery aspect.

Nothing directly connected to the **social**, **experience** or **impact** aspects were mentioned by the participants. So, if those aspects did play a role in the participants decision to replay, they were not as important as the **challenge**, **mastery,** and **completion** aspects in the specific context of this short rogue-like shooter. Of course, this does not mean that those aspects did not affect the participants' reasons to replay, only that they were not mentioned in the experiments.

If we look at the results through the lens of self-determination theory, there is a very clear connection to the need for competence and to some degree the need for autonomy. The need for competence relates directly to the challenge and mastery aspects, as both are about learning and becoming good at something. The need for autonomy comes into play whenever the player is presented with a choice of upgrades, where they themselves decide how they want to play the game (within the limits of the upgrades that are presented). Getting to decide what upgrades to pick and play with was several times mentioned as being important for the participants' desire to replay the game.

Each participant's reasons for replaying the game can, through the aspects of replayability, be indirectly linked to several of the different player motivation typologies that were discussed earlier. This supports that the motivation for replaying a game such as this is linked to the overall motivation for playing games. In turn this also means that different people will likely be replaying games for different reasons despite this experiment showing broad similarities between each participant's answers as to why they chose to replay. It would make sense that there is a focus on the challenge, mastery, and completion aspects of replayability in the contexts of rogue-like games, as these aspects are very directly baked into the genre. Rogue-likes are notoriously difficult to master and complete by design, as they inherently expect the player to die a lot. Likewise, they very often have a lot of content that can be discovered during runs or unlocked between them. So, these results largely suggest that a large part of what makes rogue-likes replayable is the inherent challenges to overcome, the variety of playstyles to learn and master, and the breadth of content to

explore and choose between, these being broadly represented by the challenge, mastery, and completion aspects of replayability.

Do player upgrades in rogue-likes enhance replayability? Based on the participants responses to the interviews in the game-loop experiment, the answer to this question is almost certainly yes, at least in the context of the game developed for this thesis. Every participant when asked why they chose to replay mentioned the upgrades as an important motivator, and additionally when asked several of the participants said that the game would likely be less replayable for them if they did not have a selection of different upgrades to choose between. This does not mean that the upgrades are the only things providing replayability. Participant C specifically mentioned that without upgrades they would likely still replay a couple of times in order to learn the game. Participant B and D both mentioned the lack of variation in levels or enemies as something that reduced the replayability of the game in the long term, meaning that the opposite would likely be true as well, i.e., that more levels and different enemies would also add replayability. But these aspects would only really be measurable with a longer experiment, that provided the participants more time to play and replay the game, until they naturally felt like they no longer had any reason to replay it.

How do different types of upgrades affect the gameplay experience? In the game-loop experiment there were two categories of upgrades. The entirely different weapons that were more powerful than the previous ones, and the weapon upgrades that enhanced the base functionality of an existing weapon. All the participants had different thoughts on how these two different categories of upgrades affected their experience. As mentioned previously each participant had a clear preference for one of the two categories. The Weapons Expert variant was noted as allowing for more tactical flexibility, as the player could simply discard their current weapon and therefore did not need to live with their previous choices. This was unlike the Archeo Engineer in which every upgrade chosen was permanent and would affect the entire run. Some participants preferred this permanence, while others preferred the flexibility. When it comes to the specific mechanical and aesthetic differences between the different weapons and weapon upgrades, the aesthetic differences never really came up, whereas the mechanical differences were mentioned

several times in the context of different options offering different ways of playing the game, i.e., different playstyles. This suggests to me that interesting mechanical differences are of greater importance than the aesthetic differences. Of course, this can neither be confirmed nor denied based on the results of this study, but it might warrant further study in regard to where development resources are best allocated when it comes to developing a variety of content.

In the sandbox experiment there was a greater breadth of different upgrades, many of which supported or pointed the players towards specific playstyles. The presence of these upgrades greatly affected how the participants chose to play the game. For example, on upgrades that triggered when using specific actions, such as on critical hits, when swapping weapons, or fulfilling a condition, led the player to play in way that would take optimal advantage of that specific upgrade. Sometimes the players picked upgrades that fit within their current playstyle, and other times they let the upgrades they picked inform and influence their playstyle. So, if you as a designer want the player to do something or try playing in a specific way, developing, and implementing upgrades that specifically enhance a specific playstyle might be a way of doing that.

What considerations do players have when choosing between different upgrades? When choosing upgrades in the sandbox experiment the players primary considerations were almost always based on what upgrade they would get the most value out of. What upgrade would be most beneficial to them, taking into account things like their playstyle, previous upgrades, current conditions, or future upgrades they might want to pick. Oftentimes there was a comparison between the weapon upgrades which provided small percentage bonuses that were always active, and the triggered effect upgrades and damage upgrades, which overall provided larger bonuses, but which were not always active. More often than not, this value comparison resulted in the participants picking the safe options, that being the upgrades that were always in effect. This idea of making a risk-reward assessment is by no means a new one. “One of the most exciting and interesting choices for a player to make is whether to play it safe and go for a small reward or take a big risk to try for a big reward” (Schell, 2020, p. 222). Jesse Schell (2020) names this concept triangularity (p. 222). This was not something I had initially researched for this thesis, but something I remembered after

analyzing the results of the sandbox experiment, and the concept very much fits with the results of my experiment. In connection to this Schell mentions that “People not only seek out options that create the most pleasure, they also avoid the ones that cause the most pain.” (p. 206). This would explain why the upgrade that allowed the player to regain health was by far the most popular, as it was the only upgrade that really made it easier for the player to avoid the pain of dying in the game, whereas every other upgrade instead would be helping the player attain pleasure by defeating enemies.

8. Conclusion

In this thesis I investigated the concept of replayability and player upgrades in video games, specifically in the context of a rogue-like top-down shooter. I developed a small game and throughout its development used it in two different qualitative experiments, the purpose of which was to investigate the following questions:

1. **What is replayability and what makes a rogue-like replayable?**
2. **Do player upgrades in rogue-likes enhance replayability?**
3. **How do different types of upgrades affect the gameplay experience?**
4. **What considerations do players have when choosing between different upgrades?**

Based on background research replayability is a measure of how long a game can be enjoyed before it becomes boring (Krall & Menzies, 2012). Based on three examples of popular rogue-like games, an important part of what makes a rogue-like replayable is by providing the player with a large variety of content. In my own experiments, an important part of creating replayability was by providing a variety of mechanically different content. Give the players different ways of playing, along with a variety of different things to try out, learn about, and master in the game. The results of my experiments suggest that mechanical differences between upgrades play a much larger role than any aesthetic differences.

Based on the results of my experiments, having different player upgrades almost certainly increases a games replayability. Of course, in my experiments the only thing that really differed meaningfully between playthroughs was the different upgrades the player could pick. So, it stands to reason that if the upgrades were the only real variation in the game,

then they would be the primary things providing replayability. Several participants mentioned wanting to replay the game in order to learn and master the game, and then outperform themselves on repeated playthroughs. So, it stands to reason that variation of content is not the sole source of replayability.

The first experiment had the participants playing two variants of the same game, with the only differences being how the player upgrades were implemented. In one variation each upgrade was a distinctly different and more powerful weapon that replaced the one the player currently had. In essence the variation between upgrades was both mechanical and aesthetic in nature. In the other each upgrade would instead improve upon the players existing weapon, and was primarily mechanical in nature, with little to no meaningful aesthetic changes. The results of the experiment showed differences in the reception of the two variants, but in essence no variation was deemed strictly better than the other. Each variation had strengths and weaknesses that played into specific player preferences. Some preferred the flexibility of swapping out their weapons and not being locked into their choices, while some preferred the experience of using a single weapon and upgrading it over time, partly due to the inherent fantasy in the playstyle, but also due to the relative simplicity when compared to the other variant, where one would have to learn and acclimate oneself to several different weapons throughout a playthrough.

In the second experiment there were a much broader variety of smaller upgrades, that all enhanced the player overall or enhanced a specific type of playstyle. The upgrades which enhanced specific playstyles also saw the players attempting to play into those specific playstyles, something they might otherwise not have done without the presence of those upgrades. When choosing between upgrades in the second experiment the participants all performed internal value calculations regarding which upgrades, they would get the most value out of. These considerations were almost universally mechanical in nature, with little to no thought given to any aesthetic considerations. Amongst the most popular upgrades were several of the simple upgrades, which had no requirements or specific activations for them to be useful. Despite the effects of these upgrades overall being smaller than the upgrades with conditions, the fact that they were always active was greatly valued by all the participants.

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