Ribble-Rabble

Designing for uncertainty in turn-based battle systems in multiplayer video games

Master's thesis in Computer Science and Engineering

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CHALMERS UNIVERSITY OF TECHNOLOGY
UNIVERSITY OF GOTHENBURG
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Nomenclature

DOT Damage Over Time - A status effect which deals damage over time.
HP Health Points - Resource used to keep units alive.
JRPG Japanese Role-Playing Game - A genre of video games.
MP Mana Points - Resource used to perform moves.
PUGS Player Uncertainty in Games Scale - A 24 item scale used to measure felt uncertainty in games.
QTE Quick Time Event - A timed event requiring player input following an on screen prompt.
TRPG Tactical Role-Playing Game - A genre of video games.
UI User Interface - The layer which users interact with on the screen.

Abstract

Uncertainty is a human felt experience which can both be positive and negative, and has been identified through research as an important part for enjoyment in games of all kinds. As uncertainty can be a positive but also a negative feeling, it is therefore important that the uncertainty in a game is properly designed to improve player experience. This project examined how different sources of uncertainty affected player experience in turn-based battle systems in multiplayer video games, and tried to identify key elements in creating an enjoyable experience. A digital prototype featuring a multiplayer battle-system called "Ribble-Rabble" was developed to explore and test these elements. The insights gained from testing the elements were used to produce a set of guidelines with considerations for elements belonging to each source. The project also identified one additional source of uncertainty that had not been previously described.

Keywords: computer, science, computer science, engineering, game design, interaction design, project, thesis, uncertainty, user experience.

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1
Introduction

Because humans lack the ability to see into the future, life is for the most part uncertain. Uncertainty can be a source of fear and stress, such as uncertainty of health and death, but it can also be a source of enjoyment, intrigue, and suspense. Games are also for the most part uncertain, and many games contain aspects of uncertainty, such as different forms of gambling, as it has been identified as a source of enjoyment in games [6]. However, as mentioned, uncertainty is not always enjoyable. So if uncertainty can be both enjoyable and frightening, both negative and positive, what is the deciding factor of what is positive and what is negative uncertainty? Is it the degree of uncertainty, what is uncertain, or what is at stake? It depends on what it concerns and how it is presented.

Design can play a crucial role in how function and purpose is conveyed to users, and how uncertainty is experienced. Depending on how information is visualised to users, designers can create or dispel uncertainty. In games, information can be hidden from players to create uncertainty, such as an opponent's hand of cards. To take the card game Poker as an example, from an outside perspective before players reveal their hands, there exists no uncertainty as all players' hands are set and unchanging. Still, humans will experience uncertainty as they do not have access to all the information, which means they cannot accurately predict the outcome. Games can also be designed in such a way that there is no uncertainty of what the goal or purpose is [8], where the design clearly indicates function and purpose to players. Design and uncertainty go hand-in-hand in creating an enjoyable experience in games, but the question is what kind of uncertainty is enjoyable and how should it be designed.

1.1 Purpose

Building upon past research on how uncertainty affects gameplay and player experience, we want to explore how uncertainty can be designed for, and what should be considered when doing so in the context of turn-based battle systems in multiplayer video games. Therefore, this project aims to answer the following research question:

What should be considered when designing for uncertainty in turn-based battle systems in multiplayer video games?

Our results can contribute knowledge in the form of guidelines, which game designers can consider to create games where uncertainty can be utilised to enrich the player

experience. Furthermore, our results can benefit researchers who want to conduct further research within the field, where they can use our specific focus as a foundation or discussion topic.

1.2 Limitations

Except for a few other games mentioned in the text to provide examples of uncertainty and turn-based games, our focus is on *turn-based battle systems in multiplayer video games*. There is a type of game called pervasive games, where players use the real world as the game environment, or in combination with a digital world, for example, Pokémon GO [37]. For time-limited reasons and to narrow the scope of the project, we have decided to exclude these kinds of games and focus on purely digital games. Furthermore, we do not focus on the entirety of games, but rather on battle systems as an isolated entity in order to explore uncertainty, whilst in reality, battle systems cannot be designed and treated separately from the game in which they exist. Because we limit the study to this specific type of video games, our results have limited generalisability and cannot be applied outside of this scope. To create general guidelines or recommendations, further research would need to be conducted on a wider range of games.

2
Background

In this chapter, we define key concepts related to the focus of the study, as well as provide examples of video games and how uncertainty is present in them.

2.1 Uncertainty in Games

Uncertainty plays a large part in theoretical areas such as statistics, economics, mathematics, and physics. Very few things are certain, and outside of theoreticals, there is no sure way of exactly predicting the future. Uncertainty implies doubt and uncertainty of outcome [8], and is the foundation of many games, such as games with dice or social interactions, although most video games contain some aspects of uncertainty. According to Costikyan [8], "games require uncertainty to hold our interest". Salen and Zimmerman [44] define a game as "a system in which players engage in an artificial conflict, defined by rules, that results in a quantifiable outcome". Costikyan [8] takes the classic turn-based game Chess as an example of uncertainty in games, as one player does not know what move the other player will make, and its strategic complexity also creates uncertainty by making it difficult to calculate the next optimal move. Caillois [6] argues that if doubt does not exist in a game, then the outcome is certain and the game must end. Therefore, doubt and uncertainty are defining aspects of games, which in turn means that games are uncertain.

Games can be designed to intentionally obscure and hide information from players [8], which in turn creates uncertainty. An example of this is the Pokémon game series [36], where the opponents' moves are unknown, which requires players to weigh potential outcomes against each other when making their own moves. Uncertainty can also emerge when something exists that the player does not yet know of, but will eventually learn through experience [8]. In games such as Doom [14], enemy placement is at first unknown and an element of uncertainty, but will during subsequent playthroughs be a certainty. The level designer has, because of this, control over the degree of uncertainty the player will experience in the first playthrough. To counteract the disappearing uncertainty, games can be designed to randomise levels for each playthrough, like Rogue [50], in which the levels, including monsters and treasures, are procedurally generated for each playthrough.

Games provide opportunities for players to attempt to overcome challenges and explore options with uncertain or unknown outcomes, whilst not having to worry about potential consequences of failure, which accompany real life situations [24].

The term challenge implies something that requires effort, which in turn might imply uncertainty of outcome depending on input effort. Malone [29] argues that for something to be challenging, it first needs to be uncertain. Caillois ([6] has earlier argued that challenge is necessary for games to be enjoyable, which combined with Malone's argument implies that games must be uncertain to be challenging and to be enjoyable. However, this does not mean that something challenging has to be either uncertain nor enjoyable. Costikyan [8] gives Super Mario Bros. [47] as an example of a game with very little uncertainty that still manages to be enjoyable. There is never any uncertainty about where the player is supposed to go; it is always to the right to reach the castle. The enjoyment is instead derived from the challenge of overcoming the challenges and obstacles along the way. Likewise, there are games which are not particularly uncertain nor challenging but still manage to be enjoyable, such as Minecraft [33], in which the enjoyment is derived from building with blocks. Challenge can also come from competition [52], against the computer or against other players, as competitive elements engage players to seek triumph in a situation where there is uncertainty of outcome. Uncertainty can lead to engagement, which has been identified as a key concept in flow theory [11], where a person is described as totally immersed in an activity.

2.2 Turn-Based Games

Turn-based games are games in which players take turns performing actions, often one at a time [7]. Turn order usually alternates back and forth between players, but can also be decided by other factors, such as battle conditions or unit attributes [28]. Some turn-based games also contain mechanics that allow manipulation of turn order, often by delaying or preventing the other player's turn. Turn-based video games are often more complicated than traditional turn-based games, involving more rules and units due to the computational ability to handle complexity [7]. Battle systems play a defining role in many video games, as it is where players will spend a considerable amount of their time playing the game [28], and they can consist of a multitude of features and be of varying complexity.

2.2.1 Example of Turn-Based Game - Hearthstone

Hearthstone [21] is a digital collectible card game which makes use of turn-based gameplay. Players battle against each other by drawing cards at the start of their respective turns, and then playing cards from their hands during their turns. Players can hold up to 10 cards in their hand at a time, and each card costs between 0 and 10 resource points to play. Players can have one or two of the same card in their deck, and the game features (at the time of writing) 2456 unique cards, from which players build decks that consist of 30 cards, meaning that the number of possible decks is enormous. This creates uncertainty in that it is practically impossible to exactly predict which cards exist in the opponent's deck. However, some decks and combinations of cards might be more popular at times and therefore see more play than others, which players can become aware of. Another uncertainty comes from not knowing what cards the opponent holds in their hand or what they will play the

next turn. Some cards also have effects with random or chance-based effects, such as attacking a random target, creating another layer of uncertainty.

Figure 2.1: Hearthstone: Heroes of Warcraft [21].

2.2.2 Example of Turn-Based Game - Fire Emblem Game Series

Fire Emblem [15] is a TRPG series which features a complex battle system that makes use of grid-based battlefields. Players form teams with unique units, and command them around battlefields to defeat their opponents and achieve victory. The game encourages strategic planning and includes uncertainty by having fog of war present on some battlefields, or unknown reinforcements may arrive and force players to rethink their strategy. Players can try to figure out how the AI controlled units will act on their turn, but cannot be absolutely certain. Furthermore, the game shows battle forecasts before players decide to engage in battle, but success is not guaranteed. Units have a chance to hit, critically hit, or other chance-based effects that can change the outcome of the battle, forcing players to take these risks into calculation before making their moves.

Figure 2.2: Fire Emblem: Three Houses [16].

2.2.3 Example of Turn-Based Game - Pokémon Game Series

Pokémon [36] is a JRPG series which uses a turn-based battle system. The most popular multiplayer battle modes are 1-on-1, and 2-on-2. Players prepare by building and forming a team of 6 units, where 3 or 4 (depending on the battle mode) are taken into battle. Before a battle starts, players are shown a preview of their opponent's team, and can then decide which of their own units to bring. The battle system creates uncertainty through atomic turn-taking, meaning that turns are taken simultaneously, and selected moves are subsequently played out in an action phase. Uncertainty is also created through unknown information about the opponent's units, such as stats, moves, and items, requiring players to anticipate potential outcomes and carefully consider their own moves. Furthermore, the game features a type effectiveness system that makes moves deal varying amounts of damage against other unit types. In older games in the series, move effectiveness was hidden and players had to rely on their previous experience and knowledge about the game when making their decisions. However, in newer games this information is shown to players during move selection.

Figure 2.3: Pokémon Omega Ruby [38].

3
Theory

In this chapter, we define uncertainty, present identified sources of uncertainty, how curiosity is related to uncertainty, and guidelines which can be used to control learning from uncertainty. We also present recommendations on how turn-based battle systems can be designed to have strategic depth, and bring up difficulties in balancing turn-based gameplay. Lastly, we list heuristics that can be used to evaluate usability, as well as present a form which can be used to measure player uncertainty in games.

3.1 Uncertainty

Uncertainty is the opposite of certainty, and is defined as "a situation in which something is not known, or something that is not known or certain" by Cambridge Dictionary [13]. Uncertainty is the absence of certainty.
As aforementioned, uncertainty is an important factor for the enjoyment of video games [8]. However, if there is too much uncertainty present in a game, it can be detrimental to the enjoyment. If the uncertainty in a game is too high, players might quit because the game feels hopeless, whilst if the felt uncertainty is too low, the game quickly becomes boring [42]. Power et al. [41] suggest that uncertainty is a subjective experience, and that the state of a game is felt differently for players of varying experience and skill. A less experienced player will likely feel more uncertain in some situations than a more experienced player would. To create enjoyable games, it is therefore important to find the right amount and type of uncertainty [8].

3.1.1 Sources of Uncertainty

Costikyan [8] has identified 11 sources of uncertainty through analysis of a plethora of digital games:

- **Performative Uncertainty -** Encompasses uncertainty generated from the players physical performance in games, which can range from a computer input to physical prowess in a sport. In a first-person shooter game such as Doom [14], players need to aim and shoot at moving targets, which requires some physical skill in using the controls.
- **Solver's Uncertainty -** Encompasses puzzle-solving in games. The games Portal [39] and Portal 2 [40] have the player play as a test subject needing to pass through a number of chambers equipped with a weapon which allows them to create portals that can be used for transportation of themselves and

other objects between two points instantaneously. The games rely on puzzle solving skill more than any physical performance.

- **Player Uncertainty -** In multiplayer games, other players create uncertainty for each other. When playing against another player, there is no precise way of predicting how they will act. However, AI with a high level of unpredictability can also pass as a form of player uncertainty.
- **Randomness -** Games with dice and other random elements create uncertainty. There are multiple forms of randomness, some which are not really random in practice but suffice for all intents and purposes, such as random numbers generated by a computer or a die roll. A game where players draw cards would not be random in reality because the next card in the pile will have a set value, but from a player perspective it might seem random.
- **Analytic Complexity -** Games which require complex decision making generate uncertainty because players might not be able to fully comprehend the amount of possible outcomes. Using Chess as an example again, its complexity makes it impossible to predict every possible outcome of a move.
- **Hidden Information -** Some games hide information from players. The Fire Emblem game series [15] is an example of where parts of the battlefield is hidden initially from players, and revealed once explored. This specific instance of hidden information is called fog of war.
- **Narrative Anticipation -** In games with a narrative, the anticipation of the next turn of events creates uncertainty of what might happen. In games such as The Last of Us [48], the story is a source of enjoyment in itself, and its twists and turns keeps players interested.
- **Development Anticipation -** Encompasses uncertainty regarding release of future additional content for games. Games such as World of Warcraft [54] periodically receive updates and expansions which adds content to the game. This creates uncertainty for players about what will come next, and gives them an incentive to keep playing.
- **Schedule Uncertainty -** Games that regulate player progress in games by having them wait in real-time for in-game events. The uncertainty comes from players' own schedules and time-keeping abilities.
- **Uncertainty of Perception -** Encompasses uncertainty regarding player perception of what is going on in a game. In 3D-shooting games, players need to identify, aim, and shoot at enemies. This creates a perceptual challenge.
- **Malaby's Semiotic Contingency -** Encompasses past experiences and learnt meaning. There are symbols in games which players will most likely recognise from past experiences and can predict their meaning, such as heart-like shapes meaning life. According to Power et al. [42], Malaby's Semiotic Contingency refers to the "unpredictability of a meaning that accompanies attempts to interpret a game's outcome".

A study conducted by Abuhamdeh et al. [1] showed that games with high levels of outcome uncertainty lead to a more enjoyable experience, and that close games are more enjoyable than games where players significantly outperform their opponent. Succeeding in competitive games raises the enjoyment for players, but most of the

enjoyment comes from being engaged in a suspenseful activity where it feels uncertain whether they will succeed or fail [1]. Outcome uncertainty is high in close games where players' scores are relatively even, because it creates suspense. Abuhamdeh et al. [1] also mention another factor which affects enjoyment in games, perceived competence, which can counteract suspense. Perceived competence refers to how competent players perceives themselves to be. They argue that players who are low in perceived competence tend to prefer games with lower outcome uncertainty, where the chance of success is greater, whilst players who are high in perceived competence tend to prefer games with higher outcome uncertainty, which can lead to more suspense. However, their study revealed that the majority of players would rather play games with high suspense than games where they were high in perceived competence, pointing towards that balance and close games are important for the enjoyment of games. Furthermore, once the outcome of a game is certain, it quickly becomes uninteresting for players [27]. Therefore, games should strive to maintain outcome uncertainty until later stages in the game. Games also need to strike a balance between player skill and luck to reach an enjoyable amount of outcome uncertainty [46]. Games which depend highly on player skill might be exhausting, whilst games which depend on luck or randomness are likely to be perceived as unfair. For this reason, players should be given the freedom to select options that trade chances of success in exchange for a more certain but lesser outcome.

3.1.2 Curiosity and Uncertainty

Video games provide environments filled with uncertainty, and curiosity acts as a motivator for players to explore and fill in information gaps [8, 20]. To et al. [49] explain curiosity as a psychological state or personal trait with a preference for exploring uncertainty, where a state of curiosity can be created through different situations arising in video games, whilst curiosity as a trait relates to the inherent quality of peoples' personalities. To et al. [49] present examples of elements that games can include to evoke and stimulate different types of curiosity, which share similarities to Costikyan's sources of uncertainty [8].

- **Perceptual Curiosity -** Relates to peoples' senses and perception of the environment, and can be instigated in video games by information through audio such as music or sound effects, visual cues or sight of objects with hidden information, haptic feedback in controllers etc. Perceptual curiosity relates to Costikyan's uncertainty of perception and hidden information, as they are concerned with how players perceive the environment and obscured information in games.
- **Manipulatory Curiosity -** Relates to peoples' impulses to manipulate objects to understand them, and can be instigated in video games through interactive objects. It also involves exploration of controller buttons to understand the mapping between input and output. Manipulatory curiosity relates to Costikyan's Malaby's semiotic contingency, as they are concerned with players' past experiences and new learning.
- **Curiosity About the Complex or Ambiguous -** Relates to peoples' preferences for strategic depth and uncertainty, and can be instigated in video

games through customisation of game objects, or ambiguity about game states. Curiosity about the complex or ambiguous relates to Costikyan's analytic complexity, as they are concerned with players' decision making, ability to analyse complex situations, and calculate optimal outcomes.

- **Conceptual Curiosity -** Relates to peoples' desires to complete information gaps and form mental models, and can be instigated in video games through implementing information gaps about cause and effect in different game states, and hiding details of game mechanics. Conceptual curiosity partly relates to Costikyan's hidden information, as they are concerned with players' information seeking to resolve uncertainty.
- **Adjustive-Reactive Curiosity -** Relates to how peoples' expectations correspond to the actual behaviour of objects in their environment, and can be instigated in video games through incentives to learn the internal logic, since rules are different from other games and real life. Adjustive-reactive curiosity relates to Costikyan's Malaby's semiotic contingency, as they are concerned with how players interpret meaning.

3.1.3 Learning and Uncertainty

Players are constantly learning in video games [42]. They form hypotheses and create strategies that they test through trial and error to come up with refined ones, and they often repeat this process until they are successful. Failure is a key component in many video games [24, 17], and the possibility of failure creates challenges from which players can learn about the game, themselves, or about other players. Howard-Jones & Demetriou [23] highlight the positive benefits of combining learning and uncertainty in video games, and a study that they conducted suggests that uncertainty in video games can create a positive emotional experience that improves engagement and memory recall. Ozcelik et al. [34] argue that video games provide a fun learning environment and that uncertainty has a positive impact on motivation. However, uncertainty as a concept is often not positively associated with learning, wherefore Hock-koon [22] has identified three sources of uncertainty and created corresponding guidelines that can be used to help people learn when playing video games.

- The first source of uncertainty mentions the possibility of a game to give players the solution to a problem, and the guideline is: "if you want the player to learn how to find an answer, you should not give him or her that answer".
- The second source of uncertainty highlights the possibility that players can find alternate ways to an answer, other than what is taught by the game, and the guideline is: "if you want the player to learn how to find an answer in a specific way or a set of specific ways, you should not allow any other way of finding it".
- The third source of uncertainty differentiates between players being able to use something and understanding how it works, and the guideline is: "if you want the player to learn how to use something, you can make him or her use

> it, but if you want the player to learn how something works, you should not limit the evaluation to simply the use of this thing".

Preferred difficulty of challenges vary greatly between players and they also have different approaches to failure [17]. Some players might approach failure positively, seeing it as a learning process, whilst others may easily become frustrated. Players who are new to strategy games try to understand basic concepts, and they use their limited knowledge to make decisions [31]. These decisions are often not optimal nor rational, but rather guesses based on available information and time. Furthermore, the more uncertainty there is about available information, the more likely players are to make risky decisions [26]. Strategies that are effective and simple, making it possible to win whilst still allowing the player to improve, are well suited for new players since winning provides enjoyment, and improving leads to a sense of accomplishment [31]. In games where even basic strategies are difficult to learn, new players may easily feel overwhelmed. Players want to compete against others who are on the same skill level, and once they improve and learn more about the game they can move on to previously intimidating strategies and take on more experienced opponents.

3.2 Game Design

To design turn-based battle systems, it is important to understand what defines and characterises them by looking at previously successful examples of turn-based games, exploring what strategic options they offer, and considering how they are balanced to create enjoyable experiences.

3.2.1 Turn-Based Battle Systems

According to a study conducted by Mäkelä & Schmidt [28], turn-based combat systems are perceived as well suited for party-based games with several playable characters, because players have full control of each party member's actions. Furthermore, turn-based games appear to be appreciated for their complexity and tactical depth, where strategic thinking is prioritised over physical performance. Turn-based games often offer a lot of customisation options and battle actions, and also allow players time to consider their options and plan out their next move, which results in a relaxed playstyle. However, in their study it was also expressed that certain turn-based games lack challenge, and that it is not necessary to deploy advanced tactics available found in the game in order to succeed. Turn-based battle systems also received criticism for being slow and boring due to frequently forcing lengthy battles with a lot of waiting time on players. Therefore, Mäkelä & Schmidt [28] propose that the number of unchallenging fights should be limited, by being able to skip them or avoid them altogether. They also suggest that there should be an option to skip or fast forward through turns, whilst also keeping animations concise.

3.2.2 Strategic Depth

In order to create attractive games with strategic depth, Apeldoorn & Volz [2] suggest that games should aim to follow game developer Blizzard's principle: "easy to learn, hard to master". However, it is difficult to define exactly what strategic depth entails. According to Apeldoorn & Volz [2], games can also follow the principles of the japanese word *shibui* (meaning simple and elegant aesthetics) to "combine outer simplicity with inner depth". As an example they bring up having a small amount of rules, since more rules bring about higher complexity, whilst allowing multiple viable strategies.

Well established collectible card games, such as Magic the Gathering, share strategic depth similarities with games in other genres [4], such as turn-based strategy games. Collectible card games are often high in complexity due to their advanced rulesets, but they are also renowned for their wide variety of strategic options offered through different team formations and unit combinations. Units are among the most important elements in strategy games [27], and they can possess unique properties, increasing the amount of possible outcomes, and therefore also the depth of games. Units are often synergistic with each other and cannot be independently evaluated, but are instead dependent on the context in which they will be used [4].

Games with party-based combat and multiple units are inherently more complex as the amount of possible outcomes increases [55]. Furthermore, battle systems are made several layers more complex by adding actions beyond that of simple "attack" (deal damage) and "defend" (prevent damage). Examples of other actions can be "heal" (restore health), "inflict status" (impede opponents' ability to act), or "use item" (effect depending on item). Use of these actions can have a significant impact on the game state and outcome, and require careful consideration and decision-making to weigh potential cost-benefit trade-offs (use of these actions equals a missed attack opportunity). Use of certain actions may be limited to specific units in order to make them unique [27], and decision-making might also be influenced by how important a particular unit is to protect for their strategy [55]. Furthermore, decision-making is made even more difficult if the opponent's units or actions are unknown to the player, creating potential for players to take advantage of psychological games, such as bluffing and anticipation of the opponent's actions, which adds an additional layer of depth to the gameplay [46]. Lastly, actions such as "inflict status" need to have some constraints to them to ensure that they do not trivialise combat through mindless use [55]. They can for example use finite resources, be limited to single target use, or have reduced chance of success or potency when used multiple times in succession.

Game designer Geoff Engelstein argues that randomness can be used to either support strategic planning, or undermine it, depending on which type of randomness that is present [56]. **Input randomness** is randomness that happens before players select their actions, which allows them to make informed decisions based on available information. **Output randomness** is randomness that happens after players select their actions, which disregards player skill and can disrupt player strategies by directly affecting the outcome. However, video game journalist Mark Brown argues

that the right amount of output randomness can improve games and force players to consider risks. In turn-based games where players are able to strategically plan for an abundance of possible outcomes, player turns can have time limits to make the game more exciting [5], forcing faster decision making, whilst also making players more prone to make mistakes. The more time players are provided with, the more the feeling of uncertainty decreases [41].

3.2.3 Game Balance

Game balancing includes delicate tweaking of game elements to create a game where there is not one superior way of play, but rather a game where many different strategies are viable [25]. Players will often look to use the current most effective strategies, hence why it is important to consider the changing metagame when balancing games. An issue with turn-based games, such as Chess, is balancing the game so that the player who goes first is not automatically put in an advantageous or disadvantageous position [5]. In Chess, white goes first and black goes second, and the general consensus between players is that white is favoured because of this. In the turn-based digital card game Hearthstone [21], the player who goes second is given an extra card in an attempt to offset the inequality of having to play reactively. The extra card allows the player to gain an additional action point on the turn of their choosing, and the card itself can be used to enable combos which can greatly impact the game state. In the turn-based game series Pokémon [36] player turns are taken atomically and subsequently played out during an action phase, where unit attributes decide who goes first, removing the need to balance this particular aspect of turn-based games. Still, it is generally preferable to go first, but this way it is up to player customisation and preferred playstyle.

3.3 Formative Evaluation

Formative evaluation can be used to to improve a design during formative stages of development, by using different methods for evaluation. Cost-effective expert methods, such as heuristics, can be applied to identify usability flaws in a design before conducting test sessions with other user research methods.

3.3.1 Heuristics

Pinelle et al. [35] have developed a set of heuristics for usability in game design meant to be used during the formative stages of development, for usability testing, and evaluating complete games:

1. Provide consistent responses to the user's actions.
2. Allow users to customise video and audio settings, difficulty and game speed.
3. Provide predictable and reasonable behaviour for computer controlled units.
4. Provide unobstructed views that are appropriate for the user's current actions.
5. Allow users to skip non-playable and frequently repeated content.
6. Provide intuitive and customisable input mappings.

7. Provide controls that are easy to manage, and that have an appropriate level of sensitivity and responsiveness.
8. Provide users with information on game status.
9. Provide instructions, training, and help.
10. Provide visual representations that are easy to interpret and that minimise the need for micromanagement.

The heuristics do not cover gameplay design, but focus on the presentation of games and usability. The heuristics can be used alongside Costikyan's sources of uncertainty [8] to act as guidelines about presentation. As shown by Costikyan, uncertainty largely depends on how information is presented to the player, and if that is done in a lacking manner, the player's experience might be negatively affected. Malone's heuristics for enjoyable interfaces [29] could be used in tangent, or combined with these usability heuristics. Malone's heuristics were not developed to focus on games themselves, but for interfaces in general, but used educational games as part of the basis of the study. The heuristics are categorised as: Challenge, Fantasy, and Curiosity. As previously mentioned, these heuristics are for designing enjoyable interfaces, but Malone takes the relation between enjoyment and uncertainty into account in a way that corresponds with Costikyan's and Caillois's reasoning:

Challenge

1. *Goal.* Is there a clear goal in the activity? Does the interface provide performance feedback about how close the user is to achieving the goal?
2. *Uncertain Outcome.* Is the outcome of reaching the goal uncertain?
   (a) Does the activity have a variable difficulty level? For example, does the interface have successive layers of complexity?
   (b) Does the activity have multiple level goals? For example, does the interface include score-keeping?

Fantasy

1. Does this interface embody emotionally appealing fantasies?
2. Does the interface embody metaphors with physical or other systems that the user already understands?

Curiosity

1. Does the activity provide an optimal level of informational complexity?
   (a) Does the interface use audio and visual effects: (a) as decoration, (b) to enhance fantasy, and (c) as a representation system?
   (b) Does the interface use randomness in a way that adds variety without making tools unreliable?
   (c) Does the interface use humour appropriately?
2. Does the interface capitalise on the users' desire to have "well-formed" knowledge structures? Does it introduce new information when users see that their existing knowledge is: (1) incomplete, (2) inconsistent, or (3) unparsimonious?

3.3.2 Player Uncertainty in Games Scale (PUGS)

To measure the feeling of uncertainty, Power et al. [41] have developed and refined a 24 item scale, Player Uncertainty in Games Scale (PUGS). The items are divided into sub-scales and range from 1 to 5. The points of measurement are meant to give designers a quantitative way of measuring uncertainty in games, and gives them an overview of how a game is experienced.

Sub-Scales	**Questionnaire Items**	**Scoring**
Decision Making	1. My actions were not influencing the outcome of the game.	Score
	2. I could not choose which actions were better	Score
	3. I could not say if the game had more than one outcome.	Score
	4. I did not know how my performance influenced the outcome.	Score
	5. I did not know how the outcome(s) were connected to what I did.	Score
Exploration	6. I needed to discover things to make progress.	Score
	7. I needed to explore in order to know what to do next.	Score
Taking Action	8. I felt I was stuck during the game.	Score
	9. I found it difficult to keep track of all elements in the game.	Score
	10. The game mechanics were overwhelming.	Score
	11. I think what I was doing in the game was not right.	Score
	12. I was not confident that I could perform some actions in the game.	Score
	13. The actions I had to perform were too demanding for my skills.	Score
	14. I struggled to do the right actions.	Score
Problem Solving	15. I knew how each goal could be achieved.	Reverse
	15. I found it difficult to keep track of all elements in the game.	Reverse
	16. I understood the game mechanics.	Reverse
	17. I knew how to play the game when I started.	Reverse
	18. I often felt lost.	Score
	19. I could find the solutions required for achieving the goals of the game.	Reverse
External	15. I knew how each goal could be achieved.	Score
	20. The game was unfair.	Score
	21. Unpredictable random elements were influencing my performance.	Score
	22. I was relying on chance in the game.	Score
	23. Random elements in the game were preventing me from achieving my goal.	Score
	24. The outcome of my actions was mainly influenced by chance.	Score

Table 3.1: Player Uncertainty in Games Scale (PUGS) [41].

4
Methodology

In this chapter, we go through different approaches to the design and development process, and present methods and software we planned to use.

4.1 Interaction Design

Preece et al. [43] divide the process of interaction design into four ”basic activities”:

1. Establishing Requirements
2. Designing Alternatives
3. Prototyping
4. Evaluating

Preece et al. [43] highlight evaluation as the “heart” of the design process. During evaluation, designers test whether a prototype meets the requirements set in the beginning of the process. It also highlights the importance of users in the design process, and that designers should involve users through user studies, participatory design and co-design activities. This way, designers can gain new perspectives and challenge their existing assumptions about the target group.

4.1.1 Research Through Design

The aim of the project is to design a prototype through iteration and research. The approach is research through design [19], which means that the process is led and driven by design. An iterative design process gives more room for evaluation and adaptation, and in that way will with every iteration generate new knowledge. Combining this with a design driven approach will allow for evaluation and exploration of more concepts than it would with a linear approach. Research through design corresponds well with how Preece et al. [43] describe the design process; it is to be repeated and heavily revolves around evaluation and designing alternatives.

4.1.2 Iterative Design

Preece et al. [43] state that the design process is an iterative process. The iterative structure, along with the emphasis on evaluation, allows for rapid adaptation of a design. The iterative design process requires designers to ideate and develop new prototypes every iteration and evaluate them. During each iteration, regardless of

where in the development the product is [18], designers will be able to quickly and cost-effectively test for new ideas.

One approach to iterative design is the double diamond model [10]. The double diamond model is divided into two "diamonds", as the name suggests. Each diamond consists of a diverging and a converging phase. During the diverging phase designers broadly explore a problem and come up with several ideas, and during the converging phase, they narrow it down to a few ideas and try to concretise the solution. The "diamonds" are meant to be repeated in their entirety throughout the design process. Like the design process Preece et al. [43] defined, the double diamond model is also divided into four part according the the British Design Council [10]:

1. Discover (Diverge)
2. Define (Converge)
3. Develop (Diverge)
4. Deliver (Converge)

The first steps, discover and define, corresponds to the first step in Preece's process; establishing requirements. It is during these steps the designers research and get to know the problem, where user research is conducted, and discover new problems. Then the designers define the challenge, set requirements, and converge their ideas into a concrete problem. The last steps are reminiscent of step 3 and 4, and a little bit of 2, of Preece's activities. During the third step, the designers develop new ideas for solutions to the defined problem. During the last step, the designers prototype and test ideas at a smaller scale and evaluate which ones fulfil the requirements and which ones do not [10].

4.2 Agile Software Development and Scrum

Agile software development is a way of working in software development. It is an iterative approach to development that is meant to be more "agile" and able to adapt to changes, and to focus on smaller releases. In contrast to the traditional waterfall model of software development which focuses on larger, more scarce releases and less agile and iterative, agile allows for continuous evaluation between the smaller iteration which then gives room for greater adaptation, overview and evaluation [3].

Scrum is a framework that incorporates the Agile methodology of managing projects with an emphasis on software development [45]. Scrum works as an iterative work process, where each iteration is called a sprint. The contents and duration of a sprint are defined with a collaboratively made plan, during which the sprint time is set, what will be done, and how it should be done. One defining, or "fundamental", aspect of scrum is, according to Schwaber & Sutherland, the team structure. A scrum team often consists of a product owner, a scrum master, and a set of developers. The developer's role, in the scope of scrum, is to plan out the sprints, set quality standards and adhere to them. Then it is up to the scrum master to coach the developers and keep them on track. The scrum master might manage several teams and be responsible for the team's effectiveness. Lastly, the product owner

tasks vary widely across organisations, but is generally responsible for the team's adherence to the product goals [45].

4.3 Prototyping

Prototyping can be divided into two parts: low and high fidelity prototyping. Low fidelity prototyping is usually done quickly and cheaply and is useful for testing out new ideas and exploring concepts. Preece et al. [43] categorises sketching and storyboarding as low fidelity prototyping methods, where designers can try to imagine how a product or feature can be used and how it should be used, and in that way explore potential problems and solutions. We therefore categorise paper prototyping as low fidelity prototyping, as it uses a composition of low fidelity sketches. High fidelity prototyping is closer to the final product and offers more functionality than lower fidelity prototypes [43].

4.4 Testing

Preece et al. [43] have identified three broad types of evaluations: controlled settings involving users, natural settings involving users, and any settings not involving users. Controlled settings involving users, as the name implies, allow designers a greater deal of control over what the test participants experience. In a controlled setting designers can more closely guide the participants towards the desired outcome. Natural settings involving users describes field studies, and occurs in settings that are natural to participants. Any setting not involving users requires designers to step in as test participants, and evaluate the prototype themselves, which is also called expert evaluation. One downside with this approach is that designers, with their in-depth knowledge of their prototype, will experience the prototype differently from how an ordinary user would. A prototype's weaknesses might not be apparent to them. Preece et al. [43] argue for choosing participants based on whether they are a future user or not. It is also important to not test the same feature on the same test participant too many times, as it might diminish the value through experience.

4.5 Interviews

Cote & Raz [9] argue that a good interviewer should create a relaxed atmosphere and put participants at ease. The goal of the interview should be clear to participants, and Cote & Raz suggest that the interview is initiated with an explanation of the goal and simple low stake questions. Then, during heavier questions, interviewers should provoke thought in participants but not impose their own ideas and ideals on them. Preece et al. [43] state that interviewers should avoid assuming thoughts and feelings, and instead let participants express those themselves.

5
Planning

We planned to produce low fidelity paper prototypes and a high fidelity prototype of a turn-based battle system in the game engine Unity [51], where we would implement and test different types of uncertainty. The high fidelity prototype would be written in the programming language C# (C-Sharp). To handle version control, we would use Git, a widely used version control system. We chose Git because it is one of the most popular version control systems. Because of past experiences, we knew that some parts of a Unity project that are prone to large changes might not communicate well with the version control and cause conflicts. We therefore decided to split up tasks and separate our commits so that they would not overlap and cause problems. This would also allow us to work in parallel, without having to worry about causing problems down the line. We would also implement another good praxis of testing our commits often before committing them to prevent faulty code. The prototype would include general systems for implementing different types of units and moves, and it should be easy to add new scripts to existing entities in Unity, so that we could quickly add and remove functionality in the prototype. The prototype would not be a finished product, but would serve as a way to explore uncertainty. The prototype should be simple and only contain necessary mechanics to have a working turn-based battle system, which could be used test the sources of uncertainty. Any other mechanics were optional, and would take valuable time to implement. Furthermore, we did not aim to make a fun or enjoyable prototype. Those attributes would simply be bonuses.

Out of the sources of uncertainty defined by Costikyan [8] (See 3.1.1), we planned to explore performative uncertainty, player uncertainty, randomness, hidden information, and uncertainty of perception. We estimated that they were within the scope of the project, and could realistically be implemented within the time span. Some of the other sources of uncertainty, such as narrative uncertainty, and analytic complexity, would likely demand larger amounts of time and effort to implement properly. Narrative uncertainty would require us to write a story to create uncertainty, and analytic complexity would require us to construct a complex gameplay system with too many outcomes for the player to compute. development anticipation, and schedule uncertainty, are sources of uncertainty that we considered to be outside the scope of the project, as they depend on external out-of-game influences.

We planned to use convenience sampling to recruit test participants, distinguishing them by how experienced they identify themselves to be with playing video games. In that way we would be able to examine if something that is certain for one of the groups is experienced differently by the other. Something that an experienced player

might recognise and be certain of might be uncertain for someone inexperienced. We would also act as test participants ourselves and evaluate the prototypes with the use of heuristics. We planned to test with two participants at a time, where they would play against each other, fill out a form with selected items from PUGS after gameplay tests, and we would then conduct a semi-structured interview in a joint manner where they could discuss their experiences. The goal of these interviews would generally be to determine what causes the participant to feel uncertainty and to what degree. Participant would also be asked about what other feelings they might have surrounding the uncertainty, such as if they enjoyed it in some way or not. This would be useful because of the past stated relation between uncertainty and enjoyment, and could act as a measurement of how successful a source of uncertainty is. It could also be that participants would have a different view of what is uncertainty and not. Therefore, uncertainty would have to be clearly defined to participants. A dilemma that could occur would be explaining the source of uncertainty to participants before or after the gameplay test. If introduced before the test they could be more attentive to details, but they would risk becoming biased, and if introduced after the gameplay test they could rethink their experience and adapt their answers accordingly. In the PUGS form (See 3.1), we decided to remove the sub-scale 'Exploration', as it concerns exploration related to movement in games, which would not exist in our turn-based battle system.

5.1 Sprint Layout

In this project, we planned to have a work process inspired by the scrum framework. This would help us set up clear tasks, goals, and assist us in structuring the work for easier management and documentation. However, we would mostly act as developers and share the responsibility between us, whilst the role of product owner would be left vacant, or filled by our supervisor. We would not completely follow the scrum role network; as we were only two developers. The role structure, which is fundamental to scrum, would force us to be flexible in our roles, adapt and work outside the framework. In other words, we planned to make use of the structure that comes with the agile software development framework scrum, however, because of the project focus and scale, we would integrate it with the double diamond, a process closer to interaction design.

Each sprint duration could vary slightly in time depending on tasks, but the standard would be 2 work weeks. Each iteration, or sprint, would consist of an ideation phase, an implementation phase, and an evaluation phase. During the ideation phase we would make use of paper sketches, as it is quick and allows us to play around with our ideas and test them out on the fly. With paper sketches we could make templates, and generic shapes, for different UI elements, and put them together in ways we wanted to test. Waern & Back [53] argue that pen-and-paper prototyping is a good way of stripping down a game to its bare essentials. This will force us to break down our ideas in smaller pieces and think about them individually, before they can be put together again. This way, we could explore defined problems and solutions as well as

find new ones. Inspired by the double diamond (The British Design Council, 2015), a sprint would consist of one diverging stage (ideation), and two converging stages (implementation and evaluation). However, the implementation phase corresponds with the define and develop stages in the double diamond, and the implementation stage will serve as a way for us to diverge, as well as converge.

- **Sprint planning and ideation (Diverge) - 10-20%**. At first we identify problems, tasks and goals with the current state of the prototypes, then we ideate solutions and more concrete tasks for us to solve. Lastly, we decide what we can realistically implement during a set time period.
- **Implementation (Diverge/Converge) - 50-70%**. During the implementation stage we aim to create a minimum viable product that fulfils this sprint's goals, and is ready to be tested. During this stage we might also run into problems we had not foreseen and have to solve, which makes this stage a mix of diverging and converging thinking.
- **Testing (Converge) - 20-30%**. Depending on what is implemented, we evaluate it with either test participants or by ourselves. Here we ensure that the prototype meets our expectations and previously set goals. Then we identify new or old problems that have not yet been fixed, with the prototype and prepare for the next sprint.

5.2 Time Plan

Figure 5.1: Initial version of our Gantt schedule.

Here we provide a Gantt schedule of how we planned to divide the time into sprints with different foci. When we decided on the order to test uncertainties, we created a time plan with the digital prototype in mind. We placed sources of uncertainty such as randomness and hidden information in the first sprints since they would play fundamental roles in the battle system. Player uncertainty was placed in the middle because of its flexibility and dependency on people, rather than technical aspects. Performative uncertainty and uncertainty of perception felt more suited to be tested in a digital environment, wherefore they were placed in the last sprints, where the digital prototype would be developed enough to test with.

5.3 Ethical Issues

The prototypes to be used in the project would likely make use of some dark gameplay design patterns, as we potentially would have to trick participants in order to make them feel uncertain. Dark gameplay patterns are defined as "[...] something that is deliberately added to a game to cause an unwanted negative experience for the player with a positive outcome for the game developer." according to DarkPattern.games [12], a web page dedicated to documenting dark patterns in games. In our case, we would implement functionality to measure player experience to benefit our project, and not the test participants.

The final prototype would be digital and controlled with keyboard and mouse, which could cause accessibility problems, as some people would not be able to use it. The prototype was not meant to be a finished product, but rather a tool to explore different aspects of uncertainty, but still, we tried to take accessibility into consideration. Because, when designing solutions for one type of user, we should actually design for everyone [32]. Another issue was that we did not have contact with people, nor organisations well versed in accessibility, nor did we contact potential test participants living with disabilities. The final prototype would optimally require minimal physical effort to use, which could alleviate some potential accessibility problems.

6
Execution and Process

This chapter shows how a literature study was conducted and summarised into a set of initial guidelines, how the process was re-planned, the process of creating prototypes and testing sources of uncertainty with participants. Paper prototypes were used to test in early stages of the process, whilst a digital prototype was being developed simultaneously and used to test in mid and late stages of the process. The process is not presented chronologically, but separately as testing with paper prototypes, followed by implementation and testing with a digital prototype, where their place in time is indicated by the sprint number in the titles. The test sessions were formative and provided us with insights, which were applied and implemented as concrete game changes, as well as converted into guidelines.

6.1 Literature Study

The literature study was conducted at the start of the project over the course of 4 weeks, where methodical searching and sorting was utilised to handpick literature to use in the project. Some literature was of greater importance than others, notably Costikyan's book 'Uncertainty in Games' [8], which served as a basis and foundation for the project. The literature study was split up into four distinct phases. The first phase was an initial search that included a broad search, which aimed to discover relevant literature for the project. Specific keywords (See 6.1.) were used to search in the scientific database Google Scholar. Each keyword search continued over multiple pages of search results, and ended when no new discoveries were made. In addition to keyword searches, a review was conducted of the proceedings from 2006-2021 in the annual IEEE Symposium/Conference on Computational Intelligence and Games (CIG), now called IEEE Conference on Games (CoG). Literature that was deemed relevant in this phase was saved in a list that underwent further sorting.

Database	**Keywords**	**Literature**
Google Scholar	video games uncertainty	51
	video games uncertainty design	22
	video games design	3
	turn-based video games	9
	turn-based battle	3
	turn-based combat	9
IEEE CIG/CoG	-	27

Table 6.1: Results of the initial literature search.

The second phase was sorting by reading abstract, introduction, and conclusion to determine which of the literature could be used in the project and identify in what area. In cases where we were unsure whether or not we should include a piece of literature, we judged the impact it had on the field by looking at the year published, place of publication, and number of citations. The third phase was sorting by reading most of the content in the remaining literature. Sorting narrowed down the list of literature considerably, making the project more manageable and focused. The fourth phase was a backward and forward search where works cited in the literature, as well as works that had cited the literature, was reviewed. The backward and forward search was generative and led to discoveries of important literature that was not identified during the initial search. After the sorting and backward and forward search, the remaining literature was down to 35. Additional literature, such as course literature, was added but not reported in the findings.

6.2 Initial Guidelines

Based on the literature study findings presented in chapter 2, and chapter 3, a set of initial guidelines were formed to aid in designing for uncertainty in a turn-based battle system. The guidelines were placed into categories of one of the five selected aspects of uncertainty; randomness, hidden information, player uncertainty, performative uncertainty, uncertainty of perception, or into a separate category called outcome uncertainty, and were updated continuously over the course of the project. When designing for uncertainty in turn-based battle systems in multiplayer video games, **consider...:**

Randomness

- Having chance-based events happen at the start of player turns to force players to rethink their strategic plans (input randomness).
- Having chance-based outcomes to have players take risks into account when making their moves (output randomness).
- Having selectable options with varying amounts of randomness where the reward reflects the risk involved (output randomness).

Hidden information

- Hiding information from players and obscuring details of game mechanics to create information gaps for players to explore and fill in.
- How information is learned by players and how much information players need to have in order to use or understand game elements.

Player uncertainty

- Having plenty of viable units, moves, and strategies to create uncertainty through variety.
- Having mechanics that can manipulate turn order to create uncertainty.

Performative uncertainty

- Having elements that require dexterity and physical input to add challenge.

Uncertainty of perception

- Using auditory or visual cues to instigate player curiosity.

Outcome uncertainty

- Balancing the game so that there does not exist one dominant strategy which is more effective than all others.
- Maintaining outcome uncertainty until later stages to preserve interest in the game.

6.3 Re-planning

During the earlier design sprints, we realised that the creation of the digital prototype would take longer than anticipated, and we had to re-plan because of this. We still created and tested the paper prototypes as planned, but pushed the digital prototype testing further along in the project. However, the delay in digital prototype testing did not impact the project negatively, and also provided us with insights about from the paper prototype testing, which could be used in the digital prototype. During the paper prototype testing we came to the realisation that uncertainty of perception was a source of uncertainty best suited to be tested exclusively in a digital environment, where audio and visual elements could work together harmoniously. Hence, we updated the Gantt schedule to accommodate for the change in planning.

Figure 6.1: Updated version of our Gantt schedule.

6.4 Paper Prototype Testing - Sprint 1-4

Low fidelity paper prototypes were created to test a variety of elements from the different sources of uncertainty. In order to create a basic battle system with core gameplay and mechanics, upon which further elements could be added, the process began with a concept creation phase which included sketching and looking at how existing multiplayer video games handle turn-based battle system elements.

The paper prototype made use of relatively simple gameplay which incorporated different elements from the sources of uncertainty. In the earliest and most basic version of the paper prototype each player had access to 3 units each, and players needed to knock out the all of the opponent's units to win. Units had the same amount of HP (100 HP), and could each perform an action per player turn. The actions units could take were attack, defend, or use a move. Attack dealt 25 damage, defend negated attacks and moves against the unit on that turn, and moves could deal a varying amount of damage, apply status effects, or heal units. Moves were unique actions and written on cards distributed to both players. To attack with units players would place a red attack indicator between the selected unit and the target of the attack. To defend players would simply place a shield next to the unit they wished to defend with. To perform a move players would place a move card next to the target of the move. If a status effect was applied, beads of varying colours were placed on the affected unit to clarify the type of status effect (orange = taking damage over time (DOT), purple = reduced chance to hit, black = unable to act), as well as to keep track of how many turns remained of them.

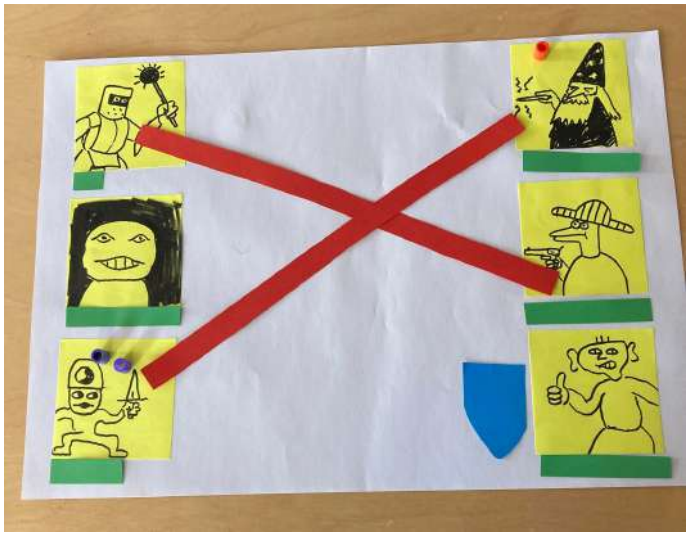

Figure 6.2: Early version of a paper prototype.

At the start of each sprint, focus shifted to a new source of uncertainty with an ideation phase about different ways to implement and test elements of uncertainty in the prototype. The elements implemented were either elements mentioned in literature, elements found in other games, or original elements that fit the source of uncertainty. The test sessions were mainly conducted with participants that

were recruited on location based on availability. The test sessions took place on a university campus, where most of the participants had a background in technology. Participants were asked to rate their previous experience playing video games on a scale from 1-5, where 1 = not a lot of experience, 2 = below average experience, 3 = average experience, 4 = above average experience, and 5 = a lot of experience, as we wanted to compare how previous experience impacted the experience of uncertainty in the battle system. For the full data set, see Appendix A.

6.4.1 Testing Randomness - Sprint 1

In the first version of tests with a paper prototype we focused on randomness as the source of uncertainty. During the ideation phase about how to implement and test randomness in the prototype we identified the following elements:

Input randomness

- Chance to start each turn (a coin flip decided which player went first).
- Get new moves each turn (players were dealt 3 random moves from a total pool of 10 at the start of the turn. Unused moves were discarded at the end of the turn).

Output randomness

- Chance to hit (Attack had a 50% chance to hit and moves had an individual chance to hit).
- Chance to critically hit (Attack and moves had a 50% chance to critically hit and deal 200% damage).
- Random turn duration on status effects (status effects lasted for 0-3 turns).

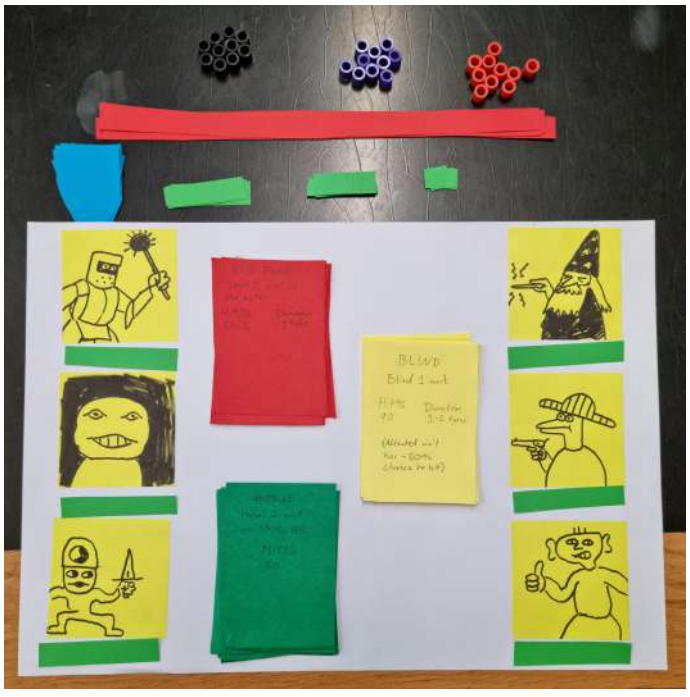

Figure 6.3: Paper prototype used to test randomness.

2 gameplay tests were conducted on separate occasions. The tests lasted about 50 minutes each, where 5 minutes were spent explaining the rules, 30 minutes playing the game, and 15 minutes for questions and a follow-up discussion.

Gameplay test 1 summary
In gameplay test 1, the participants were 2 men, who both had a lot of previous experience playing video games.

The participants agreed that having a chance to start each turn made it difficult to strategically plan for the next turn, and that it interacted weirdly with mechanics, such as defend. They also thought that getting a new set of random moves each turn was fun and created gameplay variation, but that it would be better if units were more unique and had their own pools of moves. 50% chance to hit with attacks was seen as too low, and caused a lot of frustration for the participants. They expressed that it was difficult to make decisions when the chance to hit was so low, and in their minds missing attacks should be a rare occurrence and seen as something unlucky. Conversely, the same thing applied to chance to critically hit, where 50% was seen as too high. Critical hits were both a source of fun and frustration for the participants, depending on if they dealt the critical hit or were on the receiving end of it. Furthermore, they thought that random turn duration on status effects were too unreliable since there was a huge difference between status effects lasting 0 or 3 turns. The participants also expressed that status effects preventing them from being able to act was purely frustrating and did not add any fun to the battle system. Lastly, the participants discussed if it was worth trading an attack opportunity to defend, where the consensus seemed to be that it was not.

Changes made after gameplay test 1
Tweaked randomness
- Base chance to hit with attacks increased from 50% to 90%.
- Base chance to critically hit with attacks and moves reduced from 50% to 25%.
- Random turn duration on status effects changed from 0-3 to 1-2.
- New moves each turn changed from "3 random moves from a total pool of 10" to "1 random move of each type from separate pools of 6".

Added moves
- Added more moves.
- Added move types (damage, status, and heal).
- Added moves that trade chance to hit for damage and vice versa.
- Added moves that can remove status effects.

Reworked mechanics
- Defend: Now applies a lasting effect to the selected unit that blocks the next attack or move against it.

Gameplay test 2 summary
In gameplay test 2, the participants were 2 men, who both had a lot of previous experience playing video games.

The participants thought it was fun that they got new moves each turn, but they also pointed out that heal moves were redundant on the first turn since no units had taken any damage at that point. They expressed that attacks now felt reliable, and that they would use them to knock out units on low HP, whilst going for higher damaging moves with less chance to hit on units on high HP, as the potential reward was greater. With the change to chance to critically hit, the participants saw critical hits as a welcome surprise, rather than a relied upon occurrence. Furthermore, they preferred DOT status effects over other status effects, and agreed that it was more fun to deal damage than to control and stall. Again, the participants did not think it was worth it to trade an attack opportunity to defend, and argued that offence is the best defence.

Changes made after gameplay test 2
Tweaked randomness
- Base chance to critically hit with attacks reduced from 25% to 10%.
- Damage of critical hits reduced from 200% to 125%.

Updated guidelines for randomness
Following the gameplay test sessions, the summaries were used to update the initial guidelines for randomness. When designing for uncertainty in turn-based battle systems in multiplayer video games, **consider...:**

- Having random effects happen at the start of player turns, as it enforces ongoing strategic planning and creates gameplay variation (input randomness).
- Having high chance of success on certain actions, where failure is seen as something unlucky, as it allows players to make more reliable strategic plans (output randomness).
- Having low chance of success on secondary effects on actions, where occurrence is seen as a welcome surprise rather than a relied upon effect, as it can increase enjoyment for players. Conversely however, it can also increase frustration for opposing players (output randomness).
- Having selectable actions with varying amounts of randomness, where players can observe the game state and thereafter decide the risk and reward involved (output randomness).

6.4.2 Testing Hidden Information - Sprint 2

In the second version of tests with a paper prototype we focused on hidden information as the source of uncertainty. During the ideation phase about how to implement and test hidden information in the prototype we identified the following elements:

- Battlefield conditions (weather changed each turn: normal - no effect, heat - all units lose 25 HP at the end of the turn, rain - all attacks and moves have - 20% chance to hit, hail - all attacks and moves deal + 25 damage).
- Hiding move information (damage, chance to hit, chance to critically hit).
- Hiding unit status information (type of status effect, and turns remaining).
- Hiding opponent unit information (HP, available moves).

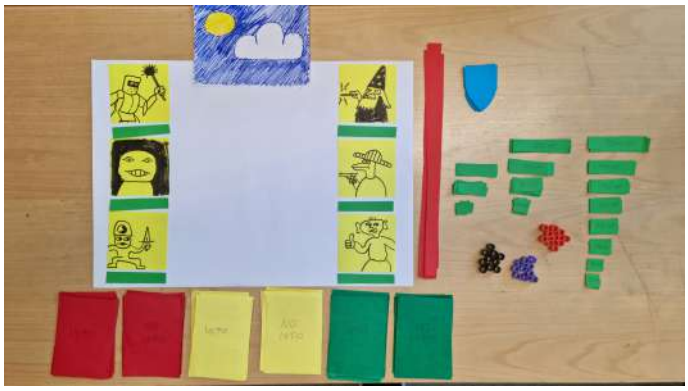

Figure 6.4: Paper prototype used to test hidden information.

1 gameplay test was conducted, but split up into 2 parts. In the first part information was hidden from the participants, and in the second part information was revealed to them. Weather cards were created and introduced at the start of each turn, but their effect was not explained to the participants in the first phase of the test. Duplicates of moves were also created that contained little to no information, which were swapped out in the second part of the test. Furthermore, both players had the HP of 1 of their units increased from 100 to 200. This change was meant to test how participants perceived equally sized health bars and amount of HP. The test lasted about 80 minutes, where 5 minutes were spent explaining the rules, 50 minutes playing the game, and 25 minutes for questions and a follow-up discussion.

Gameplay test summary
In the gameplay test, the participants were 1 man, who had a lot of previous experience, and 1 woman, who had an average amount of previous experience playing video games.

The participants agreed that battlefield conditions could disable or enable strategies, depending on if they knew their effects and how it would impact their actions. They thought that hidden information regarding damage, chance to hit, and chance to critically hit made it difficult to estimate the outcome of their actions beforehand, but not knowing the chance to hit also made it less frustrating to miss. Knowing the damage, chance to hit, and chance to critically hit allowed them to think strategically before making their decisions, and advocated foresight and long-term planning. Hidden information regarding status effects led to wrongful estimation of their potency, and forced the participants to rely on their previous experience to deduce what status effects implied. Having access to status effect information caused players to rethink their strategies, and also influenced their move prioritisation. Furthermore, the participants misinterpreted the situation and assumed that units had the same amount of HP when health bars were the same size. Knowing the HP of the opponent's units influenced their target prioritisation and they optimised their moves to avoid dealing excess damage. Progressively getting access to more information about the elements in the game was seen an enjoyable experience for the participants, but having access to all the information could make the optimal course of action obvious.

Changes made after the gameplay test
Reworked battlefield condition
- Changed hail from "all attacks and moves deal + 25 damage" to "all attacks and moves have a + 20% chance to critically hit".
- Renamed hail to snow.

Added battlefield condition
- Sun - all units gain 25 HP at the end of the turn.

Updated guidelines for hidden information
Following the gameplay test session, the summary was used to update the initial guidelines for hidden information. When designing for uncertainty in turn-based battle systems in multiplayer video games, **consider...:**

- Hiding information from players and obscuring details of game mechanics initially to create information gaps, where players can learn information over time.
- Providing enough information about units, actions, and other game mechanics, which allows players to make informed decisions and develop strategies with foresight.

6.4.3 Testing Player Uncertainty - Sprint 3

In the third version of tests with a paper prototype we focused on player uncertainty as the source of uncertainty. During the ideation phase about how to implement and test player uncertainty in the prototype we identified the following elements:

- Unit types and unit type advantage system (attacks and moves had a + 30% chance to critically hit against certain unit types).
- Charged moves (delayed hidden moves that occurred at the start of the next turn).

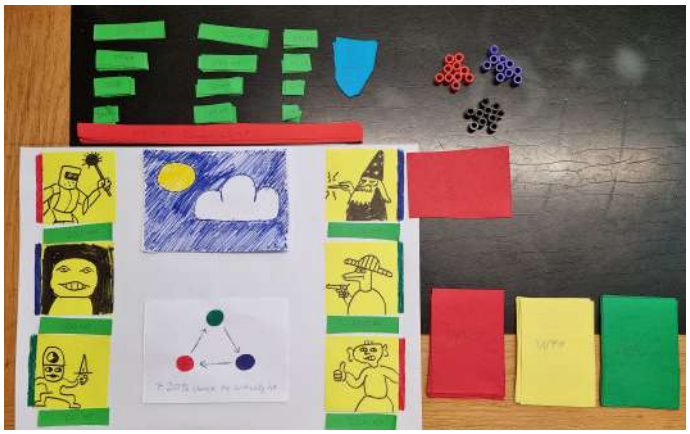

Figure 6.5: Paper prototype used to test player uncertainty.

3 gameplay tests were conducted on separate occasions. 1 of the tests was an expert test where we, the designers, tested the battle system to find possible areas of

improvement. The other tests lasted about 50 minutes each, where 5 minutes were spent explaining the rules, 30 minutes playing the game, and 15 minutes for questions and a follow-up discussion.

Gameplay test 1 summary
In gameplay test 1, the participants were 1 man, who had a lot of previous experience, and 1 woman, who had an average amount of previous experience playing video games.

The participants agreed that the unit type advantage system influenced decision making in a weird and counter-intuitive way, because it encouraged them to spread out their attacks on several units, whilst they identified the optimal strategy to be to focus on one unit and knock it out as soon as possible to have a unit number advantage. The participants did not know what to expect when their opponent used charged moves. The power of the charged moves themselves decided whether they felt worth using or not. Additionally, the participants thought it was difficult to plan ahead for the following turns when they had to discard their moves at the end of each turn. Furthermore, the participants expressed that the complexity in the battle system was quite low, and that there was not a lot of variety in what they could do each turn. Depending on if they went first or second, they had to play proactively and aggressively, or reactively and defensively. They also mentioned that as their experience with the battle system increased, their ability to form strategies rapidly improved.

Changes made after gameplay test 1
Tweaked randomness
- Moves are no longer random at the start of turns.
- Moves are no longer discarded at the end of turns.
- Each unit now has access to 3 unique moves.
- Heal moves now have 100% chance to hit instead of 90%.

Added moves
- Trap moves (hidden moves that trigger when attacked).

Removed mechanic
- Removed unit type advantage.

Gameplay test 2 summary (Expert)
In the expert gameplay test, we tested the battle system ourselves to get a feeling for the overall play experience and how it could be improved.
We found that attacks felt inconsequential if moves were always available, and that a limited resource, such as MP, could alleviate that problem. It would be messy to implement another resource in the paper prototypes, so it was something we kept in mind for the digital prototype. We also agreed with previous statements from participants that not being able to act is a boring status effect, and that it might not be suitable for our battle system. Furthermore, it was difficult to create strategies when units and moves were randomly assigned, and it was something

you identified during play. More units, customisation, and individual team building could be needed to create strategic variety.

Changes made after the expert gameplay test
Added moves
- Added more status moves.

Removed moves
- Removed status moves that makes units unable to act.

Balanced moves
- Rescaled chance to hit and damage on moves.

Figure 6.6: Updated paper prototype used to test player uncertainty.

Gameplay test 3 summary
In gameplay test 3, the participants were 2 men, who both had a lot of previous experience playing video games.

The participants thought that it was difficult to read their opponent's strategy. Because charged moves were unknown the first time they were played, the participants did not know what to expect from them, and often tried to defend themselves. Once a charged move was revealed, the participants had to manually remember what the charged move did, and which unit had access to it. Also, the participants did not want to attack into units who had active trap moves, unless absolutely necessary. Trap moves added defensive possibilities and allowed the participants to minimise incoming damage and set up to be safe for future turns before attacking. The participants identified the optimal strategy to be to focus their attacks on one unit and knock it out as soon as possible. They also wanted to apply DOT status effects before using other attacks and moves to deal damage efficiently. Through a combination of DOT status effects and attacks and moves, they calculated how many turns were needed to knock out units. The participants did not think it felt worth it to try to save units on low HP, but would rather try to deal damage with them. Furthermore, the participants thought that going first was advantageous as they could attack and possibly knock out a unit on the first turn, or set up with trap moves and be in a good position for the next turn.

Changes made after gameplay test 3
Removed moves
- Removed charged moves.
- Removed trap moves.

Updated guidelines for player uncertainty
Following the gameplay test sessions, the summaries were used to update the initial guidelines for player uncertainty. When designing for uncertainty in turn-based battle systems in multiplayer video games, **consider...:**:

- Having plenty of viable units and actions to create uncertainty through strategic variety.
- Having actions that allow players to set up for future turns with foresight.
- Having actions that allow for psychological games through uncertainty of information.

6.4.4 Testing Performative Uncertainty - Sprint 4

In the fourth version of tests with a paper prototype we focused on performative uncertainty as the source of uncertainty. During the ideation phase about how to implement and test performative uncertainty in the prototype we identified the following elements:

- Turn time limit (60 seconds per player turn).
- Minigames (at the end of turn, players had 10 seconds to perform a minigame, which would determine their chance to hit on that turn: build a tower with beads (+ 10% chance to hit per bead), pick out coloured beads from jar (+ 10% chance to hit per bead), or spin a coin (+ 10% chance to hit per second)).
- QTE (at the end of turn, players had to listen to 10 letters being read out loud and press the corresponding keys on a keyboard in quick succession, which would determine their chance to hit on that turn (+ 10% chance per right key, - 10% chance per wrong key).

Figure 6.7: Paper prototype used to test performative uncertainty.

Figure 6.8: Items used to test performative uncertainty.

2 gameplay tests were conducted on separate occasions. The tests lasted about 50 minutes each, where 5 minutes were spent explaining the rules, 30 minutes playing the game, and 15 minutes for questions and a follow-up discussion.

Gameplay test 1 summary
In gameplay test 1, the participants were 2 men, who both had a lot of previous experience playing video games.

The participants thought that a 60 second turn time limit was a lot, and did not affect their decision making at all. They expressed that the time needed per turn would probably have been longer if they had less previous experience playing video games. They thought that minigames were a fun addition to have in a turn-based battle system, but that the individual impact on enjoyment heavily depended on the type of minigame they had to complete. The participants experienced the minigames requiring physical input as having more control over the outcome, although it was still affected by randomness to some extent. They also expressed that the difference in knowing what minigame was going to be next beforehand or not affected their decision making. If they were confident in their ability to complete a minigame they would play more offensively. Furthermore, the participants thought that the QTE was very easy to complete with full points. When asked why, they responded that they had significant experience with keyboard layouts, and that it was possibly also related to the type of sensation used (input response to aural rather than visual cue). Lastly, the participants felt that it was impossible to win after a unit had been knocked out, and that some type of comeback mechanic was needed to keep it exciting after that point. They also expressed that the most frustrating thing in the battle system was missing attacks that they expected to hit.

Changes made after gameplay test 1
Balanced mechanics
- Changed turn time limit from 60 seconds to 30 seconds.

Removed minigame
- Removed the minigame with picking out coloured beads from jar.

Gameplay test 2 summary
In gameplay test 1, the participants were 1 man, who had a lot of previous experience, and 1 man who had above average previous experience playing video games.

The participants thought that a 30 second turn time limit caused them to feel some stress and definitely affected their decision making, since there was not much time to analyse whether an action felt right or not. They also thought that minigames that required physical input was a fun and unique addition to have in a turn-based battle system, which stands out from traditional luck-based elements, such as die rolls. The participants felt that they could impact the outcome, and if they knew what minigame was coming up next they could be brave in their decisions. However, they also expressed that the physical input effort required was not always proportional to the reward. Furthermore, the participants did not think that increased chance to hit was a fun reward to get for performing well, as it should almost always be certain, and would have preferred an increase in damage instead. Lastly, the participants found the QTE relatively easy to complete, but if they missed one input successive inputs were also easily missed.

Changes made after gameplay test 2

Changed mechanic
- Changed QTE from using an aural cue to a visual cue.

Updated guidelines for performative uncertainty
Following the gameplay test sessions, the summaries were used to update the initial guidelines for performative uncertainty. When designing for uncertainty in turn-based battle systems in multiplayer video games, **consider...:**:

- Having elements that require dexterity and physical input to add challenge.
- Having elements that require dexterity and physical input to give players the possibility to have more control over the outcome.
- Providing rewards proportional to the difficulty or effort of the physical input required.
- Using appropriate sensory perception when requiring fast paced input response.

6.5 Digital Prototype Implementation - Sprint 1-3

In this section we explain how the base version of the digital prototype worked, how it was developed, and how it was used in the project. The digital prototype was developed in parallel to the paper prototype test sessions, where the output served as input for the digital prototype. Our goal was to initially build a base that could later be adapted to implement different sources of uncertainty. For this, we had to construct a framework in Unity to which additional features could be easily added and removed. Therefore, the code we wrote had to have a certain level of

polymorphism, meaning that code should be reusable. We also aimed to make the digital prototype require as little input from players as possible, and dynamically load assets in run-time, which resulted in making further development easier and prevented the need for extensive refactoring.

6.5.1 Digital Prototype Implementation - Sprint 1

During the first sprint we began creating the digital prototype as soon we had decided roughly how the game would work. We created frameworks and ideated about players, units, moves, effects, and types for both units and moves. The player class would handle all player input and contain all data specific to a player, such as units, which would store the specifics about a unit, such as HP, damage and moves. The moves would store status effects it would have on a unit as well as how expensive it is. The relation between all these classes would look like the following: every player had three units; every unit had three moves; every move had one or more effects. We planned for and created the frameworks for a state-handler, which would handle which state the battle system was in, and a game-system class, which would control and modify data. The whole system would be divided into three parts according to MVC [30]: **model** (units, moves, effects), where all data is stored, **view** (player), the model presented to players, and **controller**, interaction by a player which modifies the model.

6.5.2 Digital Prototype Implementation - Sprint 2

During the second sprint we started to create a background, a UI, implement units, build a database system for moves, and set up the state-handler. We ideated about how the UI layout was supposed to look, and how unit and move selection should work. The initial plan was that players could choose the units they would like to use during play, and each unit would have a unique set of moves. This proved to be a bit more difficult than anticipated to implement, and did not fit well with the game-system and state-handler we had built. Instead we randomised which units and moves each player would start with, as it also fit well with randomness as a source of uncertainty.

We began creating a basis for what every unit should be able to do (attack, defend, make move) and how the system would handle it. The player class would be able to create and store "orders", which would then be sent to the main game-system for execution. The attack order would only inflict damage on the target, defend would add a multiplier to decrease or negate received damage during a turn to the target.

We also created and added a colourful 3D background and a 3D modelled world to make the game feel less flat and uninteresting and thus follow Malone's heuristic for Fantasy [29]. The UI is where players would get all information about their battle system and input actions. It was created to be as simple as possible, where all the UI elements were visible at all times, meaning that none of them were hidden in menus or behind steps of interaction. Information about the selected unit, selected move, current state of the game etc. was always readily visible to players.

Figure 6.9: Background created for the battle system.

The database system for moves allowed us to quickly add new moves. The same could not be done for status effects, which were instead implemented with a set of methods called during different game states:

- *At start of turn* - The status effect does something before a player acts.
- *At end of turn* - The status effect does something after a player has acted.
- *On inflict* - The status effect does something when it is applied to a unit.
- *On removal* - The status effect does something when removed from a unit.

Status effects were bound to units through the game-system class. The game-system stored active status effects and called the corresponding methods to affect the units. It also counted how long a status effect had been active on a unit and removed it when it reached the defined max value. More than one instance of the same status effect could not be applied to a unit, but instead increased the amount of turns it was active. We continuously added and tested unique effects in the battle system. They could directly alter values in a unit, damage, or heal them. Effects could affect anything reachable by code, but we decided to restrict them to only affect units.

Due to insights gathered from test sessions with paper prototypes, we decided to discontinue development of a system for disabling units, and a system for blocking attacks and moves. Both of these mechanics were received negatively during the paper prototype test sessions.

6.5.3 Digital Prototype Implementation - Sprint 3

During the third sprint we tried to connect existing systems and get them to work seamlessly together. One problem we faced was how the system would handle two players. The idea was that players would share a mouse and keyboard and take turns making input. Two player-objects existed in the game as the player class contained the data for only one player. To prevent one player from affecting the other player, the inactive player had to be disabled during the opponent's turn and stop reading input from the player. Another problem we faced was to figure out how the game would handle units that are out-of-play, or dead. We began reworking the system we started with for disabling units, but because of how the game-system was built and which sub-systems stored what information, it caused problems when trying to

destroy the units. The solution to this was to tell the system to ignore the unit if it had been marked as knocked out.

6.6 Digital Prototype Implementation and Testing - Sprint 4-6

The digital prototype made use of roughly the same gameplay as the paper prototypes, and incorporated more elements from the sources of uncertainty over time. In the most basic version of the digital prototype each player had access to 3 units, and players needed to knock out all of the opponent's units to win. Units had a varying amount of HP, MP, unique damage and hit modifiers, and could each perform an action per player turn. The actions units could take were attack, defend, or use a move. Attack dealt damage based on a unit's damage modifier, defend negated the next attack or move against the unit, and moves could deal a varying amount of damage, apply status effects, or heal units. To perform actions with units, players would select a unit, select an action, and then select a target of the action. To select something, players would click on the desired UI element, which would be highlighted by a yellow colour to indicate selection. Whilst a unit was selected, players would get information about that unit's name, HP, MP, and active status effects displayed in a text box on the right side of the screen 6.11. Whilst a move was selected, players would get information about the move's name, description, MP cost, and status effects displayed in another text box on the right side of the screen 6.11. To keep track of selected actions, a text box containing player orders were displayed on the left side of the screen 6.10. Once players had selected an action for each of their units, they could click on a button saying "Done!" to end their turn. Alternatively, if players were unhappy with their selected actions, they could click on a button saying "Cancel!", which would remove all previously selected actions from memory. The UI also contained other text elements, which provided feedback and explained what game-state the battle system was currently in.

Figure 6.10: Several orders have been given to be executed next turn.

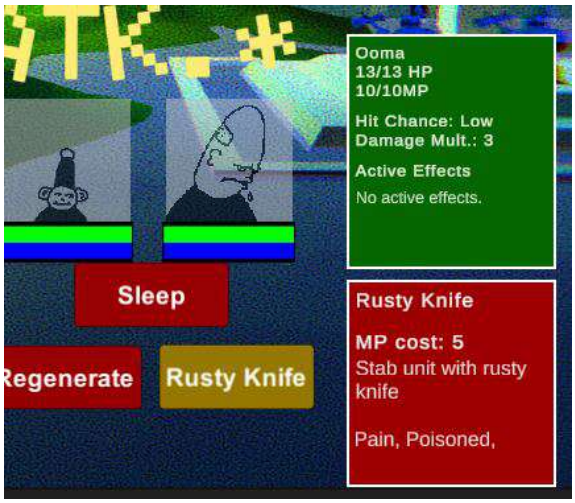

Figure 6.11: A unit and one of its moves selected.

Figure 6.12: Early version of the digital prototype.

Like with the paper prototypes, focus shifted to a new source of uncertainty in each sprint with the digital prototype. Most of the elements implemented in the sprints were elements used in the paper prototypes, but there were also new elements concerning uncertainty of perception, which had not yet been tested. The test sessions with the digital prototype were conducted similarly to the test sessions with the paper prototypes, but with one addition. We created a form using Google Forms where we copied the sub-scales, items, and scoring from PUGS 3.1, and had participants fill it out after the gameplay test, before moving on to questions and follow-up discussion. For the full data set, see Appendix B.

6.6.1 Heuristic Evaluation - Sprint 4

Before testing the digital prototype with participants, we conducted a heuristic evaluation of the battle system with Pinelle's heuristics for usability in game design [35]. We systematically checked each heuristic for flaws in the design to ensure that the usability was good enough to test with participants.

We found that the battle system provided a sufficient amount of feedback and information about actions, but that some information descriptions could be made clearer, which was improved. Views of the UI and available actions were unobstructed, but UI elements were slightly repositioned to separate different groups of elements from each other, such as units and moves. There were dynamic text logs in the battle system which provided players with information about the game status, which were updated to give players clear and continuous information. Visual representations of resources such as HP and MP were present in the battle system, but might not be good enough on their own to provide accurate interpretations of situations on their own. However, because players could select units and check their HP and MP in detail, we did not make any changes to them.

At this stage in development, the battle system was not very fun to play as it did not result in any audiovisual feedback when interacted with by players. To counteract this, we added some colour to the UI elements, rearranged the UI layout, and improved the overall usability by adding feedback in the form of visual effects. When calculating if an action was going to hit or critically hit, a visual representation of scrambling numbers appeared on the screen, and when units took damage the unit image would shake and display the amount of HP lost, whilst the health bar would animate the change. We implemented a system which allowed units to continually tell players about the status effects affecting them, for example, a burning unit could exclaim that they were on fire. The addition of visual effects made it clearer what was happening in the battle system and made it more enjoyable and in line with Malone's Heuristics [29] for Fantasy (1) and Curiosity (1.a, 1.b, 1.c). Elements such as these are also similar to how Hearthstone has visual effects for events [21].

Figure 6.13: Particle system and effect text.

6.6.2 Testing Randomness - Sprint 4

We built an interface with the built-in Unity Random-system, which would allow us to add to, and modify the system. We added random elements in plenty of ways, such as which player would go first, which units players would have, and which moves units would have, if units would hit or critically hit, and how much damage attacks and moves would deal. Most randomness was generated as a float number between 0 and 1, and the result of an attack followed a Gaussian distribution with the extremes (closer to 0 or 1) being miss and critical hit. A small variable increased for every miss that occurred (and reset to 0 for every hit), and was added to the result to prevent too many misses. The thresholds for miss and critical hit changed according to the attacking unit's modifiers for chance to hit and critically hit. Both of these outcomes increased in probability the closer their thresholds were to the middle of the Gaussian curve (0.5).

```
Result = RandomGaussian();
if(Result <= lowerThreshold*AttackingUnit.hitMod)
   if(RandomValue() >= 0.5)
      //Hit Another Unit and return
   //Missed
else if(Result >= higherThreshold/AttackingUnit.critMod)
   //Critical Hit on Target
else
   //Ordinary Hit on Target
```

From the test sessions with paper prototypes, we discovered that missing an action often led to disappointment and frustration. Therefore, we added a probability that if a unit missed there was a chance for the attack or move to be redirected to a random unit, including friendly units. Furthermore, we added a modifier which increased the chance to hit linearly in accordance to how many turns had passed to prevent a round from taking too long. Both of these modifiers also slightly increased the chance to critically hit.

Figure 6.14: An attack missed and is redirected.

Figure 6.15: Digital prototype used to test randomness.

2 gameplay tests were conducted on separate occasions. The tests lasted about 60 minutes each, where 5 minutes were spent explaining the battle system and the UI, 30 minutes playing the game, 5 minutes filling out PUGS, and 20 minutes for questions and a follow-up discussion.

Gameplay test 1 summary
In gameplay test 1, the participants were 1 man (participant 1), who had a lot of previous experience, and 1 woman (participant 2), who had below average previous experience playing video games.

The amount of previous experience playing video games affected their ability to follow along in the battle system. Participant 2, who had more previous experience expressed familiarity and recognised elements found in the battle system, whilst participant 1, who had less previous experience found it overwhelming and harder to keep track of the elements. However, both participants expressed that there was too much going in the background, and that they did not have enough time to read some of the texts before they disappeared. Both participants also expressed difficulties in connecting status effects to the actions they selected during their turns.

Participant 2 expressed that missing was boring and could be devastating to their strategy, but that hitting another target could dampen the pain. They also said that they found themselves in a position where they felt the only chance they had of winning was to rely on critical hits or the opponent missing. Participant 1 knew there was a risk of missing but did not think about it too much. Both participants inspected their available units and moves to decide which actions they wanted to take with each unit, where they wanted to select strong offensive moves with units who had potential to deal a lot of damage. The participants did not let chance to hit nor chance to critically hit affect their decision making and strategies too much, but participant 2 said that they did sometimes rely on critical hits to knock out units. Participant 1 once had three critical hits in a row and felt that they were in a

very advantageous position because of that, whilst participant 2 did not often miss or critically hit, but thought that the damage on moves was random. They thought that the possibility of missing could be exciting because it affected both of them. The participants also agreed that even though that the battle system contained random elements they did not completely dictate the outcome.

Gameplay test 2 summary
In gameplay test 2, the participants were 1 man (participant 1), who had a lot of previous experience, and 1 man (participant 2), who also had a lot of previous experience playing video games.

The participants did not think that the battle system was balanced, and participant 2 expressed that the player who went first would also probably be the winner as they could potentially knock out a unit during the first turn. Participant 1 thought that moves and status effects were unclear and lacked descriptive information, and they had to rely on previous experience playing video games to estimate what the outcome would be based on their names. The participants could not remember what happened during previous turns, and found it difficult to follow along as a result, but they appreciated the animations that played when attacks and moves critically hit, as well as when status effects were applied and triggered.

The participants did not want to use defend nor healing moves, as they felt unnecessary and not worth it. Instead they selected the moves that they thought would deal the most damage, based on names and MP cost. Their decision making and strategies were not affected by chance to hit nor chance to critically hit, because they could not estimate their likelihood. Both participants tried to apply DOT status effects to the opponent's units, and chose to not target units on low HP if they were already likely to be knocked out from DOT status effects. The participants thought that the battle system was heavily influenced by random elements, and participant 2 described the battle system as "randomness galore", where the only thing they could influence was their choice of actions. They thought that the outcome depended a lot on the units and moves assigned to them at the start of the round. We found that the participants did not notice to what degree the game was random, or detect when their chances were modified. During the gameplay test, we told the participants what their chances were in broad strokes in hopes that their more intimate knowledge of the battle system could strengthen certain feelings. For example, would their experience differ if they knew what their chances were, or if what we told them was different from what it actually was?

Updated guidelines
Following the gameplay test sessions, the insights were used to update the guidelines for randomness. When designing for randomness in turn-based battle systems in multiplayer video games, **consider...:**

- ***The purpose of the randomness***. What effect will it have on the game? Does it make sense for it to be random rather than predetermined? Consider what players would and would not expect.

- ***The context of the randomness***. Does a random element fit in the context of the game? What is the randomness supposed to represent? How is it presented to players? Consider the mental model players might have.
- ***How, or if, the randomness should be modulated***. Should the system ensure a certain ratio of success? Players' mental models of randomness do not often correspond to reality. Will player experience differ towards worse or better depending on the ratio? Consider the ratio of success and how/if to modulate it.
- ***Alternative outcomes***. Certain outcomes might be experienced as worse by players. Construct alternative outcomes for failure rather than empty events. Consider the possibilities of failure and success.

6.6.3 Testing Hidden Information - Sprint 4

We decided to remove most of the available information in the game about units and moves. This meant that participants did not have a way, other than the name itself, to know what a move did or how powerful a unit was. We named moves correspondingly to their respective power, as participants previously determined the strength based on names. A lot of information, such as the inner workings of the system, were not available to players. In the previous sprint we showed an abstraction of the chance to hit (low/average/high). We did not tell players that the chance to hit or chance to critically hit followed a Gaussian distribution or how a unit's hit-modifier played a part in that calculation. This was explicitly hidden information, but it did not cause a lot of uncertainty for players. We believe it was because players did not need that specific information, since it was not in line with their mental models for how the battle system worked. However, players will probably want to know how much HP units have left, the approximate chance to hit with moves, the amount of damage moves will do, and what status effects they will apply. With this information hidden, players have no useful information directly presented to them and they have to learn by playing and observing.

Figure 6.16: Digital prototype used to test hidden information.

2 gameplay tests were conducted on separate occasions. The tests lasted about 60 minutes each, where 5 minutes were spent explaining the battle system and the interface, 30 minutes playing the game, 5 minutes filling out PUGS, and 20 minutes for questions and a follow-up discussion.

Gameplay test 1 summary
In gameplay test 1, the participants were 1 man (participant 1), who had a lot of previous experience, and 1 man (participant 2), who had above average previous experience playing video games.

The participants found it difficult to interpret and make sense of what was going on in the battle system, and they both agreed that the battle system was moving too fast. There were too many elements on the screen competing for attention, resulting in that the participants did not know where to look. Participant 2 thought that the animations helped because they provided feedback, but also expressed that sound effects would be a good addition.

The participants thought that it was difficult to form strategies and to play to win, because it was impossible to tell how strong units and moves were. Both participants chose moves based on their names, where they argued that moves with basic names, such as *Fire*, felt inferior to moves with more formidable names, such as *Establish Order*. The participants also recognised some of the names in the battle system from other games they had played, and could use their previous experience to figure out what certain moves and status effects did. Participant 2 said that they could probably figure out the details of moves and status effects if they analysed them thoroughly, but it was simply too much effort. The participants also expressed that they did not feel like they could impact the outcome.

Gameplay test 2 summary
In gameplay test 2, the participants were 1 man (participant 1), who had above average previous experience, and 1 man (participant 2), who had a lot of previous experience playing video games.

The participants recognised features in the battle system from other games they had played in their past, and were thus familiar with the language used. Both participants agreed that they did not have time to read all the pop-up texts, because they disappeared too quickly from the screen. However, even though they missed some of the texts, they said that they could still gain an understanding of what had happened by looking at the HP of units.

Participant 2 described the battle system to have a learning curve, where they knew very little at the beginning and had to test out moves to learn what they did. However, when a move missed, they did not learn anything new, and had to wait another turn before trying it again. Participant 2 pointed out that attacks, moves, and status effects still showed damage numbers, so if they paid attention they could compare them to each other, and participant 1 thought it was weird that the damage numbers were displayed with decimals. The participants chose moves based on their names, where participant 1 tried to select the moves that they thought would deal

the most damage, whilst participant 2 tested out most moves. Participant 1 said that the moves matched their mental model of what they thought would happen. Both participants focused their attacks and moves on one of the opponent's units and tried to knock it out quickly, as they identified it to be the optimal strategy based on their previous experience. Participant 1 could distinguish healing moves from damaging moves and used healing moves to try and save their units on low HP, but participant 2 identified which of the opponent's units could heal and tried to knock it out first. Participant 2 experienced the chance to hit to be too low, and their strategy was disrupted by accidentally hitting their own units. Participant 1 did not expect misses to have a chance to hit another unit and was surprised when they hit one of their own units. Participant 1 also thought that a unit's size in relation to their unit portrait was indicative of their max HP. Lastly, participant 1 expressed that they liked the limited amount of information found in the battle system, as it advocated learning from their mistakes and did not require them to read a lot of information before starting to play. Participant 2 said that they liked testing things out, but that the battle system could offer a little more information so that they would not have to go in completely blind and learn everything from the ground up.

Updated guidelines
Following the gameplay test sessions, the insights were used to update the guidelines for hidden information. When designing for hidden information in turn-based battle systems in multiplayer video games, **consider...:**

- ***What is hidden***. What will be hidden from players and why? Consider the effect omitting the information will have on players.
- ***How it is hidden***. Should players be able to reveal the hidden information? Is the information hidden at all times? Information can be hidden from players, whilst at the same time shown in an abstract form that hides its specifics. Consider when and where players might look for what information.
- ***What is not hidden***. If something is hidden, what is not? How does the missing information affect the shown information? Consider how players might interpret shown information.

6.6.4 Testing Player Uncertainty - Sprint 5

We found that it would be difficult to rework the battle-system to strengthen player uncertainty. The definition of player uncertainty and the examples we found often regarded more complex systems where players had a large number of available options to play, which our battle system lacks. Instead of reworking the battle system we asked the participants to try to form strategies, and to identify their opponent's strategy. Because the battle system used hot seat gameplay, we had the participants look away when it was not their turn, which caused them to not know which units and moves their opponents had. The uncertainty would instead stem from what moves the opponent would use and which unit they would target to knock out.

2 gameplay tests were conducted on separate occasions. The tests lasted about 60 minutes each, where 5 minutes were spent explaining the battle system and the

interface, 30 minutes playing the game, 5 minutes filling out PUGS, and 20 minutes for questions and a follow-up discussion.

Gameplay test 1 summary
In gameplay test 1, the participants were 1 man (participant 1), who had above average previous experience, and 1 man (participant 2), who had below average previous experience playing video games.

The participants thought that the player aspect added fun and a level of unpredictability to the battle system. They also said that they tried harder to win when they were playing against a real player and that it added a competitive element. Because they were trying harder to win, participant 1 analysed their units and moves thoroughly before making decisions. Both participants chose their moves based on MP cost, as they found it difficult to estimate the damage of moves based on their descriptions. Participant 2 described the battle system to be fun due to being able to analyse and theorise, but that it was not descriptive enough to help them form a strategy and make decisions. They found it difficult to estimate the total damage of a move when DOT status effects were involved. Both participants focused their attacks on one of their opponent's units, as they identified it to be advantageous to have one more action than their opponent. Participant 1 mostly used their MP on offensive moves, whilst participant 2 initially saved some of their MP to heal their units on low HP. Participant 1 tried to deduce how much damage they would take on the following turn by looking at how much HP they had lost on a turn, and by also looking at the opponent's MP, because chances were they would do the same moves again the next turn. When they felt that they were behind on HP they tried to heal their units. Participant 2 took their time to make decisions, and they also said that it was relatively easy to identify the optimal strategy given the units and moves they had at their disposal, and even though they knew what their opponent was going to do, they felt like they did not have the tools to stop it from happening anyway. Participant 2 also mentioned that playing against someone they knew helped them because they already knew about their friend's playstyle. Participant 1 said that being able to choose which units and moves to play with would be helpful in order to form a strategy, whilst participant 2 mentioned that it would be helpful to be able to inspect the opponent's units. Lastly, participant 1 expressed that the battle system had a snowball effect that was hard to stop when put into motion, meaning that if one of them got off to a good start they had almost won at that point.

Gameplay test 2 summary
In gameplay test 2, the participants were 1 man (participant 1), who had average previous experience, and 1 man (participant 2), who had below average previous experience playing video games.

Participant 1 described the battle system to be simple, whilst still having complexity to it. Participant 2 mostly liked the appearance of the battle system, but thought the units felt a little out of place because they were in black and white, whilst the rest of the battle system was very colourful. Both participants described the battle

system as competitive, but that the hot seat gameplay allowed them to have a good time together as friends.

Participant 1 chose their moves based on names and what type of status effects they applied, whilst participant 2 did not fully understand what status effects did, and chose their moves based on MP cost instead. Participant 1 wanted to wear the opponent's units down over time with DOT status effects, whilst participant 2 preferred to deal direct damage. This was partly because they thought status effects were confusing and could not connect DOT status effects to what had happened during previous turns. Participant 1 expressed that they tried to play optimally, but that their decisions would not have changed if they played against a computer instead of a real player. Participant 2 also wanted to play optimally, but they were unsure whether what they were doing was right or not. Participant 1 expressed that they liked the freedom in what they could do during their turn, and felt like their choice of action mattered. However, they also said it was difficult to do any type of counter-play because they could not anticipate what their opponent was going to do. Participant 2 thought it was difficult to follow along in what was happening when they looked back on the screen after their opponent's turn. They said that it was all happening too fast, and they looked at the change in HP of their units to get an understanding of the battle status.

Updated guidelines
Following the gameplay test sessions, the insights were used to update the guidelines for player uncertainty. When designing for player uncertainty in turn-based battle systems in multiplayer video games, **consider...:**

- ***What options players have***. If players have a narrow set of potential actions available, it will be easier to predict the next move and the amount of uncertainty will be reduced. Does one player have more available options at a given time? How accurately should players be able to predict each other's actions? Consider how players' available options will affect the game.
- ***What direct effect one player's actions has on the other***. Will players be able to directly affect each other's actions? Will players be able to prepare for potential retaliation? Consider what players could gain from, and how they would experience being able to affect each other's options.

6.6.5 Testing Performative Uncertainty - Sprint 5

We added two minigames, a "running button" and a QTE, for players to complete in the battle system. The running button was a button that quickly moved around on the screen in a random pattern, and stopped when a timer of 3 seconds ran out, or if the current player managed to catch it by clicking on it. The QTE displayed a random key on the screen and the current player had to press that key before a timer of 3 seconds ran out. Both these events used audio and visual feedback to indicate whether they were successful or not. If players managed to complete any of the tasks they received bonus damage to their moves on the current turn. This was made more apparent in gameplay test 2 where we added a text saying "+ATK

DMG". We chose this as a reward because it was easy to implement, and also because test sessions with paper prototypes showed it to be an enjoyable reward. The type of task that players had to perform was random and appeared at the start of every turn, indicated by a numbered countdown accompanied by a distinct sound. During this sprint we implemented a few sound effects and music. The sound effects were meant to indicate what was happening and to help players differentiate between certain events, for example, hits, critical hits, and misses. These additions were meant to correspond to Malone's heuristics about Curiosity (1.a, 1.c) [29];

Figure 6.17: The running button. Players had to catch "Bobo", who quickly moved around across the screen.

Figure 6.18: The QTE. Players had to press the key that appeared on the screen.

We did not tell players what the tasks in the minigames would be, which made them uncertain about what they would have to do. If they did not know what would be required of them, they would also not know if they could trust their ability to overcome the tasks. If they were informed about what the tasks would involve, they could assess themselves and their ability to overcome it, which would reduce their uncertainty. However, a challenge we faced was that players quickly got used to the tasks and it resulted in them almost always succeeded with them. We therefore had to balance the difficulty accordingly by slightly changing the timers and the movement speed of the running button. The participants' skill and ability to complete the tasks also varied, mostly according to their previous experience with video games.

2 gameplay tests were conducted on separate occasions. The tests lasted about 60 minutes each, where 5 minutes were spent explaining the battle system and the

interface, 30 minutes playing the game, 5 minutes filling out PUGS, and 20 minutes for questions and a follow-up discussion.

Gameplay test 1 summary
In gameplay test 1, the participants were 1 man (participant 1), who had a lot of previous experience, and 1 woman (participant 2), who did not have a lot of previous experience playing video games.

Participant 1 recognised elements and the language in the battle system from their experience with other games, and kept track of their units' HP and MP by continually inspecting them, but could not keep track of the status effects they were affected by. However, they thought it helped that the units expressed things about their status. Participant 2, who had less previous experience playing video games, felt like they understood the basics, and checked their units' MP before making decisions, but had a hard time keeping up with what was happening after they had selected their actions and they were played out. They were not able to read all the texts, and could not understand why their units took damage all of a sudden. Both participants chose their moves based on MP cost, since they figured that moves with higher MP cost would deal more damage. Participant 1 mentioned that it reminded them of how other similar games work. Participant 1 started out by spreading out their moves on the opponent's units and applying DOT status effects, but switched strategy when they realised that it would probably be better to focus on one unit and knock it out. Both participants therefore also tried to heal their units on low HP.

Neither of the participants had their strategy influenced by the minigames and whether they managed to complete them or not. They mostly saw them as fun things to do in between turns and could not really identify how they affected the battle system. Participant 1 mentioned that it was advantageous to go second before knowing what minigames existed in the battle system, as they would get a chance to see their opponent try one of them, and could get ready for that minigame on their turn. However, they realised the keys they had to press were different, so they had to be ready to press any key. After playing for a whilst and having seen both minigames, participant 2 expressed that they hoped to get the QTE during their turn since they found it easier to complete than the running button. They were more confident in their ability to complete the QTE, and felt like their skill was not up to the task for the running button. Participant 2 thought that they would have lost if they got the running button several times in a row, and participant 1 thought that they had an advantage when it came to precision in clicking the running button, as they had more previous experience playing video games. During later turns, both players were on the edge of their seats and prepared by having one hand on the mouse and one hand on the keyboard. They experienced the countdown before turns as a signal to get ready, and were excited to see what they had to complete.

Gameplay test 2 summary
In gameplay test 2, the participants were 1 woman (participant 1), who had above average previous experience, and 1 woman (participant 2), who did not have a lot of previous experience playing video games.

The participants thought that the battle system featured too much information, and found it difficult to keep track of everything. Participant 2 had very little previous experience playing video games and had difficulties interpreting many elements in the battle system. They could not make out how powerful moves were or what status effects did, and they did not understand what the abbreviations HP and MP meant. Furthermore, they did not recognise the visualisation of HP in the form of a green health bar, nor the visualisation of MP in the form of a blue mana bar. Participant 2 explained that a green bar to visualise health was not self explanatory, in contrast to hearts, which is a more grounded metaphor. They wished that they had got a thorough walkthrough of the UI and the basics of the battle system before playing, as it would have made their experience more enjoyable.

Participant 1 checked their units' hit rate and damage modifier, more than looking at the actual moves, in order to make decisions. They tested out some moves, and once they found one that worked well, they kept using it. Participant 2 chose their moves solely based on how cute or fierce the move names sounded. Participant 1 thought that too many elements in the battle system were random, and that it dictated how they would play since they were assigned random units and moves, with the possibility of getting duplicates. Participant 1 felt that it was unfair that the minigames were random as they had to complete the running button several times in a row, which they thought was almost impossible. They perceived that they had more time to complete the QTE, and that it therefore was much easier, whilst the time to complete both minigames was actually the same. Participant 2 experienced the minigames to have the same time to complete, but thought that it felt like they had less time because the running button was much harder. Both participants' strategies were unaffected by the minigames, but they saw them as fun additions where they had to be ready for their turns.

Updated Guidelines
Following the gameplay test sessions, the insights were used to update the guidelines for performative uncertainty. When designing for performative uncertainty in turn-based battle systems in multiplayer video games, **consider...:**

- ***The context when performative input is required***. What will players be thinking about when the task begins? Will they be prepared? How will their preparedness affect their performance? Consider when and how the task is introduced to players.
- ***To what extent the outcome relies on performative input***. The reward of a task should preferably be proportional to the task's required effort and/or difficulty. What tasks are fit to decide the outcome? Consider how players will experience success in relation to the task and its reward.

6.6.6 Testing Uncertainty of Perception - Sprint 6

We added a system that caused UI elements to shake and change the pitch of the music when certain conditions were met. The first iteration of the system took the quotient of the total current HP and the max HP of all units and used it to calculate

the magnitude of which the UI elements would shake and the pitch of the music. We also added a *Sanity* meter which slowly emptied itself and needed to be refilled by players clicking on it, but in later iterations it was dependent on the total remaining HP of all units combined. In the first iteration it was solely meant to be a visual distraction for players. They were not supposed to know whether it actually had some effect on the battle or not, or what affected its value. In later iterations we changed it so that its filled percentage affected the chance to hit during random checks. We ultimately found that it felt unnecessary for it to directly affect the battle, as it was in no way apparent to players what it was doing. We scrapped the idea that it should affect the factors and variables in the battle system, and instead rebuilt it to simply affect the audiovisual experience. The last iteration caused UI elements to shake, the music to increase in pitch, and applied a color filter to the background. We tried different magnitudes of the different additions, and we found that a faster change in increments were preferable, as a slower change made the changes less apparent. The additions to the system were meant to communicate to players that something in the game was changing. They would not know what it meant and it would make them feel uncertain of what was happening. Additionally, in between turns, when status effects were triggered, uncertainty of perception was created because players did not always correctly interpret what the status effects actually did. Lastly, we changed the defend mechanic to work differently, and in its final iteration it added a multiplier to the damage received by a unit to lessen it. It was the least important mechanic as it was unpopular during most of the test sessions.

2 gameplay tests were conducted on separate occasions. The tests lasted about 60 minutes each, where 5 minutes were spent explaining the battle system and the interface, 30 minutes playing the game, 5 minutes filling out PUGS, and 20 minutes for questions and a follow-up discussion.

Gameplay test 1 summary
In gameplay test 1, the participants were 1 man (participant 1), who had above average previous experience, and 1 man (participant 2), who had an average amount of previous experience playing video games.

The participants thought that randomness mostly decided the outcome in the battle system and that there was little room to express individual player skill. Participant 1 felt like they could not make decisions based on their knowledge of the battle system Participant 2 thought that the randomness was a fun factor when it worked in their favour, and when it worked against their opponent. Both participants thought that it was hard to understand what the different moves did and how powerful they were, due to a lack of descriptive information. Participant 1 said that they originally set out to explore their units and moves, but when they could not make out which moves were better, they stopped trying to figure it out and started to just attack instead. They felt it was difficult to estimate total damage of moves where there were DOT status effects involved. Participant 2 explored their units and moves to get an understanding of what they could do on their turn. They selected the moves with the highest MP costs, as it would make sense that they would deal the most

damage, but also saved some of their MP so that they could heal their units on low HP later. Participant 2 expressed that they had to rely on their memory to remember how much HP the opponent's units had left, which was hard because of their bad memory.

The participants noticed the sanity meter present in the battle system, and had different theories as to what it meant. Participant 1 wondered if it affected the battle somehow, and thought that the fill amount decreased gradually in relation to how much time or how many turns had passed. Participant 2 thought that it was based on the amount of clicks, and that a lower fill amount perhaps affected their actions negatively in some way. Participant 2 thought that sound effects worked well as feedback in the battle system, and that the countdown between player turns served as a reminder to get ready. Furthermore, participant 1 thought that the music and change in pitch slowly caused them to lose their sanity, whilst participant 2 felt it enhanced the gameplay and created a more immersive experience. Both participants thought that it was fun that the UI elements moved around, and that it was a challenge to click on them once they started moving a lot.

Gameplay test 2 summary
In gameplay test 2, the participants were 1 man (participant 1), who had an average amount of previous experience, and 1 woman (participant 2), who had an average amount of previous experience playing video games.

The participants thought that the battle system was fun to play, and participant 1 said that some elements were familiar to them, whilst some elements were completely new. They liked this combination of mechanics as it created a unique experience, but mentioned that the battle system could use some balancing and fine tuning. Both participants felt that the battle system could benefit from being slowed down to make it more friendly towards new users, as it could be difficult to follow along in what was happening. Participant 2 had difficulties understanding how status effects affected their units and would have liked access to more information about them. Participant 1 felt some moves were objectively better than others, and chose their moves mostly based on MP costs, as they thought that was indicative of how powerful they were, but also paid attention to the move names, as some sounded more novel than others. They exhausted all their available MP quickly, and did not bother using healing moves, as it did not fit their playstyle. Participant 2 chose the moves that sounded most fun to them, and they were not as interested in winning as they were in having fun.

Participant 1 thought that the sound effects and the music added to the gameplay experience, and that the battle system would be much more dull without them. They thought that it was cool that elements were moving around, but that it could be somewhat annoying and made it difficult to see what was going on. Participant 2 agreed that the sound effects added to the experience and that the music created a nice ambience. They identified that the moving UI elements had a relation to the fill amount in the sanity meter, but also expected something else to happen since it felt like the battle system was breaking down. Participant 1 was unsure if it had any

implications on the gameplay, whilst participant 2 was curious and thought that it was meant to make it harder to click on the UI elements, which participant 1 also worried that they might not be able to. Furthermore, participant 1 thought that the change in music pitch was a bit stressful at first and expected it to apply a time limit to their turn, but were relieved of the stressful feeling when it did not. Participant 2 felt like there was a build-up of suspense throughout the round, but ultimately found it pointless when nothing else happened.

Updated Guidelines
Following the gameplay test sessions, the insights were used to update the guidelines for uncertainty of perception. When designing for uncertainty of perception in turn-based battle systems in multiplayer video games, **consider...:**

- ***The degree of the perceptual challenge***. Perceptual challenges can, for both experienced and inexperienced players, cause frustration and disrupt the experience. Consider what players are able to handle at any given time.
- ***What the perceptual challenge will encompass***. What elements will the perceptual challenge encompass? Will some elements clash or work in unison? Consider the context of the perceptual challenge.
- ***How the perceptual challenge is introduced***. If players are not introduced to the perceptual challenge in a proper way, they can feel too much uncertainty as they are unfamiliar with it. Consider how players are introduced to the perceptual challenge.

During the test session we found that our implementation of uncertainty of perception did not exactly correspond to what we found in our pre-studies. It did not become more difficult for players to identify elements in the battle system. What the battle system instead managed to do was to confuse and distract players through audio and visuals. This created a type of **audiovisual uncertainty**.

6.6.7 PUGS

To collect data using PUGS, we created a form with Google Forms where we inserted the items from PUGS. We also added an extra question at the start of the form, where we asked participants to rate their previous experience playing video games on a scale from 1-5. For the full data summary, see Appendix C.

The results from PUGS showed that previous experience playing video games was related to how uncertain participants felt during test sessions with the digital prototype. Experienced participants could more easily decide which actions were better, and determine how those actions affected the outcome. Most participants did not feel stuck at any point during the test sessions, but had a hard time keeping track of the elements, and also felt overwhelmed by the mechanics in the battle system. Most participants also had a hard time determining whether what they did was the "right" course of action. Most participants did not feel lost, and always knew what to do in order to progress in the battle system. Lastly, the results showed that most participants felt that the battle system was heavily influenced by external random

elements, and that they were relying on chance as the deciding factor in how well they performed. We used this information continually throughout the project to tweak and balance randomness.

7
Results

In this chapter, we present the results of the project, which were a working digital prototype of battle system, and 19 guidelines presented in a list consisting of 7 sets corresponding to different sources of uncertainty.

7.1 Ribble-Rabble

The final version of the battle system, appropriately named "Ribble-Rabble", was used to test the different sources of uncertainty. The battle system functions around a main game-system, a state-system, and 2 player-objects. The battle system includes sound effects and music, and has a basic UI which shows units, their status, command buttons for attack, defend, and 3 moves, the selected move, an end turn button, a cancel button, a quit button, a dice visualisation, and a game-state visualisation.

Figure 7.1: The final prototype.

The final version of the battle system consists of 7 (see Appendix D.1) unique units, 28 unique moves (see Appendix D.2), 25 unique status effects (see Appendix D.3), and 2 players. Each player is assigned 3 random units, and each unit is assigned 3 random moves at the start of the round. It is also random which player goes first.

The goal is to reduce the all of the opponent's units' HP to zero (knocking them out). Players take turns, where a turn consists of 4 phases (in order): start of turn, players give orders, orders are executed, end of turn (next player's turn).

- **Start of turn:** The current player has to complete a random performative task to receive a boost to damage during that turn. There are 2 types of tasks: a QTE where players have to quickly press the random key that appears on screen, and a running button which rapidly moves around the screen that players have to catch by clicking on it (see section 6.6.5).
- **Players give orders:** Each unit can be given 1 order, to attack, defend, or perform a move towards another unit.
- **Orders are executed:** Actions and their corresponding animations are played out, one at a time.
- **End of turn:** The current player's turn ends and the other player's turn begins.

Units are unique and have a varying amount of HP, MP, base attack damage, defense, hit chance, and critical hit chance. Attacks and moves can hit, critically hit, or miss, and if they miss, they have a chance to hit another random unit. Most events in the battle system are random in some way, such as if attacks or moves hit, critically hit, miss or are redirected. Other examples are damage done by attacks or status effects, and the maximum number of turns a status effect is applied to a unit (see section 6.6.2). Each move has at least one status effect tied to it, which can restore a unit's HP, increase or reduce their hit chance, attack damage, and defense, or deal damage over time. If a unit is taken out of play, moves which restores a unit's HP can resurrect it. Lastly, a sanity meter exists in the lower left corner of the battle system where the fill amount is the sum of all of the units' HP. As sanity decreases, UI elements start to shake, the music pitch is increased, and the battle system background shifts in colour (see section 6.6.6).

7.2 Guidelines for Designing Uncertainty in Games

The test sessions provided insights that were used to develop and generate new guidelines, to create a final list of guidelines. The final list is divided into categories based on the sources of uncertainty the guidelines correspond to. Beyond the original 5 sources of uncertainty, we propose guidelines for a new source of uncertainty, audiovisual uncertainty, based on our insights. Furthermore, we present guidelines for outcome uncertainty, an uncertainty we did not initially set out to test, but frequently appeared as an important and interlinked source of uncertainty in the test sessions. The guidelines are written in a way that can help designers think about what to consider when designing for uncertainty in turn-based battle systems in multiplayer video games.

How to use the guidelines
The guidelines are meant for designers to consider when designing for a specific source of uncertainty in turn-based battle systems in multiplayer video games. The

guidelines are also meant to get designers thinking about the implications of their design decisions and help them find creative solutions. The guidelines can be used in conjunction with other guidelines and heuristics, such as Pinelle's heuristics for usability in game design [35], but we propose that our guidelines should take precedence over other others, when used in the specified context.

7.2.1 Guidelines for Randomness

When designing for randomness in turn-based battle systems in multiplayer video games, **consider...:**

- ***The purpose of the randomness***. What effect will it have on the game? Does it make sense for it to be random rather than predetermined? Consider what players would and would not expect. During our testing with paper prototypes we found that participants did not find missing attacks and moves to be enjoyable. Therefore, in later iterations we had ordinary attacks almost always succeed. During digital prototyping for randomness (see section 6.6.2), we found that participants did not complain about misses to the same extent as before. We argue that this was because of a combination of that the computer handles all the work of handling HP and damage, the effects that happen, and that it is faster paced than a paper prototype. We can tie this to Malone's heuristics [29], and argue that a more cohesive and enjoyable interface made the misses more tolerable. In Fire Emblem [15], players have to consider the chance of success, or risk of failure, before going into battle, which encourages strategic thinking and decision making.
- ***The context of the randomness***. Does a random element fit in the context of the game? What is the randomness supposed to represent? How is it presented to players? Consider the mental model players might have. In "Ribble-Rabble", we visualised the randomness when making attacks and moves as a "die-text" (it displayed random numbers, giving the illusion of a die rolling) to give players a sense of randomness. Even if the randomness in this instance does not work at all as a die would, it was still effective in conveying randomness to players. As discussed in section 8.2.2, how it is visualised can be paramount to how players experience randomness (see section 6.6.2). How players expect randomness to work also affects their strategic thinking (see section 3.2.2). In Fire Emblem [15], players watch as an animated battle between units is played out, and wait in suspense to see if their unit's attack will hit, critically hit, or miss.
- ***How, or if, the randomness should be modulated***. Should the system ensure a certain ratio of success? Players' mental models of randomness do not often correspond to reality. Will player experience differ towards worse or better depending on the ratio? Consider the ratio of success and how/if to modulate it. In "Ribble-Rabble", we implemented a counter to keep count of how many times and how often participants missed their attacks and moves, and modulated their hit chances thereafter. The more they missed, the more likely they where to hit. We also had that for every third miss, the next attack

or move was guaranteed to hit. Think about this when the randomness system has been implemented and tested, so that it can be evaluated to know if it is needed at all (see section 8.2.2 for more). In Fire Emblem [15], players can position their units in certain ways around an enemy unit to increase their chance of success during battle.
- ***Alternative outcomes***. Certain outcomes might be experienced as worse by players. Construct alternative outcomes for failure rather than empty events. Consider the possibilities of failure and success. During testing of "Ribble-Rabble", we found that participants often did not find misses enjoyable at all, and even detrimental to other events in some cases. We therefore implemented a simple system that gave each miss a chance to redirect an attack or move to a random unit. This made it more exciting for participants as they risked hitting their own units each time they missed. Think about this when the randomness system has been implemented and tested, so that it can be evaluated to know if it is needed at all (see section 6.6.2).

7.2.2 Guidelines for Hidden Information

When designing for hidden information in turn-based battle systems in multiplayer video games, **consider...:**

- ***What is hidden***. What will be hidden from players and why? Consider the effect omitting the information will have on players. During development of "Ribble-Rabble", we decided that players should not have access to their opponent's unit information, such as moves, because it could lead them to quickly identifying the strongest unit and focus on getting it out of play. With the information hidden, participants had to assess each unit's strength during play instead, which created tension and uncertainty. Participants would need to learn about the battle system over time, which should be fun for players, as argued in section 3.1.3. In Pokémon [36], players cannot inspect the other player's units, and are therefore unaware of their stats and available moves. Instead, players have to identify these things over the course of the battle and try to remember them.
- ***How it is hidden***. Should players be able to reveal the hidden information? Is the information hidden at all times? Information can be hidden from players, whilst at the same time shown in an abstract form that hides its specifics. Consider when and where players might look for what information. In "Ribble-Rabble", specific information about player units, such as hit chance and moves, was hidden until a player selected one. All units' HP was shown at all times, but only as an abstract "health bar" that visualised a percentage of the HP they had left. In Hearthstone [21], the other player's cards are hidden until they play them; its information and values are then revealed.
- ***What is not hidden***. If something is hidden, what is not? How does the missing information affect the shown information? Consider how players might interpret shown information. In "Ribble-Rabble", players could see both a unit's MP and their moves' MP-cost, which allowed them to plan how they

spent their resources. If we were to show the total MP but not the MP-cost, it would create uncertainty for players as they would not know how much MP they would have left after a move, which corresponds to what we found regarding enabling strategic thinking (see section 3.2.2). In Fire Emblem [15], players have access to most of the information regarding a battle, but the uncertainty lies in knowing that the outcome will be influenced by chance.

7.2.3 Guidelines for Player Uncertainty

When designing for player uncertainty in turn-based battle systems in multiplayer video games, **consider...:**

- ***What options players have***. If players have a narrow set of potential actions available, it will be easier to predict the next move and the amount of uncertainty will be reduced. Does one player have more available options at a given time? How accurately should players be able to predict each other's actions? Consider how players' available options will affect the game. In "Ribble-Rabble", it was rather simple for players to predict each other's actions, as the available options were not that many. More options would allow for more strategic planning and uncertainty, as shown in 3.2.2. In Pokémon [36], players can build their units and team formations in a wide variety of ways, making it almost impossible for the other player to know what options the other player has available to them.
- ***What direct effect one player's actions has on the other***. Will players be able to directly affect each other's actions? Will players be able to prepare for potential retaliation? Consider what players could gain from, and how they would experience being able to affect each other's options. In "Ribble-Rabble", players could take an opponent's unit out of play, which made the opponent unable to use that unit. Furthermore, if players had a unit with a move that healed, they could resurrect their knocked out units. In Pokémon [36], a lot of uncertainty comes from the uncertainty regarding what the other player will do and if it will disrupt player strategy.

7.2.4 Guidelines for Performative Uncertainty

When designing for performative uncertainty in turn-based battle systems in multiplayer video games, **consider...:**

- ***The context when performative input is required***. What will players be thinking about when the task begins? Will they be prepared? How will their preparedness affect their performance? Consider when and how the task is introduced to players. In "Ribble-Rabble", there was a countdown with accompanying sound to warn players of the upcoming challenge. This was useful to think about after a task was completed, which allowed us to assess its difficulty and think about how to prepare players for it.

- ***To what extent the outcome relies on performative input***. The reward of a task should preferably be proportional to the task's required effort and/or difficulty. What tasks are fit to decide the outcome? Consider how players will experience success in relation to the task and its reward. During the development of performative uncertainty in "Ribble-Rabble", we constantly changed what the reward of success would be and tweaked how difficult the tasks were. We needed to find a balance between challenge and reward. In Pokémon GO [37], when players select certain moves, they need to complete a minigame by swiping over elements appearing on the screen, where the damage of the move depends on how well they perform.

7.2.5 Guidelines for Uncertainty of Perception

When designing for uncertainty of perception in turn-based battle systems in multiplayer video games, **consider...:**

- ***The degree of the perceptual challenge***. Perceptual challenges can, for both experienced and inexperienced players, cause frustration and disrupt the experience. Consider what players are able to handle at any given time. In "Ribble-Rabble", players were tasked with completing two performative challenges instead of one, where the perceptual challenge of identifying the tasks would increase uncertainty. It is therefore important to assess how multiple elements work together. The additions described in 6.6.6 were also meant to generate uncertainty in that they would make the interface busy and harder to read.
- ***What the perceptual challenge will encompass***. What elements will the perceptual challenge encompass? Will some elements clash or work in unison? Consider the context of the perceptual challenge. In "Ribble-Rabble", if we were to change its implementation to have everything happen at the same time, all performative challenges, UI shake, and all orders being executed, it would increase busyness to a level that would make it difficult for players to follow the chain of events. Inspired by Hearthstone [21], the battle-system executes one event at the time.
- ***How the perceptual challenge is introduced***. If players are not introduced to the perceptual challenge in a proper way, they can feel too much uncertainty as they are unfamiliar with it. Consider how players are introduced to the perceptual challenge. If players know what they should look for, the difficulty of a perceptual challenge will diminish. In "Ribble-Rabble", we prepared players for a performative task by having a countdown and a text explaining what they would do. In Hearthstone [21] players have a limited time to play their cards. This could pose a challenge to some players. The game indicates this by a burning fuse that when burnt down ends the current player's turn. A player's knowledge of the time limit will help them plan out their turn and manage their time.

7.2.6 Guidelines for Audiovisual Uncertainty

During the test sessions we identified a new source of uncertainty that did not fit in with the other sources: **audiovisual uncertainty**. It almost fits in with uncertainty of perception, but when compared to how Costikyan [8] defines and exemplifies it and the examples given by him does not completely describe what we found. We define audiovisual uncertainty as the combined uncertainty generated by, mostly, the busyness of both audio and visual elements in a game. It does not necessarily mean that it should pose a challenge for players, but it should make them feel uncertain in their actions. For example, in "Ribble-Rabble", before a task required physical input, a loud countdown sound played and a visual 3 second countdown was shown to indicate that a task was about to start (see section 6.6.6). Players would anticipate a task and then feel uncertain whether they would be able to solve it. Even if they had no idea what the task would be, they would still anticipate that something was going to happen. This uncertainty would have been created solely through audiovisual elements in the game. To summarise, what differentiates audiovisual uncertainty from uncertainty of perception, is that it is not about perceptual challenges, as it is with uncertainty of perception, but uncertainty created by audiovisual elements. One could argue that audiovisual uncertainty is a generally broader source and that the source uncertainty of perception might be tied to it, but the differences between them are large enough to warrant a division.

When designing for audiovisual uncertainty in turn-based battle systems in multiplayer video games, **consider...:**

- ***The combined effect of audio and visuals, where and when it is applied, and what purpose it has***. The context of the effect will greatly impact how players will experience it. Consider player expectations in each situation. In "Ribble-Rabble", the "running button" emitted an annoying sound, looked funny, and ran around quickly. All these elements combined were meant to make players want to catch and stop it.
- ***Whether audio and visuals should create a challenge for, or help, players***. Should it act as an obstacle for players or should it assist them by making them uncertain and then rethink their approach to something? Consider player goals in each situation. In "Ribble-Rabble", each task was preceded by a countdown and an accompanying sound to alert players to get ready for it. The audiovisual effects in Hearthstone [21], and Pokémon [36], assist players in keeping track of what is happening in the game.
- ***Consider how, or if, either players or the game-system modulates audio and visuals***. What should modulate, if at all, the effect? Consider what players should be able to do and how they affect the game. Most games allow players to tweak certain aspects of the audio or the visuals, such as turning down or turning off the music. By allowing players to modulate audiovisual aspects in such a way, players can either increase or decrease the audiovisual uncertainty.

7.2.7 Guidelines for Outcome Uncertainty

The test sessions revealed that participants perceived it as hopeless and impossible to win when they had less units remaining than their opponent. This significant and sudden shift in outcome uncertainty was not intentional, and defeated the purpose of each player controlling several units. When outcome uncertainty is removed and it becomes obvious that there is no longer a way for a player to win, the enjoyment of continued play is decreased [1]. Outcome uncertainty has ties to other sources of uncertainty, and we propose that designers look at outcome uncertainty as an overarching umbrella term.

When designing for outcome uncertainty in turn-based battle systems in multiplayer video games, **consider...:**

- ***Maintaining outcome uncertainty***. When should the outcome of a game become certain? How do players determine if the outcome of a game is uncertain or not? Consider maintaining outcome uncertainty until later stages to preserve player interest in the game. In "Ribble-Rabble", if a player's unit was taken out of play it almost certainly meant that players was going to lose. We therefore allowed for healing moves to be able to resurrect units, as a way to try and maintain the outcome uncertainty. In Hearthstone [21], whilst there is no outright mechanic for this, there is the possibility of a disadvantaged player drawing a card on their turn (input randomness), which can turn the game in their favour.
- ***Accounting for player skill difference***. The outcome of a game can be near certain between players of varying skill levels. Consider allowing players to adjust individual difficulty settings to account for player skill and even the playing field. Uneven games have a low amount of outcome uncertainty and are less enjoyable [1]. In "Ribble-Rabble", we tried to mitigate the difference in player skill by, for example, making two performative challenges that tested different skills. Furthermore, randomness is independent from player skill and we argue that more reliance on randomness means less difference in player skill, such as rolling dice. In Pokémon [36], players can have units that vary greatly in stats. If the difference is significant, player skill will matter less.

8

Discussion

In this chapter, we discuss methods used in the project, the results, generalisability and validity of the results, ethical aspects, and future work.

8.1 Method Discussion

The methods used in the project worked well, and some of them served additional purposes than intended. The gameplay tests were originally meant to let users get a feel for the battle system to be able to answer questions and follow-up discussions. However, we quickly realised that the gameplay tests themselves were a valuable source for gathering insights, as they let us observe the participants' decision making and reactions to what was happening in the battle system in real-time. Also, even though participants were not asked to think out loud during the test sessions, most of them still did so to an extent, which provided us with a window into their thought processes. The reason we did not ask them to think out loud was to preserve player uncertainty by not revealing their strategies to each other.

We tested one of the sources of uncertainty at a time, and once a source of uncertainty had been implemented in the battle system, it became a permanent addition and was not removed for when the next source of uncertainty was implemented. This was because we wanted the sources of uncertainty to work together in unison to create a full experience of felt uncertainty, as it would in a real game. What mainly differed was the line of questioning at the end of the test sessions to steer the discussion in the desired direction to explore the current source of uncertainty. Having multiple sources of uncertainty present in the battle system also retained the possibility for discussions to circle back to previously tested sources of uncertainty.

When filling out PUGS, we asked participants to tell us if they were experiencing any difficulties understanding the statements. The majority of participants reported having difficulties in understanding the way that statements were written, mainly because some of them used negations, such as *"My actions were not influencing the outcome of the game"*, which reportedly caused a high level of cognitive load. Furthermore, some participants had troubles understanding the statements in relation to the battle system they tested, which had to be explained. PUGS was mainly used to compare how participants with a varying amount of previous experience playing video games experienced uncertainty in the battle system. The results from PUGS provided us with information about how the participants perceived the battle

system. Furthermore, filling out PUGS made participants think about aspects of uncertainty which were explored in the follow-up discussions.

The follow-up discussions generated a substantial amount of qualitative data. During the follow-up discussions we diligently took notes of what participants were saying, but it could have been more capturing, albeit more time consuming, if we had recorded and transcribed the discussions instead. However, since we had trouble recruiting participants, we did not want to add something that could make them uncomfortable, as it would probably reduce their willingness to participate even further. When asked to participate, most people were concerned with how long it would take, and often declined when told the test session would last for about 60 minutes. Time was mainly the issue for people, and it did not seem to matter that we offered an incentive to participate in the form of coffee and pastries. To other students we also offered to participate in studies that they were conducting, which resulted in a number of people agreeing to partake. People who were willing to test even offered to participate in more tests if needed. However, we did not want to reuse the same participants for the test sessions, as their previous experience with the battle system would have affected their perception and understanding of it.

8.2 Result Discussion

The battle system made use of esoteric abbreviations and terms, such as HP and MP, which were unfamiliar to some participants. This made us aware of the fact that previous experience playing video games played a big part in how well participants understood components in the battle system. Not only were the abbreviations and terms unfamiliar, but some participants did not recognise the visualisation of a green health bar and blue mana bar. Furthermore, a lot of uncertainty was felt when initially playing, as participants familiarised themselves with the battle system and its components. The test sessions showed that initial uncertainty also varied according to the amount of previous experience participants had, and that less experienced participants felt more uncertain (see section 6.6.3). Participants who had less previous experience were also not able to form strategies as well as the participants who had more experience. The initial uncertainty slowly faded over time as participants became more experienced with the battle system (see section 6.6.3). We believe it is important to take previous experience into consideration and to design a learning curve where elements are introduced at an appropriate pace to keep the amount of felt uncertainty on an equal level over time.

8.2.1 Connected Uncertainties

During our test sessions we found that some sources of uncertainty can be connected to each other. Randomness can be connected to analytic complexity due to the potential amount of outcomes, but it can also be connected to hidden information, as the participants did not know the inner workings of the system. An hypothetical example of this could be that in a system an action would fail in intervals of multiples of 3 or 7. Participants could maybe notice that every third action fails and conclude

that it is in fact not random, but add in that every seventh action also fails and it will most likely throw them off. This is not random, but could be interpreted as random. It could also be the result of a random system, because if it is random, a permutation such as this would be possible. This makes it theoretically impossible to conclude if it is random or not; only if all the information of the system is available. We found that hidden information and player uncertainty are sources of uncertainty that can be difficult to completely separate from each other. For example, unknown information about the opponent's units and moves contribute towards uncertainty through hidden information, as well as player uncertainty, as the lack of information makes it difficult to plan ahead and identify the opponent's strategy. However, not all hidden information contribute to player uncertainty. In test sessions with the paper prototypes we hid information about battlefield conditions, move information, and unit status. These elements did not cause player uncertainty, but instead related to the game state or provided players with information about mechanics, allowing them to make more informed decisions. However, in the test sessions we also hid opponent unit information (HP, available moves), which was directly linked to players' ability to identify the opponent's strategy (see section 6.6.3). Not knowing what moves the opponent had at their disposal, in combination with not knowing the opposing player's strategy, could make a situation very uncertain.

Performative uncertainty showed to have some ties to hidden information. If participants got information beforehand about what was asked of them, they could estimate whether or not their confidence in their ability to complete the physical challenge was up to the task. Once participants had learned all the available minigames, the feeling of uncertainty was reduced. Performative uncertainty can also be connected to uncertainty of perception since it can modulate how difficult a performative task is. However, even if several sources of uncertainty can be connected and modulate each other, it is easier to understand the guidelines if they are separated into the sources of uncertainty.

Lastly, the way we implemented uncertainty of perception in the digital prototype caused some participants to experience performative uncertainty as well. Participants found moving UI elements to be challenging to click on, and physical dexterity was required of them to go through with their turns. They had doubts about being able to click on them, but always managed to do so since no time limit was imposed upon them.

8.2.2 Randomness and Uncertainty

We discovered during the test sessions that what the participants were told about a random outcome would decide how they experienced it. If they were told that a positive outcome had a small chance of happening, regardless of if it was true or not, they would feel that they had been lucky when it occurred. However, if the improbable outcome occurs on the first try, the feeling of luck would be diminished. When trying for an improbable outcome and failing, the spent time and energy to achieve success increases for players. This greater cost can be viewed as a challenge which should lead to some sort of enjoyment, but the challenge must have a reward,

so that when players finally succeed in reaching the improbable outcome they will feel a greater satisfaction from it than if they would have succeeded early. Although, if the reward is experienced as insufficient the challenge will be experienced more as a source of annoyance rather than enjoyment. This shows a relation between the level of randomness, the outcome, and enjoyment. The randomness must be balanced towards the outcome. One way of counteracting negative feelings in randomness is to include guarantees and/or modifiers for pushing the randomness towards a certain outcome. An example of this would be to count every failure and increase the chance of success.

The perception of randomness is also dependent on how it is visualised to players. Visualisation of randomness decides how it is interpreted. Because players cannot accurately calculate the probability of a random element, whether because of lack of time or insufficient amount of information, they cannot predict the chance of success either. This means that players rely on information to predict the outcome. By not visually representing randomness (visualised die rolls, showing chance of success etc.) at all, players will have no way of evaluating the potential outcome. This makes it easy to trick players into believing one thing about randomness, whilst it in reality is another.

8.2.3 Satisfying Outcomes and Unsatisfying Results

Being able to disable units for a certain amount of time introduced some emotions into the battle system. One of these was the fear of having a unit disabled and be unable to act on the following turn. It is evidently a powerful mechanic and can tip the game in a player's favour. It was experienced as a frustrating mechanic during the test sessions, since in practice, a disabled unit is out of play, which means that the player has fewer units to play with. However, it can be experienced as satisfying for the other player, as they will gain an advantage and be able to act with lesser repercussions. During the test sessions we also identified that having less units than the opponent removed the outcome uncertainty as it felt difficult to win from that point onward. To summarise, disabling units can contribute to uncertainty but causes frustration and hinders gameplay.

In the digital prototype, moves had a chance of missing their target unit. The uncertainty regarding whether a move hits or not, can be exciting for the player being the target of the move, but might lead to frustration for the player performing the move. In an iteration of the digital prototype, a mechanic was implemented for redirecting missed attacks to a random unit, apart from the initial target. This added to the uncertainty of missing by adding the uncertainty of the chance to hit friendly units. It kept players interested after a move had missed, anticipating if it would hit another unit instead.

These examples, disabling, missing, and redirecting are uncertainties which might be frustrating for players. Mechanics that resulted in less gameplay were often detrimental to the user experience (see section 6.6.2 and section 6.4.4). The solution to disabling units was to not include it in the battle system at all, whilst a solution

to the frustration of missing moves was to add a mechanic which had a chance to redirect it to another unit. Another solution, or facilitator, to the uncertainties of missing, hitting and critically hitting, was to keep count of misses and alter the chances of success thereafter. This was supposed to alleviate the frustration of failure. For example, if a player had missed 3 moves in a row, the next move would have an increased chance of success. Players would then be more likely to succeed and feel satisfied with the outcome. Another variant is to keep count of all moves made and force the to hit or miss depending on some parameter. As mentioned in section 8.2.2, players will most likely not notice this manipulation of randomness. When told about their chances of success, they will most likely build a mental model of what the outcome will be. For example, they might think that if the chance of success is 33%, then if they try 3 times, at least 1 of the tries will succeed. To better fit their mental model of the probability, a system like this can keep count of the misses and increase the chance of, or guarantee, a success.

8.2.4 Varying Uncertainty and Challenge

The sources of uncertainty we implemented were experienced differently from player to player. The most obvious example in our implementation is hidden information regarding moves. A player with a lot of previous experience playing video games would be able to figure out more accurately what a move did than a player with less experience would. Performative uncertainty also stood out as a source of uncertainty that could vary wildly in our test sessions. Something that was an easy task for one player can be much more challenging for another player. For example, players could find it very difficult to handle a mouse precisely, and as the battle system only accepted input from a mouse, a basic task such as selecting a unit or a move could be uncertain. However, since there was no time limit to force quick input, we believe that the battle system was forgiving enough for that source of uncertainty to exist without making it unfair. However, for players who found handling a mouse difficult, the running button was very challenging to complete. In section 2.1, we showed the connection between enjoyment, challenge and uncertainty, and in this instance the increased challenge could lead to decreased uncertainty, and subsequently decreased enjoyment.

8.2.5 The Audiovisual Experience

We discovered that both audio and visuals played a part in how the participants experienced uncertainty. It seemed that participants focused more on the uncertainties we wanted to examine if there was enough audiovisual feedback. From our test sessions, we could see that uncertainty around the state of the battle system resulted in a worse experience. By adding systems for showing and telling players what was happening, through audio or visuals, we reduced the amount of negative uncertainty. We could also create new uncertainties through elements such as a dice visualisation when performing actions, which could introduce players to uncertainties they were not previously aware of. The audiovisual experience could be a source of uncertainty in itself and maneuver players towards a desirable outcome. The digi-

tal prototype made use of audiovisual feedback to indicate what was happening, the current state of the battle system, and what players could expect to happen next. As the audiovisual experience could both create and dispel uncertainty, it will be important to consider the purpose and context (see table 7.2.6).

8.3 Validity, Generalisability and Uncertainty in the Results

We formulated the guidelines in a manner that could make them fit games similar to our battle system, but we cannot be completely certain about their applicability. As we only tested with paper prototypes and a digital prototype, we have little data to support the validity and generalisability of the guidelines in other areas. It is uncertain whether the guidelines are applicable to games of our target genre, or if our results are a result of chance since we have only tested with the one digital prototype that functions in a specific way, and games can vary drastically in how they function. What is certain is that we have created guidelines that are helpful for when designing for uncertainty in the battle system "Ribble-Rabble". It is therefore up to designers to evaluate which guidelines could fit into their design.

8.4 Ethical Aspects Discussion

During one of the test sessions, we encountered an issue. One of the participants suffered from colour blindness, which is something we had not accounted for in one of the minigames, where participants had to identify colours. It was nearly impossible for the participant to complete the minigame, and was therefore put at a major disadvantage. Colour blindness is a common vision deficiency, which in hindsight was an oversight from our side. Even in the digital prototype, there was room for improvement regarding the use of colours and colour contrast in the UI elements to accommodate colour blindness.

In another test session, a participant felt that their ability to play was hindered by their limited memory. The battle system occasionally caused a high level of cognitive load due to some information being hidden, where participants had to keep information about moves in their memory. This was not as much of an issue, but definitely worth noting. Furthermore, we were essentially tricking users by lying about randomness in the digital prototype. The reasoning behind this is discussed thoroughly in both section 8.2.2, and section 8.2.3. Patterns that trick users into believing something that is not true is often defined as dark gameplay patterns. We argue that this was to increase player enjoyment rather than for our benefit.

8.5 Future Work

If we were to improve the digital prototype used in the project, the next steps would be to balance the gameplay, and improve usability aspects of the user interface. The

guidelines could also be refined through more extensive testing in different settings.

The battle system is not balanced. Neither units, nor moves, are particularly well designed in relation to each other. Also, most of the test results pointed towards the same thing, that knocking out an opponent's unit put players in an advantageous position, and thus much more favourable to win, removing most of the outcome uncertainty. Therefore, some type of comeback mechanic would need to be implemented in the battle system to preserve outcome uncertainty beyond that point. However, comeback mechanics should not be powerful enough to completely turn the game around by themselves, as it can encourage stalling and counteract the goal, which is to knock out the opponent's units. We did not set out to make a battle system that was balanced nor fun, so balance was not an issue in and of itself, but it would be interesting to develop further. Furthermore, by extending the roster of playable units, and allowing players to select and customise their units, strategic variety could be increased and more synergistic unit combinations made available.

The user interface has some issues regarding feedback, and information overload. Sound effects drastically improved feedback in the battle system, but not enough to always make participants understand the connection between an action input and what was output at the end of the turn. A way to alleviate this problem could be to show the name of actions as they are happening. Another alternative could also be to bring the units to a focus area, such as the centre of the battle system. In the battle system, there are too many elements present on the screen at the same time competing for attention, which caused participants to not know where to divert their gaze and were therefore not able to follow along in what was happening. It would most likely be better to condense and confine the information to one and the same location. Participants also reported difficulties in estimating the power of moves, especially where status effects were involved, as they could deal damage over time, or in other ways affect units. A change could therefore be to provide more information and have clearer descriptions of moves and status effects. However, by having access to more information, the most optimal course of action could become obvious. Participants often expressed how they were trying to find the optimal strategy, which is possible to do when the level of analytical complexity is rather low.

Finally, the battle system is very bare-bones and shallow, and lacks many elements that would make it a more enjoyable experience. The elements we implemented to test the sources of uncertainty work individually and could be further developed to make a cohesive battle system. If there were well designed mechanics, elements etc. there could be another layer of depth and strategy to the battle system with more available options to create uncertainty for players. For example, if the battle system featured a map, it would open up possibilities to explore hidden information through the inclusion of fog of war, a common element of uncertainty in turn-based strategy games such as Fire Emblem [15]. This would also invite other sources of uncertainty, such as analytical complexity, because of the amount of possible moves that players would have. Lastly, if the battle system was part of an actual game with additional surrounding core elements there would be even more opportunities to include other sources of uncertainty.

9
Conclusion

The aim of this project was to answer the research question: *What should be considered when designing for uncertainty in turn-based battle systems in multiplayer video games?* To answer the question, we conducted a thorough literature study, where the findings were utilised to design and develop varying fidelity prototypes of a battle system, which were used to test five different sources of uncertainty: randomness, hidden information, player uncertainty, performative uncertainty, and uncertainty of perception. As described in section 8.2.1, we identified that the sources of uncertainties can in some ways be connected and modulate each other. Some of the connections go so far that certain variations of uncertainty cannot exist without another, such as the "fake" randomness (as described in section 8.2.1), which would be ineffectual as an uncertainty without the presence of hidden information. The sources of uncertainty were implemented in the prototypes one at a time, and tested with players in an agile and iterative process. The process was divided into design sprints where each sprint focused on one of the sources of uncertainty. Feedback from the test sessions were used to improve the prototypes, and to continually develop and refine a set of guidelines. We found that players experience uncertainty differently depending on how it is presented to them. For example, with randomness (as discussed more thoroughly in section 8.2.2), players can experience a random event as either certain or random, depending on various factors such as previous knowledge, and how the randomness is visualised. Two more obvious examples are hidden information and uncertainty of perception, which entirely revolve around how players perceive something. A less obvious example would be player uncertainty, and in section 8.2, we discuss how player uncertainty is modulated by the information available to players.

The final version of the prototypes, and part of the end result, is a battle system called "Ribble-Rabble", which is a turn-based battle system that contains a combination of all of the sources of uncertainty. The guidelines, the end result, are 19 guidelines which designers can consider when designing for uncertainty in turn-based battle systems in multiplayer video games. Apart from the original sources of uncertainty, we identified and propose guidelines for an alternative source of uncertainty, which we called **audiovisual uncertainty** (see section 7.2.6). Furthermore, we propose guidelines for the concept of **outcome uncertainty** (see section 7.2.7), which is established to be critical for the enjoyment of games.

The guidelines are presented here in a condensed form where only their names are displayed. To view their full explanations, see 7.2. When designing for uncertainty in turn-based battle systems in multiplayer video games:

Guidelines for *Randomness*
- *Consider the purpose of the randomness*
- *Consider the context of the randomness*
- *Consider how, or if, the randomness should be modulated*
- *Consider alternative outcomes*

Guidelines for *Hidden information*
- *Consider what is hidden*
- *Consider how it is hidden*
- *Consider what is not hidden*

Guidelines for *Player Uncertainty*
- *Consider what options players have*
- *Consider what direct effect one player's actions have on the other*

Guidelines for *Performative Uncertainty*
- *Consider the context when performative input is required*
- *Consider to what extent the outcome relies on performative input*

Guidelines for *Uncertainty of perception*
- *Consider the degree of the perceptual challenge*
- *Consider what the perceptual challenge will encompass*
- *Consider how the perceptual challenge is introduced*

Guidelines for *Audiovisual Uncertainty*
- *The combined effect of audio and visuals, where and when it is applied, and what purpose it has*
- *Whether audio and visuals should create a challenge for, or help, players*
- *Consider how, or if, either players or the game-system modulates audio and visuals*

Guidelines for *Outcome Uncertainty*
- *Consider maintaining outcome uncertainty*
- *Consider accounting for player skill difference*

The guidelines are meant to aid designers and cause them to reflect on how enjoyment can be created through uncertainty in turn-based battle systems in multiplayer video games. The guidelines are a result from testing exclusively in this setting, wherefore their area of application is limited, although some of the guidelines are on a level of generality that they may be applicable in other contexts. The implementations in "Ribble-Rabble" are developed just enough for testing and lack functionality beyond essentials, whilst the games described in section 2.2 are fully developed commercial games from large game studios and their sources of uncertainties are more nuanced and multi-faceted. As discussed in section 8.2.1, the sources of uncertainty can work together, and we argue that a more developed game would result in a better of combination of sources of uncertainty, as the games in section 2.2. Further and more extensive testing is therefore needed to determine the guidelines' applicability in other settings.

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A

Appendix 1 - Paper Prototype Test Sessions

A.1 Randomness

A.1.1 Gameplay Test 1

Chance to start each turn
- It is difficult to strategically plan for the next turn.
- Back to back turns can nullify the effect of a defend action.

Get new moves each turn
- Getting random moves is fun and creates variation.
- The move pool could be unique to each unit.

Chance to hit
- 50% chance to hit with attacks is too small.
    - Missing is a big source of frustration.
    - It is difficult to make decisions when the chance to hit is low.
    - Missing should be seen as something unlucky.
- There should be a way to increase accuracy.

Chance to critically hit
- 50% chance to critically hit might be too high.
    - Critical hits is both a source of fun and frustration.

Random turn duration on status effects
- Random turn duration on status effects can be too much.
    - Not being able to act is a big source of frustration.
- There is a huge difference between status effects lasting 0 or 3 turns.
    - Duration span could be shrunk to 1-2 turns.
- There should be a way to dispel status effects.

Other comments
- Units could have unique stats, such as chance to hit and critically hit.
- Attacks and moves could have a chance to hit more than once.
- Moves could target multiple units.
- Defend does not feel useful even at 100% damage reduction.
    - Attack opportunities are too valuable to miss out on.

- There should be a way to bypass defend.

A.1.2 Gameplay Test 2

Get new moves each turn
- Separate move types are fun.
- Heal moves are unnecessary on the first turn.

Chance to hit
- Normal attacks feel reliable.
    - Normal attacks are preferable to use on units with low HP.
- It is more appealing to use higher damaging moves with less chance to hit on units with a lot of HP left.
    - The risk is low and the reward is high.

Chance to critically hit
- Critical hits feel more like a welcome surprise than a relied upon occurrence.

Random turn duration on status effects
- Random turn duration on status effects is fun.
- Damage over time status effects is preferable over other status effects.
    - It is more fun to deal damage than to control and stall.

Other comments
- Trading an attack opportunity to defend does not seem worth it.
    - Offence is the best defence.

A.2 Hidden Information

A.2.1 Gameplay Test 1

Battlefield conditions
- Not knowing battlefield conditions can impede strategies.
    - Works as output randomness.
- Knowing battlefield conditions can enable strategies.
    - Works as input randomness.

Move information
- Not knowing damage, chance to hit, and chance to critically hit can entail difficulty in estimating outcome.
    - Can make it less frustrating to miss attacks and moves.
- Knowing damage, chance to hit, and chance to critically hit can advocate strategic thinking and affect decision making.
    - Promotes foresight and long-term planning.

Unit status information

- Not knowing unit status information can lead to wrongful estimation of potency.
    - Forces players to rely on previous experience to deduce what status effects imply.
    - Causes players to want to defend units that are inflicted with status effects.
    - Players might assume that status effects last forever, if not specified.
- Knowing unit status information can cause players to rethink their strategies.
    - Influences move prioritisation.

Opponent unit information
- Not knowing opponent unit information can lead to misinterpretation of the situation.
    - Players assume that units have the same amount of HP if health bars are the same size.
- Knowing opponent unit information can cause players rethink their strategies.
    - Influences target prioritisation.
    - Leads to optimisation of moves.

Hidden information and known information
- Not knowing information at the start of the game, but progressively learning information over time can be a source of enjoyment.
- It feels possible to calculate the optimal move when rich information is provided.

Other comments
- Defend feels like a boring action.
- Units are expected to have more unique implications for gameplay.

A.3 Player Uncertainty

A.3.1 Gameplay Test 1

Unit type advantage system
- Unit type advantage influences decision making in a weird way.
    - The optimal strategy seems to be to knock out one unit as soon as possible as having an extra unit makes a huge difference.
    - Unit type advantage seems counter-intuitive since it encourages players to spread out attacks on several units.

Charged moves
- It is unclear what to expect from charged moves.
- The power of moves decides whether it is worth it or not to play a charged move.
- Difficult to plan ahead when moves are discarded at the end of each turn.

Other comments

- It is easy to understand the game and the available options each turn.
- Experience playing the game affects ability to create a strategy.
- There is not a lot of variety in what you can do each turn.
    - Some options feel objectively better than others.
    - The optimal move can almost be calculated.
    - It does not feel worth it to focus units with high HP.
- It feels like damage can be nullified by healing.
- Moves are more exclusive and fun to use than regular attacks.
- Some status effects (stun/sleep) feel useless if they only last 1 turn.
    - Players essentially skip a turn to make the opponent skip a turn.
- There are both pros and cons with going first each turn.
    - When going first players can try to knock out units immediately.
    - When going second players can play reactively to what happens.
- There is always risk involved, so players need to decide whether they want high risk for chance at a high reward.

A.3.2 Gameplay Test 2 (Expert)

Insights

- Regular attacks feel inconsequential if moves are always available.
    - Limited resources (such as MP) might alleviate this problem.
- Charged moves damage needs to scale well to feel worth it.
- Being unable to act is a boring status effect.
    - Turn order manipulation might work better for single player games.
- It can be hard to create a strategy when units and moves are randomly assigned.
    - Strategy is limited and something you identify during play.
    - More units, customisation, and individual team building might be needed to create strategic variety.

A.3.3 Gameplay Test 3

Charged moves

- It is hard to know what to expect from the opponent.
- Charged moves can feel slow and like too much investment.
- Charged moves can cause players to want to defend.
- Charged moves are unknown the first time they are played and then become known.
    - Players need to remember what moves units have access to and what the moves do.

Trap moves

- Attacking into a unit with an active trap is only an option when it is absolutely necessary.
    - Players want to prepare with defensive actions before attacking into an active trap.
- It feels safe to play defensively and set up for future turns with trap moves.

    - It is less risky to play defensively and reactively than to play offensively and possibly be left defenseless.
    - Players want to minimise incoming damage.

Strategic thinking
- It feels optimal to target one unit and knock it out as soon as possible.
- Players want to set up with defensive actions before going on offense.
    - Players want to reapply defensive actions when exhausted.
- Players want to apply status before attacking to deal damage effectively.
    - Players plan ahead and calculate how many turns are needed to knock out a unit.
    - Players try to find the optimal solution and avoid overkill.
- It does not feel worth it to use resources to try to save a unit on low HP.
    - Sacrificing units on low HP to deal as much damage as possible is probably better than trying to save them.

Other comments
- It is easy to understand and play.
- There are only a few available actions, but it still requires thinking to make decisions.
- Going first seems advantageous.
    - The player who goes first can attack freely right away or set up defensive actions.
- Battlefield conditions introduce an element of randomness that makes players rethink what they should do on that turn.

A.4 Performative Uncertainty

A.4.1 Gameplay Test 1

Turn time limit
- 60 seconds per turn is a lot, and does not affect decision making.
    - Time needed might depend on previous experience.

Minigames
- Minigames are a fun element to have in a turn-based battle system.
    - Enjoyment varies and depends on the difficulty and type of minigames.
- Elements that require physical input gives players more control over the outcome, although it is still affected by randomness to some extent.
- Not knowing what minigame is next or what physical input is required can be exciting, but can cause players to play safe.
- Knowing what minigame is next or what physical input is required can influence decision making depending on how confident players are in their ability to complete it.
- Minigames might not be inclusive.
    - Colour blindness is common and makes one of the minigames unfair.

- Minigames can cause performance anxiety.

QTE
- The QTE is very easy to complete with full points.
    - Probably related to significant experience with keyboard layout.
    - Possibly related to the type of sensation (input response to aural rather than visual cue).

Other comments
- The most boring thing about the game is missing attacks that are expected to hit.
- It feels impossible to win when a unit is lost.
    - A comeback mechanic could help keep outcome uncertainty even after a unit is lost.

A.4.2 Gameplay Test 2

Turn time limit
- 30 seconds per turn caused players to feel a little stressful and affected decision making.
    - A time limit lets players be brave in their decisions.
    - There is not much time to dwell on if an action is right or not.

Minigames
- Minigames that require physical input is a fun and unique element to have in a turn-based battle system.
    - Performative minigames stands out from traditional luck-based die rolls.
- Players have a real chance to impact the outcome.
- Not knowing what type of physical input is required can cause players to play safe if they are not confident in their ability to complete the minigame.
- Knowing what type of physical input is required can influence decision making depending on how confident players are in their ability to complete it.
- The amount of effort in physical input does not always feel proportionate to the reward.
- Chance to hit is not a satisfying reward.
    - Chance to hit should almost be certain.
    - It would probably be more fun if it affected another aspect, such as damage.

QTE
- The QTE is easy to complete.
- If players miss an input, successive inputs are also easily missed.

B

Appendix 2 - Digital Prototype Test Sessions

B.1 Randomness

B.1.1 Gameplay Test 1

What is your overall impression of the battle system?
Test user 1
Sometimes it is a little confusing about what is going on. It says what is happening in the text but it does not happen slowly enough that you are able to understand. The only time it is slow enough is when effects are applied. But it is not clear which effect is doing what. It is a bit uncertain.

Test user 2
The design was funny, and so were the characters and their names. I feel like I have played similar games before where you select a unit, an attack, and then a target. But if you're not used to playing games it can be overwhelming and confusing. Maybe I should have read more on the units and moves so that I did not lose all my mana right away. The second round we played I thought more about it.

What was most/least enjoyable about the battle system?
Test user 1
It is funny and cool when things on the screen shake. It provides feedback and you know when things are happening. The worst thing is when your attacks miss. It is just boring... But when you miss and hit someone else it is a little comforting. Sometimes it felt like the stakes were too high and a miss would be devastating. Maybe it would be better if the stakes were lower, so that it does not feel as bad to miss. When my units were on low health I had to rely on the opponent missing, and my own attacks being critical hits. Moves also cost a lot of mana.

Test user 2
The most enjoyable thing was that it was funny and that it actually works. I have never been involved in game development before so it was exciting. The least enjoyable thing was that there was too much going on in the background. There are fast moving texts which you need to read and the background is constantly moving. There is a lot of movement and just a lot going on at the same time. I knew that

there was a chance that I would miss my attacks but I did not think too much about it.

Can you go through your thought process for when you selected moves?
Test user 1
I received a unit which had the potential to do a lot of damage, which I revived and tried to keep alive and deal damage with. I selected attacks that inflicted status with other units. I looked at how strong the units were in relation to each other to decide whether they were worth attacking with or not.

Test user 2
I selected every unit and read what their attacks did, how much damage they did and so on. I spent all my mana and used moves first and then went to to regular attacks when I could not perform any more moves. During the second round it was more apparent to me in what order I should click on things, unit -> attack -> unit.

The battle system featured chance to hit and chance to critically hit. How did these elements influence your decision making and strategy?
Test user 1
Sometimes it felt like I had to rely on a critical hit in order to knock out a unit, and I would rather count on reliable damage. When I was losing and the game was about to end I tried to go for attacks and hoped that it would knock out units right away, because status effects would not have been worth it at that point. Sometimes it is worth it to rely on random outcomes.

Test user 2
It did not affect my decision making and strategy very much. When I had three units left I figured that at least one of them would hit.

The battle system featured status effects which affected units. How did this influence your decision making and strategy?
Test user 1
When my units were low I tried to heal them back up. I thought 'oh this unit is not feeling well and is about to die. I should probably protect it'. Otherwise I tried to apply as many status effects as I could on the opponent's units because it would put me in a better position.

Test user 2
I did not think much about status effects. I wanted to use positive status effects such as heal on my own units and status effects that sounded negative on the opponent. Amount of mana left mattered more than life left, and limited mana made it so that I could not select many moves.

This gameplay test focused on randomness as an uncertainty. How was your experience with randomness in the battle system?
Test user 1
I did not really notice the randomness in the game. I did not miss a lot of attacks and I very rarely got critical hits. The damage on moves felt random though. To

feel the randomness, more things need to happen, like maybe a higher chance to critically hit or higher chance to miss. But at the same time it is very boring to miss. Maybe alternative outcomes.

Test user 2
When I got to start the round it felt like I had a severe advantage. Or maybe I was just lucky during the round with hits and critical hits? I got three critical hits in a row once.

How did these elements of randomness impact your enjoyment of the battle system?
Test user 1
It is funny when you miss and still manage to hit someone else. The calculations in the middle of the screen are fun to follow and see what happens. However, there are more things that feel certain than uncertain. Randomness exists but it does not 100% decide the outcome.

Test user 2
It is nice to know that the opponent can miss, because that is good for me. But at the same time I can also miss, and that is bad. It is exciting that there is a chance and some randomness involved and that you can miss and not always hit.

Other input?
Test user 1
I think it looks like fun. But one time it said I missed my target but I managed to hit someone else, and that was the same target that I tried to hit in the first place. I did not really understand that.

Test user 2
I did not understand what the calculations in the middle of the screen meant. The first impression that I got was that it was unclear what was going on. I have not played that many games before and I am not used to having to read on every single unit and move to decide what actions I want to take. But it was fun to play. It feels like a real game and looks like a real game.

B.1.2 Gameplay Test 2

What is your overall impression of the battle system?
Test user 1
It is very unbalanced. But it is intuitive, the controls are easy to learn. Some of the moves and status effects are unclear what they do, while some of them are kind of clear, such as fire, slash, stab etc. You can guess/estimate what it is that they do. On one of the moves I had, two different effects were written down on it, but I had no idea what any of them did. Maybe there needs to be different text sections, or a descriptive text, or make use of bold or cursive font to clearly show which words are applicable effects.

Test user 2

The player who gets to start will most likely also be the winner. If the player who starts uses their strongest moves right away and focuses on one unit they will probably knock it out, and then they have pretty much won at that point. The controls were simple. Damaging status effects were overpowered. They need to be nerfed or removed.

What was most/least enjoyable about the battle system?
Test user 1
Defensive moves were boring and unnecessary. Status effects were fun, but they should be removed from a unit when it is knocked out. The visuals were also fun, with the animations and the particle system.

Test user 2
The least enjoyable thing was that healing moves were not good enough. I revived and healed my units but they just kept dying to status effects. There needs to be a better incentive to use healing moves. Units just keep dying as it works now. The most enjoyable thing was to win. And critical hits were fun with the animation. I do not know what the calculations in the middle meant though.

Can you go through your thought process for when you selected moves?
Test user 1
At the start I did not know what the moves did, but it was clear what moves were offensive, such as fire. I wanted to use my damaging moves first until I did not have any more mana, because they felt stronger than regular attacks and I did not know if I would be able to use them later. When I did not have any mana I switched over to regular attacks.

Test user 2
I used my moves first until I had no mana left. At first I was not going to only use offensive moves, but the defensive moves were not good enough. I wanted to focus all my attacks on the same unit, and I used the moves which I thought would deal the most damage.

The battle system featured chance to hit and chance to critically hit. How did these elements influence your decision making and strategy?
Test user 1
Not at all. When you realise that you can knock out a unit in one turn you just go all in. It is hard to make strategic plans because it is difficult to estimate how big of a chance there is to hit with moves. It is misleading as it is right now.

Test user 2
Nothing, I did not think about it. I did not know the chance to hit and I could not understand what hit mod meant.

The battle system featured status effects which affected units. How did this influence your decision making and strategy?
Test user 1

If I had a DOT on one of my units I did not care to try to save it. Instead I tried to apply as many DOTs as possible on the opponent's units because they did a lot of damage.

Test user 2
If an opponent's unit has low HP and a damaging status effect on it I did not attack it because it was probably going to die anyway. It would have been a waste of an attack opportunity. I also tried to save my own units when they were on low HP but if they had DOTs on them there was no point. DOTs were too strong.

This gameplay test focused on randomness as an uncertainty. How was your experience with randomness in the battle system?
Test user 1
It was very random. It would feel reasonable to have similar units. One round I had three of the same unit and it was very powerful.

Test user 2
EVERYTHING was random. I would describe this as "randomness galore". You could choose what moves you wanted to use but you could not influence much more than that.

How did these elements of randomness impact your enjoyment of the battle system?
Test user 1
Honestly, I did not think a lot about the randomness. There was so much going on at the same time with the animations for damage, status effects etc. I understood why I missed some attacks but I did not think a lot of it. There are a lot of elements on the screen which are distracting but fun. What happens on the screen can be too much. I do not think this is a game that I would play for a long period of time. It is fun to play but becomes too much after a while because it does not feel like you can affect the outcome a lot. It would perhaps be suitable as a party game because it is fun and chaotic. It feels a bit like playing dice. It is casual and has a lot of randomness. There is not much of a competitive element because of the randomness.

Test user 2
It affected my enjoyment quite a lot. For example, one round I had a unit with dog shit spells. Then I felt unlucky. The fact that you can miss attacks also affects the enjoyment of it. I was frustrated when I received bad moves and when I missed, but when I got good units with good moves, and critically hit my attacks, then it was fun.

Other input?
Test user 1
I like the visuals, but maybe it is a bit too shaky. It becomes annoying after a while. You should definitely not add more shakiness. But I like the animations that play when you apply status effects. It would probably be good to have a battle log of some sort that shows what happened during the previous turns, because it can be

hard to follow along or even remember what has happened. It is also difficult to see whether or not a unit still has an active status effect on it. Maybe it needs to have something like a border or an overlay on it. It would also be nice to be able to read and know what the different status effects do. It was fun to test, I laughed a lot the entire time! The test was well structured and you asked good questions, but maybe the statements in the questionnaire were formulated in a weird way.

Test user 2
I agree, there is a lot going on with all the moves. It would be good with a battle history log.

B.2 Hidden Information

B.2.1 Gameplay Test 1

What is your overall impression of the battle system?
Test user 1
It was hard to know how to win and form a strategy, because I could not tell how good the different moves were. It was not a good experience because you want to win, but it was unique because the characters said things.

Test user 2
There were a lot of new things to take in and make sense of. I am used to video games and I think sound plays a big part and can help to interpret what is going on, like how much damage a move does, or when a critical hit happens for example. When the animations were happening I did not really know where to look, because there was so much going on at the same time.

What was most/least enjoyable about the battle system?
Test user 1
The game looked good, but the fonts and the UI were ugly. And also, text logs happened too quickly.

Test user 2
I think it was exciting that you could not really tell what was going to happen during a turn. You did not know how strong the units or the moves were, and you could have luck or bad luck which could make the outcome something else than you had planned. At the same time it made it hard to actually make a plan. The game also moved too fast so it could be hard to follow along with what was happening. It became better after some time when I knew where to look on the screen, but I still think it could benefit from being slowed down.

Can you go through your thought process for when you selected moves?
Test user 1
I wanted to choose what I thought was best, but it was confusing, so I chose by name what I thought sounded best.

Test user 2
I also went with what I thought sounded best. For example, moves such as fire sounded basic in comparison to establish order so I thought the latter would be better, but I do not know if it was.

The battle system featured little to no information regarding units and available actions. How did this influence your decision making and strategy?
Test user 1
It is hard to know how to react against the opponent. You had to try and figure things out on your own as the game went on.

Test user 2
I do not know if I had a strategy other than selecting what I thought were the strongest moves and trying to attack the same unit to knock it out.

This gameplay test focused on hidden information as an uncertainty. How was your experience with hidden information in the battle system?
Test user 1
With little or no information it is difficult to understand anything. As an experienced gamer I could recognise some things and estimate what would happen when I selected a move.

Test user 2
It was fun, but it also felt a little like it did not really matter what I chose to do on my turn. Maybe I could try to really analyse the effects of my moves, but that would have been too much effort.

How did the amount of information impact your enjoyment of the battle system?
Test user 1
It was fun to explore and find out what the different characters and moves could do.

Test user 2
Like, we did not have access to any information. I could try to make out how strong different moves were by their names, and also by paying attention when the animations played out in the game to try and connect what moves I chose to what was happening.

Other input?
Test user 1
Not really.

Test user 2
I think you have a good thing going here, but maybe you need to make it more user friendly for when people are playing the game for the first time.

B.2.2 Gameplay Test 2

What is your overall impression of the battle system?
Test user 1
It feels like a classic RPG, like Pokémon. You have a couple of moves that you can select per unit in your roster. That way it was familiar, but I do not have too much experience with video games. I had to explore a lot. I recognised some of the mechanics from other games, such as early Final Fantasy games.

Test user 2 It reminds me of roguelikes or dungeon crawlers, except that it is multiplayer. It feels like if you had played with this battle system a lot you would eventually learn what works best. You start to figure out the underlying algorithms. At the beginning of the battle you do not know anything so you have to test things in order to figure it out. So there is kind of a build-up or learning curve, but once you have somewhat learned how it works it is all good. The different attacks and moves were similar to what they do in other games, so you could guess what they would do. But when I missed my attacks I wasted a turn and did not learn what they did.

What was most/least enjoyable about the battle system?
Test user 1
There are a lot of funny attacks, such as fart and flirt. It was fun to explore what things did from the start. Seeing the animations was fun. One thing that was bad was that the combat animations were fast and the lines of text which explained what was happening disappeared too quickly. It was hard to follow along, but I could notice the differences in HP and stuff like that.

Test user 2
There were too many misses. The base chance to hit felt too low... It would be understandable if I had a status effect on me. The best thing was that you had to explore and learn how things worked. It was new and interesting. It was a bit too fast though. Text disappeared before you could read it.

Can you go through your thought process for when you selected moves?
Test user 1
I wanted to understand what the different moves did. I have some experience with games like this, so I chose the moves that sounded like they would deal damage to the opponent. I focused on one and the same unit to knock it out and win.

Test user 2
I identified a strategy right away. I tested moves, selected one of the opponent's units and I went all in on it to knock it out right away. That is the way to win in many other games. It is an easy strategy that often works. If you have not balanced the game well that strategy can be very strong. Knocking out one unit early on and leaving the opponent with only 2 units left. But my strategy failed a bit when I missed and hit one of my own units. That was not so good.

The battle system featured little to no information regarding units and available actions. How did this influence your decision making and strategy?

Test user 1
I thought the size of the units in relation to the size of their portrait was indicative of how much HP they had. I did not really have a great strategy. I wanted to make the best decisions, and I could guess what some of the moves did, for example I guessed that fire would deal damage. Another unit had patch up, which to me sounded like a healing move. So I made guesses like this and got confirmation at the end of the round.

Test user 2
It made it harder to know what things did. I could guess what attack did, so I could just go all in on that. I identified that one of the opponent's units could heal so tried to knock out that unit first.

This gameplay test focused on hidden information as an uncertainty. How was your experience with hidden information in the battle system?
Test user 1
It lived up to my expectations mostly. It matched my mental model of what would happen when I selected the different moves. Even if there was not a lot of information I feel like I had a good understanding of it. But I did not know that I could hurt other units, or my own, when I missed. That is not usually how it works.

Test user 2
You received some information when you attacked, such as how much damage attacks did, and when status effects triggered. You had to keep track of it in your head, but I did not play it long enough to memorise the numbers and compare them to each other.

How did the amount of information impact your enjoyment of the battle system?
Test user 1
It was fun to explore. When I play games I do not want to read so much about what things do so that was nice. Some games just throw heaps of text on you. I liked to test it out on my own and learn from my mistakes.

Test user 2
It was a bit slow to get started and notice what things do. I think there needs to be at least some information available from the start so that you learn a little from just looking at it. Now you go in completely blind. There needs to be some balance to it. Now you put time into trying it out and learning that way, which takes more time than reading.

Other input?
Test user 1
The decimal numbers were weird. It was unclear that the moves cost mana when there was no information. But it was interesting and fun. We needed some help when bugs occurred, but there is not much to say about that. It happens. We could still get the full experience.

Test user 2
I think it is good. Some of it was a bit weird but it worked well. Some things were obvious bugs.

B.3 Player Uncertainty

B.3.1 Gameplay Test 1

What is your overall impression of the battle system?
Test user 1
It was very cool. I did not think that it would be on the development level that it was, so I was impressed by it.

Test user 2
It was exciting to play. I like the idea of competitive but friendly games. It is something that I could see myself playing as a party game.

What was most/least enjoyable about the battle system?
Test user 1
I like that I played against another real player and not just the computer. That made it more unpredictable and the stakes were higher, because I did not want to lose against someone else. It was also nice that we were sitting next to each other taking turns, because then you get the social aspect too. We could laugh and curse at each other when it was going good or bad for us. What I did not like very much was that there was a snowball effect which was very hard to stop, so I could potentially lose right out the gate if the other players got off to a good start.

Test user 2
The best thing was analysing and learning the components, because that let me theorise what actions I wanted to make on my turn and create a good strategy. What was not good was that it was counter-intuitive and hard to decide what I wanted to do, because I could not decide which moves were better. The descriptions on moves were not very descriptive, and it was impossible to know how much damage they would deal. Some of them applied status effects which did damage over time, but it was difficult to calculate the total damage it would do.

Can you go through your thought process for when you selected moves?
Test user 1
Because the goal was to have a winning strategy, I tried to analyse what units and moves I had at my disposal to try to calculate what the most optimal choice of action was every turn. The units were easier to analyse than the moves because you had numbers to compare between, while the moves were more vague in their descriptions. So to decide on moves I checked the MP cost of them, since it would make sense that moves with higher MP cost would deal more damage. I focused on one of my opponent's units and tried to knock it out as soon as possible as I realised it would give me an advantage.

Test user 2
Because the move descriptions were so vague, I also looked at the MP cost of moves to help decide the power of them. I generally went with the moves that had the highest MP costs until I ran out of MP, but in some cases I also spent MP to heal my units, although it did not really seem worth it. I focused my attacks on one of the other player's units, because I figured that if I managed to knock one of them out I would have one more action per turn because I would have one more unit per turn.

The battle system lets real players battle against each other. How did this influence your decision making and strategy?
Test user 1
I did not know how strong the other player's units were, nor what moves they had. I had to pay close attention to what was happening when the other player ended their turn and I could look again. I tried to deduce how much damage I would take on the next turn if the other player went for the same actions again. I suspected that they would, because they were also instructed to try to create a strategy, and had therefore probably chosen what they thought were the optimal actions. I also looked at how much MP the other player's units had left, since they could not keep up the same course of actions endlessly. When I identified that the other player was focusing on only one of my units as well, I tried to defend and heal it if I felt that I was behind on HP.

Test user 2
It affected me in the way that I badly wanted to win. So each turn I took my sweet time and tried to figure out the best actions to make. I could not really tell what the other player was thinking or planning to do since I could not look at their units or moves. I just noticed that they were focusing on one of my units, and initially I tried to heal units on low HP, but it did not seem to be worth it so I focused more on offence instead.

This gameplay test focused on player uncertainty. How was your experience with player uncertainty in the battle system?
Test user 1
It was great. I got an experience that you could not replicate with a computer, because you cannot always predict what the other player is going to do. In this case it was relatively easy to identify the optimal strategy, given the units and moves I had at my disposal, and the same went for identifying the other player's strategy. Also, even though I knew what the other player wanted to do, I felt like I did not have enough tools to stop it from happening.

Test user 2
Playing against a friend made it fun, and it was a challenge to predict their actions. You know your friend's playstyle, and if they take games seriously or not. You also know if they are sore losers, which is just an extra incentive to win, so you can rub it in their face. If you are ahead you can be disrespectful and choose weaker moves to BM (bad mannered) the other player. But you also need to be careful so that you do not get caught off guard and lose after.

How did the knowing that you were playing against another player impact your enjoyment of the battle system?
Test user 1
Positively. It became competitive in a friendly way that pitted us against each other. Neither of us wanted to lose, so we actually tried our hardest to win. But it felt like my chance to win depended a lot on the units and moves that I got, rather than on my decision making.

Test user 2
It made it more fun to play, but I think that it also depends on who you are playing against, because you are sitting next to each other. If it is a good friend you will probably have a better time than if it is someone you do not know.

Other input?
Test user 1
Perhaps players should be able to choose their own units and moves if the goal is to create a strategy. I think that some extra variety in units and moves would also be good.

Test user 2
Being able to inspect the other player's units would certainly help in trying to understand their game plan.

B.3.2 Gameplay Test 2

What is your overall impression of the battle system?
Test user 1
It was pretty simple to play, but at the same time there was a lot of complexity to it. It has a lot of potential to be both a casual game and a more competitive game. Either way it was fun to play!

Test user 2
I think it looked kind of crazy, but it had such a vibe to it. The graphics were super weird, but oh so interesting. I loved just looking at it, truly a work of art.

What was most/least enjoyable about the battle system?
Test user 1
Most enjoyable was that I could make a lot of different decisions on my turn, and it felt like my decisions mattered in whether I would do well or not. Least enjoyable was that I had no idea about what the other player could do with their units, so it was hard to prepare or do any type of counterplay. I wished that I could have clicked on the other player's units and looked at what they could do.

Test user 2
The best thing was definitely the appearance of it. The units felt a little out of place because they were in black and white, but otherwise it looked great. I think the least enjoyable thing was that it was confusing. My units kept taking a lot of

damage from things like bleeding and poisoning, and I could not connect what was happening to why it was happening.

Can you go through your thought process for when you selected moves?
Test user 1
I chose moves that sounded like they did a lot of damage. Some moves applied status effects, and I did not know it at the start, but I quickly realised that they were very powerful over time. So I also looked at what status effects would be applied if I used a move. Then I tried to apply status effects to all of the other player's units to wither them down over time. It felt like a good strategy.

Test user 2
I wanted to use funny moves, but they were probably not the strongest, so I chose what I believed to be the strongest, even if it meant spending all my MP right away. I thought that the amount of MP was indicative of how powerful a move was, so I chose moves based on that. I did not think about status effects at all because I could not really tell what they did. Some dealt damage over time, but I wanted to deal damage right away and focused on one of the other player's units.

The battle system lets real players battle against each other. How did this influence your decision making and strategy?
Test user 1
It did not affect me that much. It was fun that I was playing against someone, but I think I would have made the same decisions even if I was not playing against a real player.

Test user 2
It made me want to win, so I tried to play as well as I could. I do not think my understanding of the game was good enough to make the best decisions, but I concocted a strategy and tried to stick to it.

This gameplay test focused on player uncertainty. How was your experience with player uncertainty in the battle system?
Test user 1
It was very uncertain, because I did not know what the other player's units could do, and therefore I could obviously not anticipate what they would do on their turn. After their first turn I could almost identify their game plan, to take out one of my units, but even once I knew that, I did not know what I could do to stop it from happening.

Test user 2
When I looked back on the screen after the other player had made their turn I was not sure about what I was seeing. I saw moves happening and my units lost HP as a result of that.

How did the knowing that you were playing against another player impact your enjoyment of the battle system?
Test user 1

Mostly positively. We had a good time while playing and could laugh together. It would not have been the same if it had been online, then we would have just sent emotes and stuff to each other.

Test user 2
It appealed to me because of my competitive nature. I tried hard to win when I was told that we would be playing against each other. But it was fun because we are friends and can tease each other about things like this.

Other input?
Test user 1
Being able to click on the other player's units during your turn would probably help a lot to identify their strategy.

Test user 2
I think it could be slowed down a bit so it is easier to follow what is happening. Because I was not allowed to look when the other player made their turn I could not really tell what was going on when my units took damage.

B.4 Performative Uncertainty

B.4.1 Gameplay Test 1

What is your overall impression of the battle system?
Test user 1
i think it was funny, mostly because of the characters because they made it humorous. It was fun to play, and to be able to play against someone else on the same computer. I did not really understand what the status effects on my characters did. I looked at HP and MP in the unit info box, but not so much at the effects. The characters said things like ouch I'm bleeding, which helped to understand what was happening, but otherwise it was hard to keep up.

Test user 2
Sadly we never got to see someone win because the game crashed. But it was good. It was logical what the moves did, and there was an explanation at the side which was good. The countdown between player turns was fun. Maybe I misunderstood some things, but I knew what moves I chose and how much MP I had. When the attacks were playing out I did not really understand the connection between what I did on my turn and what was happening. I could not keep up with it. I felt the same when my attacks missed and I hit someone else. It went too fast. Maybe it would be good to minimise the amount of text that appears, like when a character says I'm bleeding, and show it in some other way.

What was most/least enjoyable about the battle system?
Test user 1
The most enjoyable thing was the characters, they were funny. It was very humorous. Least enjoyable was that it was unclear and I did not know what the different status

effects did. And when you press end turn a lot of things happen. It was hard to keep up. I mainly looked at how much HP units had remaining afterwards

Test user 2
Most enjoyable was that you could play against someone on the same computer. Like, that it is a real player. Least enjoyable was what happened after I pressed end turn, because I could not keep up with what was happening. Suddenly my own units took damage during my turn...

Can you go through your thought process for when you selected moves?
Test user 1
I thought that moves that cost more will do more. That was my thought process. In other games that is usually how it is. And sometimes I wanted to make moves which would apply bleed or other status effects. If I knew that one of my units was affected by a status effect or low on HP I wanted to heal it, provided that I had enough MP to do so. In the beginning of the rounds I wanted to see how much damage my moves did. I split my attacks between units at the start but then I focused on one and the same unit because I realised it would be very advantageous to have more units left than the opponent. Then they will have less opportunities to attack every turn. It seems to be the most effective strategy. Sometimes I contemplated whether I should spend a turn to heal or just go all out and attack.

Test user 2
I also picked the moves that cost the most MP because I thought they would do more damage. I do not know if that was the case, but that was my understanding. I looked at how much MP my units had left and how much MP their moves cost, and then I saw what moves I could select. One turn I only had MP to use a healing move, so I did that. Some moves applied effects that lasted for several turns. I did not know that moves would apply effects which would continue to do damage over several turns. I did not think too much, I just did. But one thing was that I wanted to heal units that had low HP. I was more focused on my own game and did not think a lot about what the other player did.

The battle system included elements where the outcome was affected by physical input. How did this influence your decision making and strategy?
Test user 1
I did not think about it actually. I saw it more like a minigame in between turns. It did not feel like it affected anything, but I managed to complete it successfully every time. In other games you have strategy phases where you can move units around on a battlefield, but here you have minigames instead. Nothing about the characters change over time, except HP and MP, so you do not have to think about placement and so on. I did not notice how the minigames affected the game, I guess.

Test user 2
I have no idea. It is positive if it does something for my turn if I manage to complete it, but when I played I did not know what it did for me.

This gameplay test focused on performative uncertainty. How was your experience with performative uncertainty in the battle system?
Test user 1
When we played we had these 2 specific minigames, but there can be many others too. If you play this game for like 8 hours you will probably become very tired of them. We saw what minigame the other player had to complete, which can give an unfair advantage if you need to complete the same one, but we had to press different keys. I had one hand on the keyboard and one on the mouse to be ready for both minigames. In some games you can become annoyed if someone wins because they get lucky.

Test user 2
I think it was fun. You had to get ready for your turn. I hoped that I would get the minigame which required me to press a key because it was easier. I think you always hope to get the easier minigame, or the one that you are good at, because then you know that you will be able to complete it. Maybe it would be more even if you get the same minigames under the same conditions. If I would have got the hard one a couple of times in a row I would not have stood a chance. But I am also not very good at games. I think it was nice that we sat next to each other and played. We did not get the same keys to press so you had to be ready for anything. Either to press a key on the keyboard, or chase with the mouse.

How did the elements of performative uncertainty impact your enjoyment of the battle system?
Test user 1
Positively. You had to be ready to react, like sitting on the edge of your seat. I kept thinking that it was an event that I had to complete, and that it gave me something if I managed to. I never felt bothered by it and thought ugh now I need to do this again. It would be nice if you got some feedback which tells you that you get bonus damage or something.

Test user 2
It was fun that it affected your turn positively. But it would be good if it said something about getting extra damage. If you did not tell us, I would not have known that it did something.

Other input?
Test user 1
The music was good. It did a lot for the experience. And when the countdown started I was like oh shit, a countdown, here we go! Some things need to be clarified though. You have the order info box to the left that explains what will happen when you press end turn, but you could benefit from having red/green arrows or something between the units to show who is attacking/healing who. Otherwise you need to remember what you selected. And it would probably be better if you could see status effects on your units by having an icon, colour overlay or something on their portrait, instead of having it in the text box to the right. And you should also show how many turns there are left on status effects. We did not choose our units or

our attacks so it was hard to create a strategy before knowing what it all did. In that way random elements affected a lot. Also, I might have had an advantage because of my previous experience with playing games, especially precision wise when it came to clicking on the moving character. I also recognised a lot of the language from other games so I could guess what would happen before I used some of the moves. Many of the elements exist in games from different genres that I have played before.

Test user 2 The countdown and sound really got your attention, which was good. As a user it takes a lot of time to read all the text on the screen. I think that I process information faster if it is in some other form, like icons. I did not have as much experience playing video games as the other player so they probably had a better understanding of what to do from the start. But I understood it over time. I understood that MP was a limited resource. I did not understand or know what to expect from the different status effects. I have some experience with casual games, puzzles and problem solving. This was a little more complicated than that.

B.4.2 Gameplay Test 2

What is your overall impression of the battle system?
Test user 1
It was unfair. There were many uneven proportions. Text boxes were unproportional in relation to each other. + ATK DMG was very big... It stayed on screen for too long and hid other elements behind it. There was an information overload, a lot to take in, so I ignored some things, such as MP.

Test user 2
There was a lot of text. Information overload so I did not really read anything. I did not understand that you had a limited amount of MP. I took a chance on most things. All I did was take chances.

What was most/least enjoyable about the battle system?
Test user 1
It was not fun that the minigames were random. I got the hardest one ALL THE TIME. It would have been more enjoyable if it varied more. You could also get many of the same moves on your units since they were random, or you could get several healing moves, limiting your offensive options. I liked the end of turn effects, but it could also be very confusing. Sometimes you took damage and did not understand why. And maybe get rid of the quit button. It was not very obvious which moves that were attacks and which moves that were heals. The minigame with the teleporting character that you needed to click was super hard! It was so fast. It felt very unfair, because you had much more time to complete the QTE.

Test user 2
I had no idea about how powerful moves were. It was hard to understand how attacks and end of turn effects were connected. I had trouble following which units were mine when they swapped places. It was weird that you could attack your own units. I could not remember which units I had selected an action with. There was a

green and blue bar that I did understand what it was. Then I was told it represented life points, but I have played games like Zelda, where life points are shown in hearts, which is a grounded metaphor. I am not used to it looking like this.

Can you go through your thought process for when you selected moves?
Test user 1
At the start I looked around a bit. I checked my own units, where it said hit multiplier and hit rate. I looked at the characters more than I did the moves. If I noticed that a move was good, I kept using it. I did not explore too much. I never read what the text box on the left said. I did not really understand the information in it. It was just more text and information overload, so I ignored it.

Test user 2
I thought about the names of the moves. First I chose moves that I thought sounded cute, like charm, and then I went with what was the most terrifying sounding, like slash.

The battle system included elements where the outcome was affected by physical input. How did this influence your decision making and strategy?
Test user 1
Not at all. It was fun, but did not affect anything. You just selected what you thought was the best. You were like, okay, cool beans, good to know.

Test user 2
It did not affect anything, because I did not understand what it did. It was a little fun, but I was mainly wondering when it was my turn.

This gameplay test focused on performative uncertainty. How was your experience with performative uncertainty in the battle system?
Test user 1
Chasing the character was awful. I only managed to complete it once. There was a huge difference in the time you had to complete the two minigames. It would have been nice to have a timer showing how much time you had left.

Test user 2
I think the amount of time was the same for both minigames, but you experience time differently in the minigames, so one felt like it had less time than the other because it was harder.

How did the elements of performative uncertainty impact your enjoyment of the battle system?
Test user 1
It was a fun addition, but I was a bit annoyed that I almost always had to chase the character. I was relieved when I got the QTE. It was unfair and felt scripted.

Test user 2
It was fun, and I gloated when the other player failed their minigame. It was a minigame every turn, so you always had to be ready.

Other input?
Test user 1
I thought it was unclear that you could attack the opponent by pressing the attack button. I thought that pressing the attack button would give me 3 offensive moves to use, and that pressing the defend button would give me 3 defensive moves to use. So I thought they were menu toggle buttons that would switch the moves my units had.

Test user 2
I would have wanted more instructions and information about the different status effects before I started playing. Also, perhaps a basic walkthrough of the UI and things that I would need to know, such as HP and MP.

B.5 Uncertainty of Perception

B.5.1 Gameplay Test 1

What is your overall impression of the battle system?
Test user 1
It all felt random, but maybe that was the point? I did not know or understand all the mechanics, but it did not feel like there was a lot of room to express player skill.

Test user 2
It felt a bit familiar. I think it was hard to know what everything did, or what the purpose of some things was. I healed one of my units and expected a different result. I was trying to remove status effects. A lot of things were random so I just hoped for the best.

What was most/least enjoyable about the battle system?
Test user 1
It was so absurd that it became fun. It felt like a fever dream, like I had taken drugs and sat down with some random RPG. Other than that it was a bit overwhelming. There were many things I did not understand. I got the feeling that it did not really matter what I did. I missed descriptions on the status effects. I did not know how powerful they were.

Test user 2
The hardest thing for me was probably my bad memory. I wanted to check how much HP the opponent's units had but I could not do that, and I forgot how much HP they had when it was my turn again. It was fun that the elements moved around. It was a challenge in and of itself to click on them. It was also fun that it was random and it worked in my favour, and then I could laugh when it did not go the way my opponent wanted it to.

Can you go through your thought process for when you selected moves?
Test user 1

In the beginning I thought a lot about my moves, but after a while I just pressed the attack button. I wanted to see what moves I had available and what they did, so at the start I explored all my units and their moves, but when I could not understand how powerful the moves were I just stopped trying to figure it out. My actions would not matter if I did not understand. I could not make decisions based on knowledge. It is also hard to compare how powerful moves are when there are status effects involved and not just direct damage, because then you need to calculate it over time.

Test user 2
I started by inspecting my units and reading their different stats. It took me a while before I had gotten through it all, but then it felt good because I would recognise them. My units had many healing moves so I did not have many options for when going on offense. But less options also made it so it went faster and I did not have to think it through too much. I could choose to attack, or use MP to attack in a different way. I wanted to start off strong so I initially chose the moves with the highest MP cost. I hoped that if something cost a lot, it would also deal a lot of damage. I also saved some MP for if I needed to heal my units. When I tested moves and found something that worked, I would go for the same thing the next time again.

The battle system featured sounds and some vague visual elements. What did you think of them?
Test user 1
Regarding the Sanity meter, I did not know what it did at the start, but I hoped that I would find out later. Did it decrease gradually depending on the amount of turns that had passed? Or was it based on time? I do not know. I thought it was fun to aim and try to click on the buttons, even though I missed most of the time.

Test user 2
I thought the Sanity meter was based on time or amount of clicks. I did not think about it when we played but maybe it affected my actions negatively? The sound effects worked as feedback when things happened.

This gameplay test focused on uncertainty of perception. How was your experience with uncertainty of perception in the battle system?
Test user 1
I think the most notable thing was the sound during the countdown between turns where you had to prepare. It was a reminder that it was the other player's turn.

Test user 2
I do not know.

How did the sounds and vague visual elements impact your enjoyment of the battle system?
Test user 1
They made it more exciting, but I was starting to lose my mind after a while because of the music.

Test user 2
It is always nice to have music. It enhances the game experience. It was immersive. It was fun that things moved around, but I do not know if I would appreciate that long term. In some games you can disable the music, but at the same time it provides a unique characteristic.

Other input?
Test user 1
No.

Test user 2
Is it meant to be so noisy?

B.5.2 Gameplay Test 2

What is your overall impression of the battle system?
Test user 1
It was fun to play. It felt somewhat familiar because there were mechanics that I recognised from other games which worked in roughly the same way that I am used to, but at the same time it also had other mechanics that I've never seen in a game like this before. It was a little weird, but refreshing. I had fun.

Test user 2
It was really fun, and I am impressed by how creative you have been when designing it. I think it could benefit from being slowed down a bit and be more clear in what is going on. That would make it more user friendly.

What was most/least enjoyable about the battle system?
Test user 1
I think the best thing was that it combined many mechanics from different types of games and packed it into one. It was a completely new experience for me and not something I expected at all. There is always room for improvement and balancing but it was definitely a unique experience. The worst thing was probably that it was hard to follow along with what was happening. Some things happened too fast and I did not have time to read all the different texts on the screen. Maybe it could be slowed down a bit so it is easier for new people who do not know the UI well.

Test user 2
The best thing was the design of the units and the moves. I loved that it was humorous and contained elements that were a bit childish. And the worst thing, hmm... It was hard to understand what the active effects on my units did. Sure, I could select the units and look at the box with information about active effects, but I did not know what the effects did, so I could not plan accordingly. Sometimes my units took damage and I did not really know why. So that is something that could maybe be improved.

Can you go through your thought process for when you selected moves?
Test user 1

Some moves seemed objectively better than others, as long as you had the mana to use them. So I mainly used what I thought were the strongest moves based on MP cost. Some moves also sounded better than others based on their names. Some of them had very cool names while others sounded pretty basic. I did not use healing moves at all because they do not really fit my playstyle. I like to play aggressively and win fast, and if I fail to do that and have used up my resources, I am probably left in a bad situation, which means I will lose.

Test user 2
I chose the moves that sounded fun to use. If I had the opportunity to fart on my opponent I would not miss it. Was it the best thing I could do? Probably not. I did not care much about winning. I was just trying to have fun while playing.

The battle system featured sounds and some vague visual elements. What did you think of them?
Test user 1
I liked the sound effects. They were fun and really added to the gameplay experience. Without them it would be dull to play I think. The background music was also a nice addition so that it was never completely silent. The background looked cool and the camera movement made it feel more alive, but it could also make it harder to see what was going on.

Test user 2
Some of the sound effects were comedic and ridiculous, and I loved that. The music was cool too and created a nice ambience. When the buttons started moving around it felt like something was going to happen, or that the whole system was breaking down. I think it had something to do with the amount of Sanity displayed in the corner.

This gameplay test focused on uncertainty of perception. How was your experience with uncertainty of perception in the battle system?
Test user 1
It was mostly positive I would say. I am not sure of the implications any of it had on the gameplay, but it was a fun experience, at least for me. But it was also the first time I played it, and I think that you might find it annoying after playing for a while.

Test user 2
I did not really know what to expect. Buttons started moving around and I did not know why. Was it meant to make it harder to click on them? Or was it building up to something else? It kept speeding up throughout the game but I do not think it ultimately led to anything. So my experience is that I was curious at first, but it felt kind of pointless in the end.

How did the sounds and vague visual elements impact your enjoyment of the battle system?
Test user 1

I think some of it made me feel a little stressed, but not too much. The sound effects were fun, and the music set the mood, but then it started to go faster the longer we played. And then there was the Sanity meter that also decreased over time and everything started to move around. At that time I was concerned that I would not be able to click on the buttons, but it turned out fine. I was kind of expecting there to be a time limit to your turn when the music was sped up, but there was not, so it was not that stressful. Otherwise I mostly saw it as a fun addition that enhanced the gameplay experience.

Test user 2
They definitely added something, but I am not sure what. They were a bit mysterious and it was not clear when or why things started to happen, but maybe that is how it was intended to be. Like I said before, it built up some suspense when the buttons started to move around because I expected something to happen.

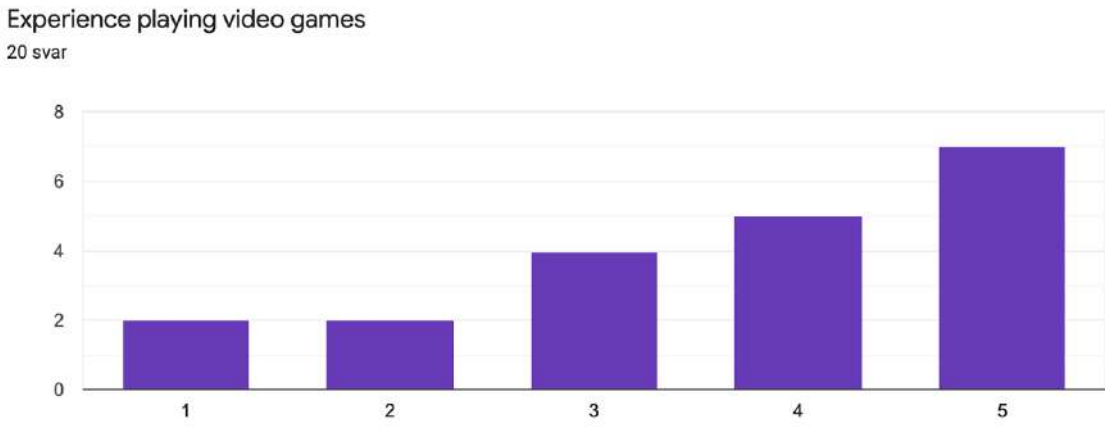
Other input?
Test user 1
It was fun to be here and be part of what you have been working on. Good luck with the rest of it!

Test user 2
Like we said before, you can work on making some things more clear, but it was really fun to test it out.

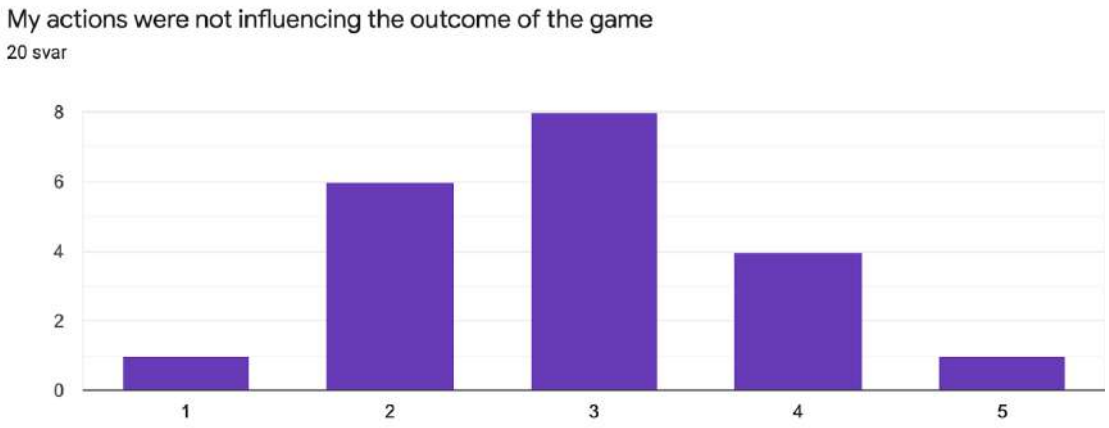
C

Appendix 3 - PUGS Results

C.1 Experience

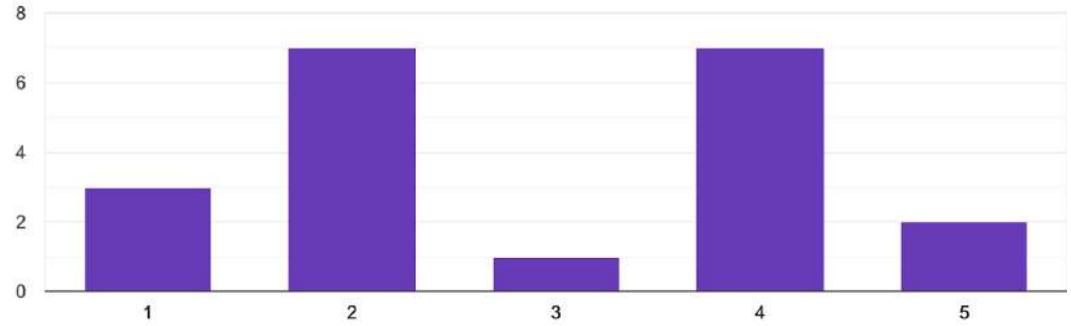


C.2 Decision Making



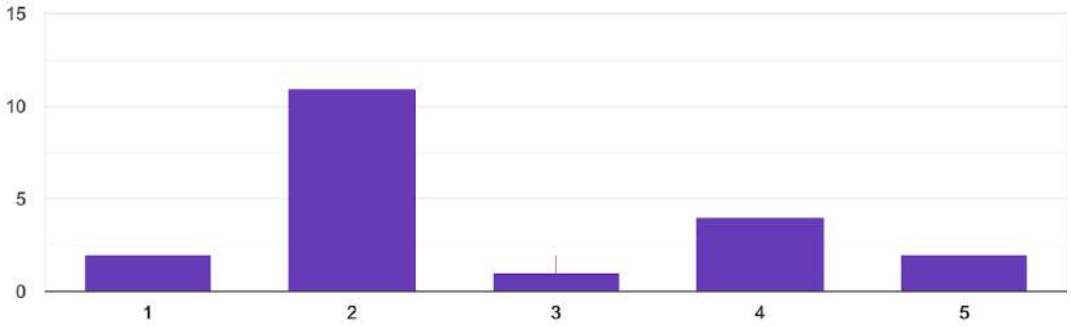
I could not choose which actions were better

20 svar



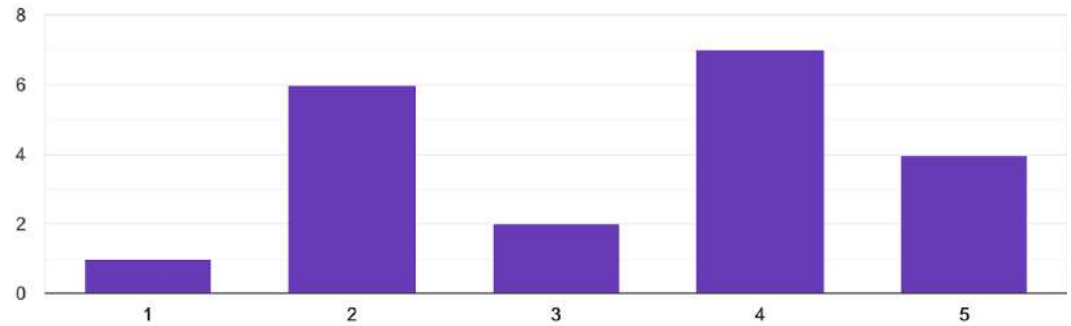
I could not say if the game had more than one outcome

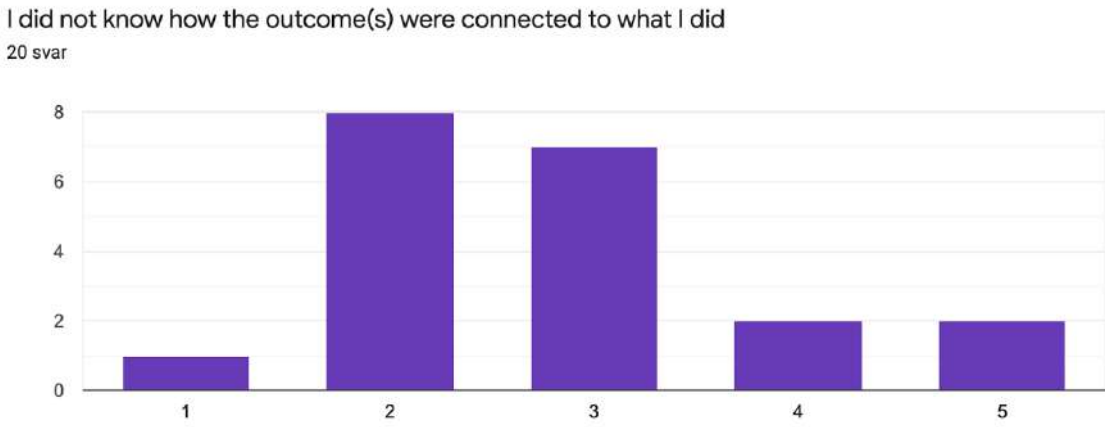
20 svar



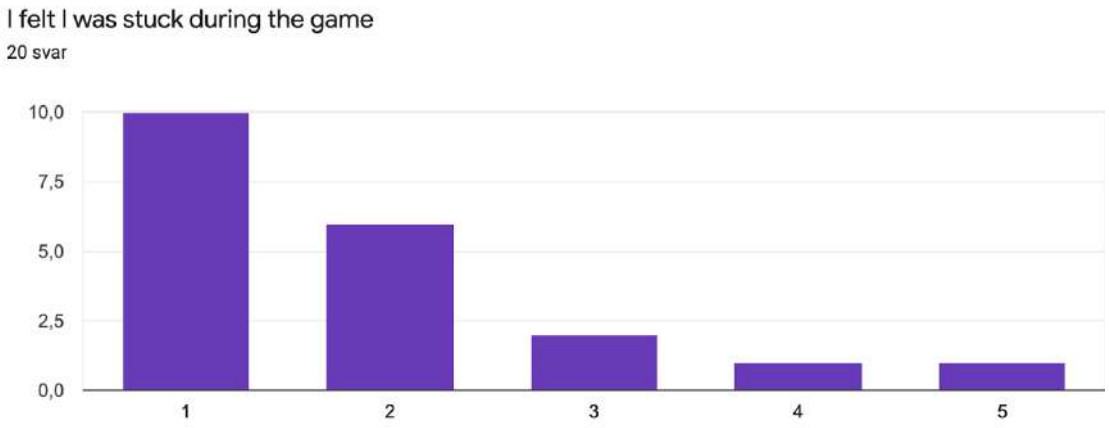
I did not know how my performance influenced the outcome

20 svar



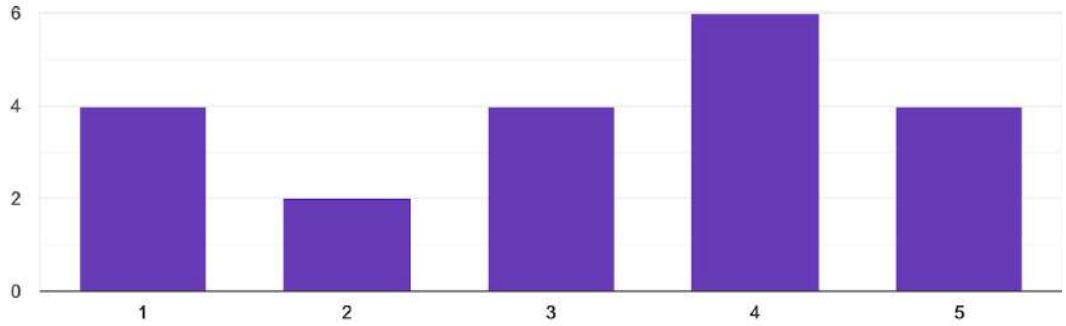


C.3 Taking action



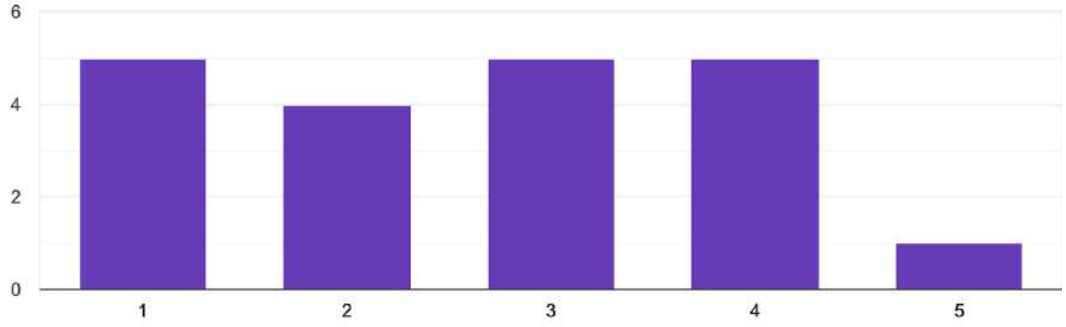
I found it difficult to keep track of all elements in the game

20 svar



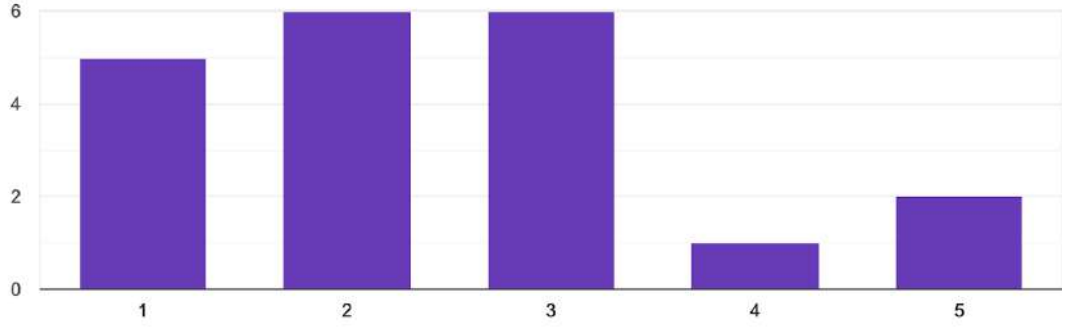
The game mechanics were overwhelming

20 svar



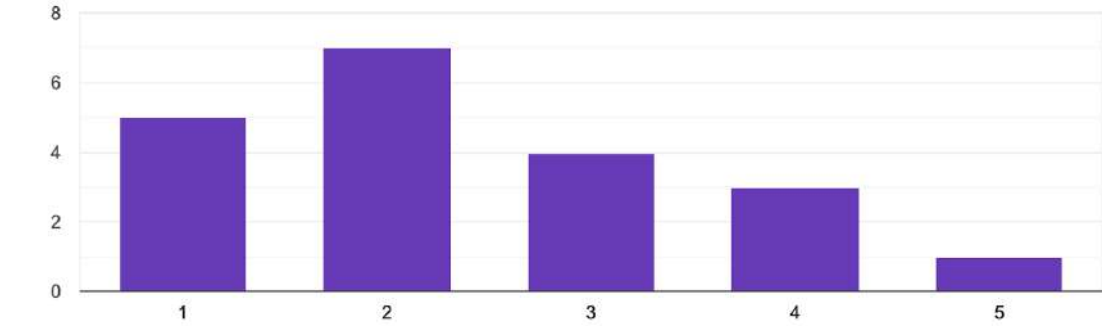
I think what I was doing in the game was not right

20 svar



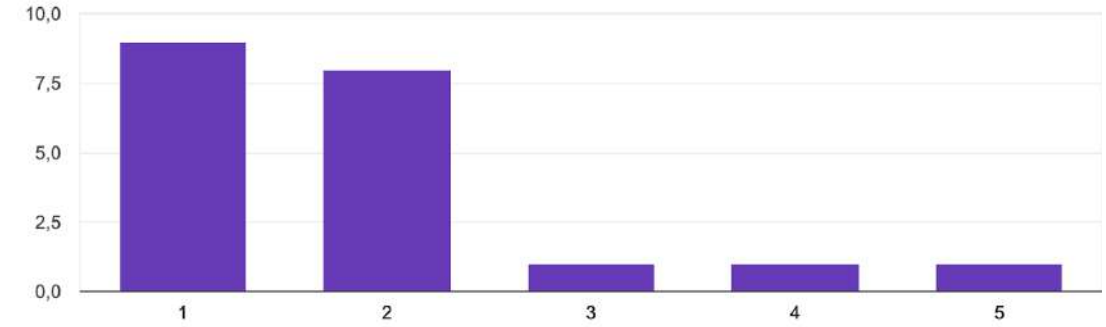
I was not confident that I could perform some actions in the game

20 svar



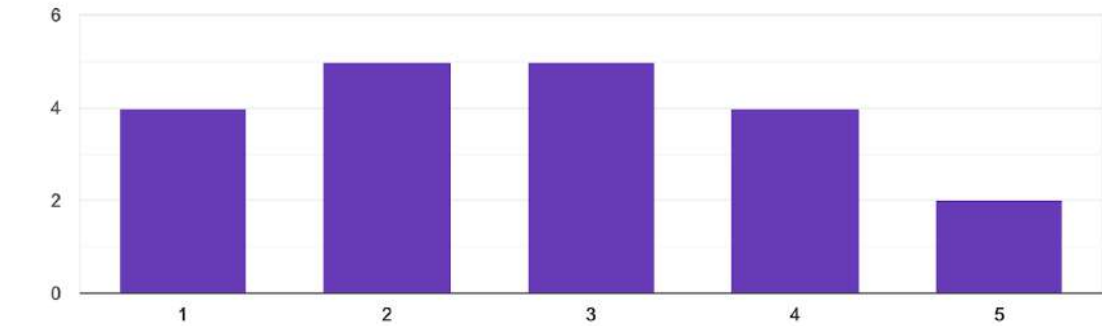
The actions I had to perform were too demanding for my skills

20 svar

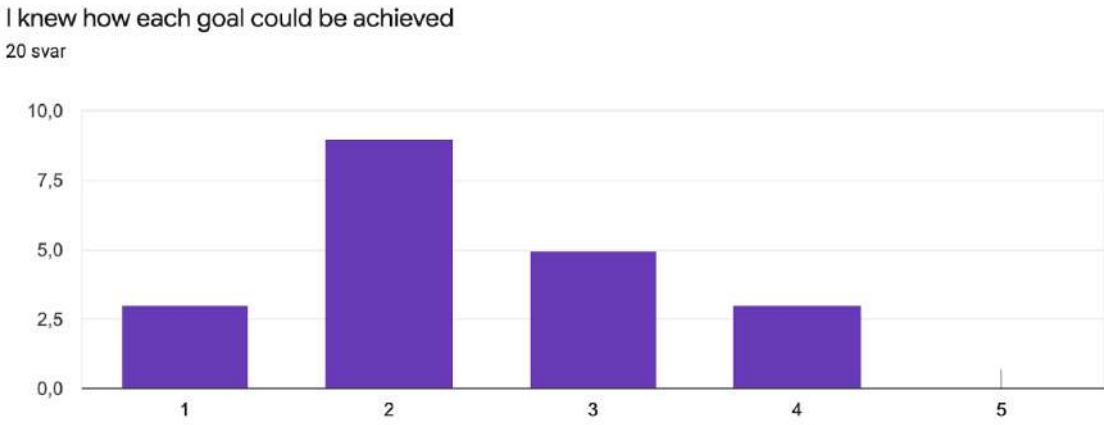


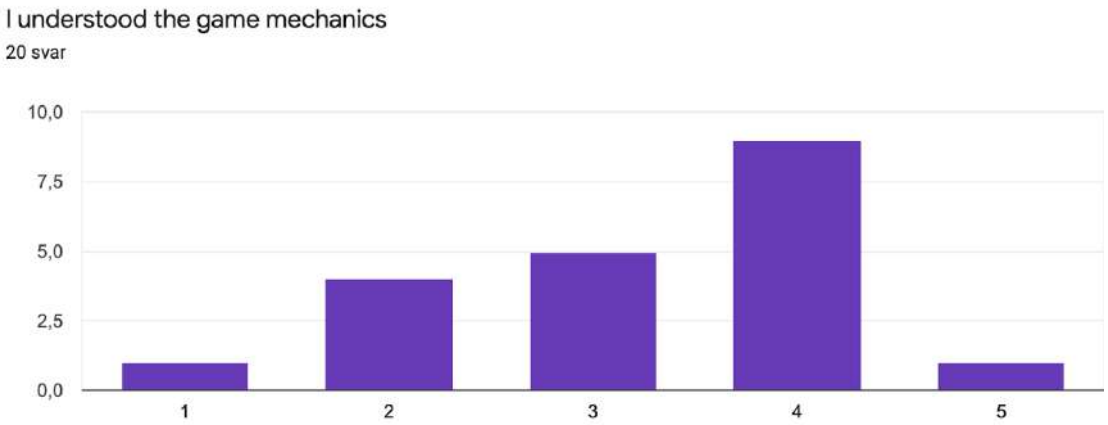
I struggled to do the right actions

20 svar



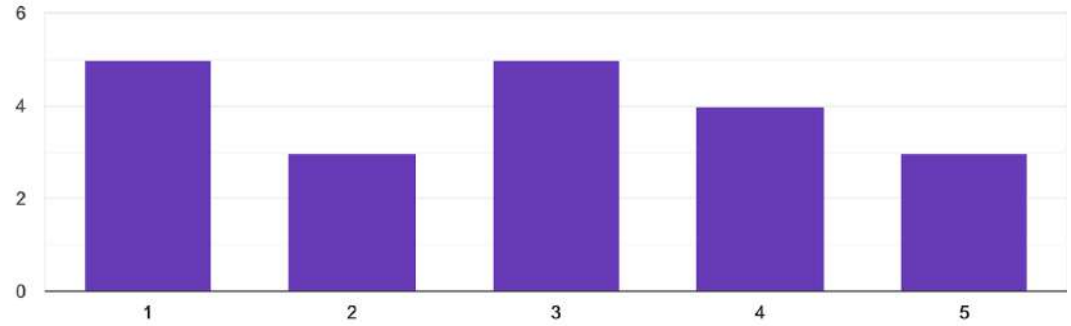
C.4 Problem Solving





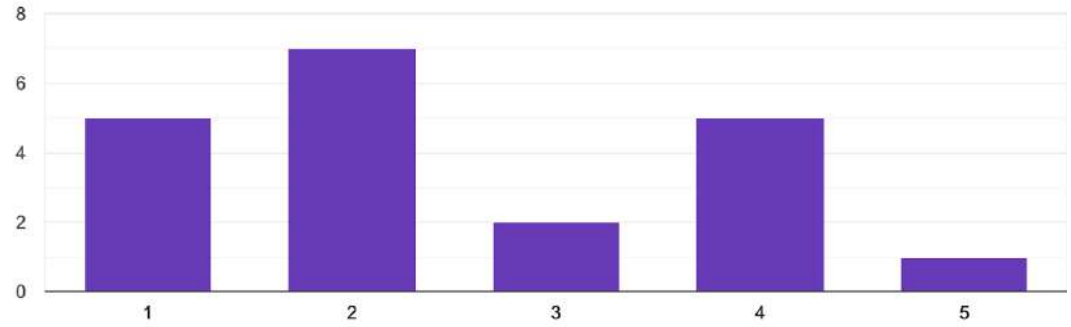
I knew how to play the game when I started

20 svar



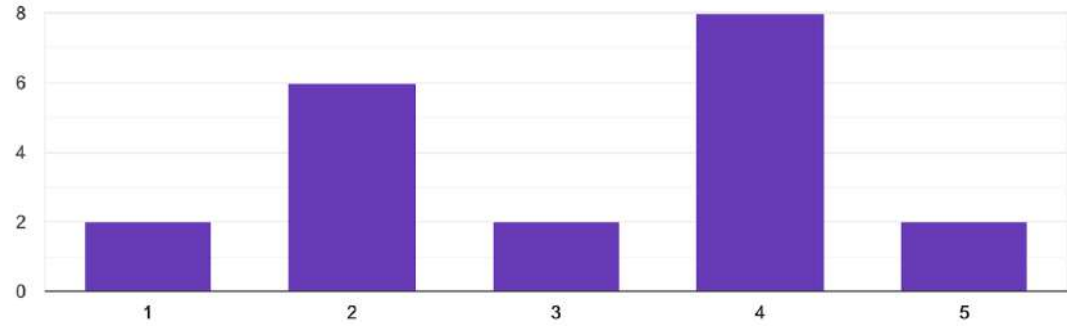
I often felt lost

20 svar

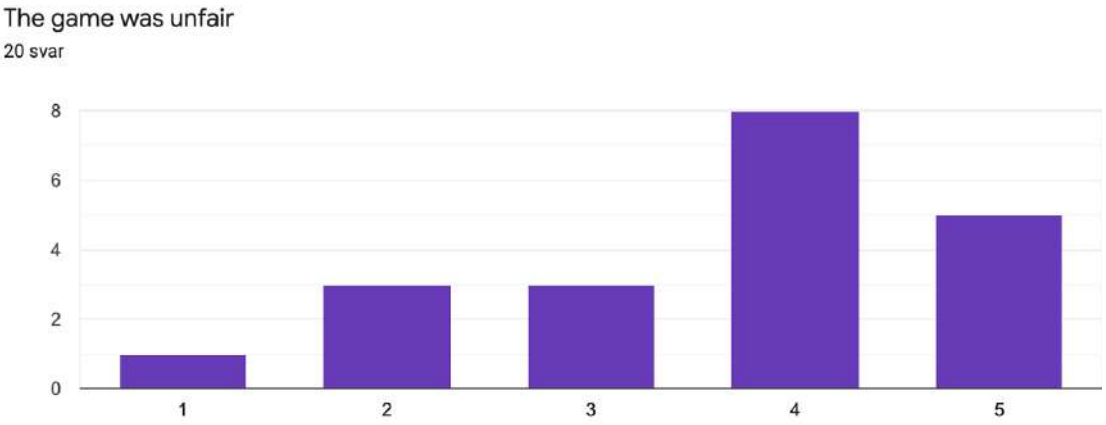


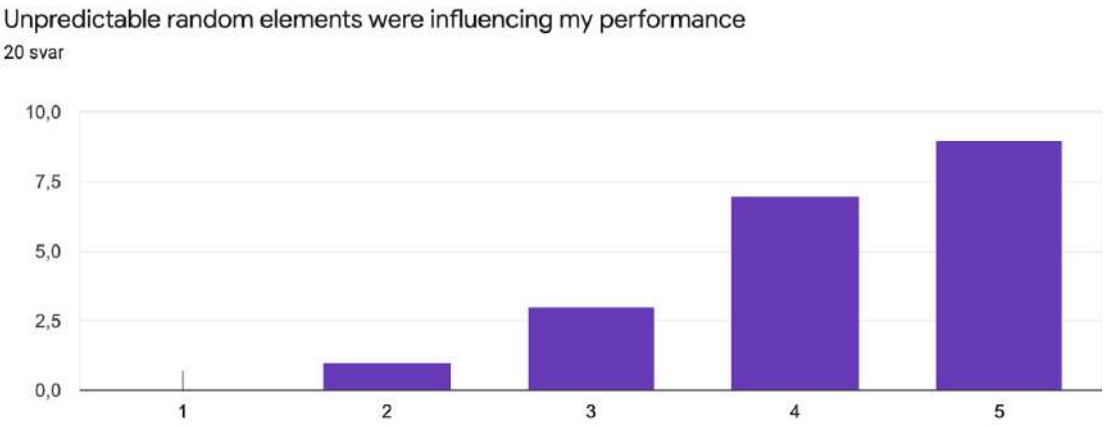
I could find the solutions required for achieving the goals of the game

20 svar



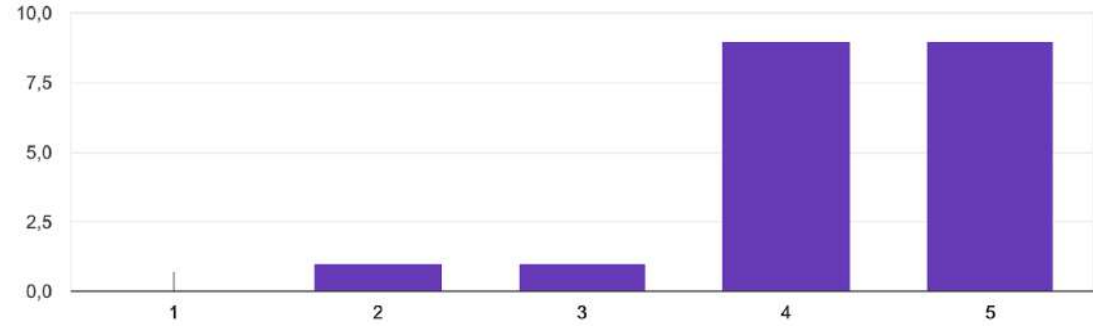
C.5 External


The game was unfair
20 svar
8
6
4
2
0
1
2
3
4
5


Unpredictable random elements were influencing my performance
20 svar
10,0
7,5
5,0
2,5
0,0
1
2
3
4
5

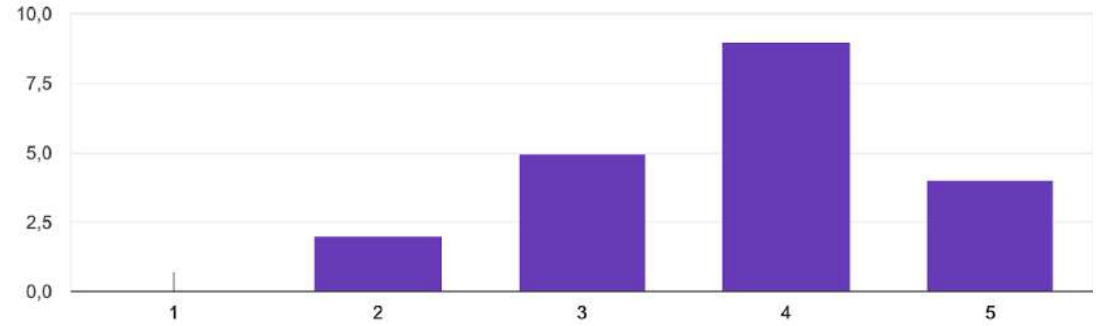
I was relying on chance in the game

20 svar



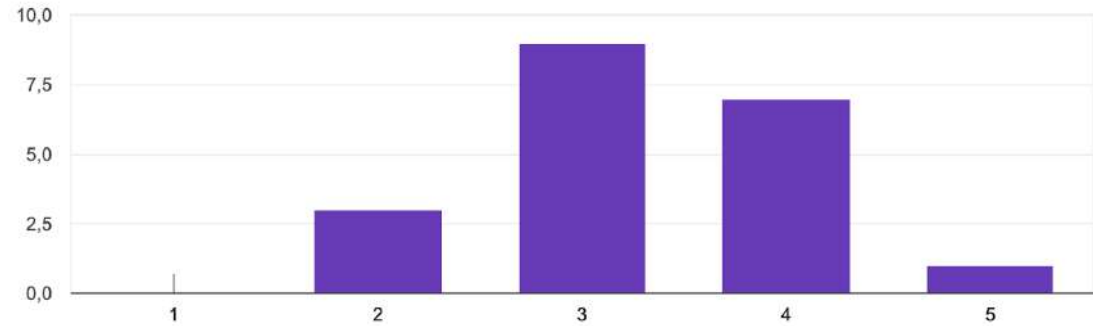
Random elements in the game were preventing me from achieving my goal

20 svar



The outcome of my actions was mainly influenced by chance

20 svar



D

Appendix 4 - Units, Moves, and Status Effects

D.1 Units

Name	HP	MP	Dmg. Mult.	Hit Mod.	Crit. Mod.	Def. Mod.
Dajep	10	10	1	1	1	1
Ooma	13	10	2	0.75	1.15	1
Posmos	10	10	0.9	1.5	1.8	1
Saint David	10	25	0.7	0.9	0.9	2
Knut	10	5	3	0.65	0.9	2
Ozzy	15	15	0.9	0.85	1	1
Ingo	15	10	1	1.5	1.5	0.8

D.2 Moves

```
    [
{
"RequireTarget": true,
"MPcost": 5,
"MoveType": 0,
"Effects": ["Sleeping"],
"ObjectSlug": "sleep",
"Description": "Put a unit to sleep.",
"MoveName": "Sleep",
"Damage": 0,
"HitChance": 0.9
},
{
"RequireTarget": true,
"MPcost": 2,
"MoveType": 5,
"Effects": ["Fire"],
"ObjectSlug": "fire",
"Description": "Light a unit on fire.",
"MoveName": "Fire",
```

```
"Damage": 1,
"HitChance": 0.9
},
{
"RequireTarget": true,
"MPcost": 3,
"MoveType": 7,
"Effects": ["BadSmell", "SonicBoom"],
"ObjectSlug": "fart",
"Description": "Fart.",
"MoveName": "Fart",
"Damage": 1,
"HitChance": 0.9
},
{
"RequireTarget": true,
"MPcost": 2,
"MoveType": 8,
"Effects": ["Headache"],
"ObjectSlug": "headache",
"Description": "Give headache",
"MoveName": "Headache",
"Damage": 0,
"HitChance": 0.9
},
{
"RequireTarget": true,
"MPcost": 2,
"MoveType": 9,
"Effects": ["Emboldened", "Inspired"],
"ObjectSlug": "compliment",
"Description": "Give a compliment to a unit",
"MoveName": "Compliment",
"Damage": 0,
"HitChance": 0.9
},
{
"RequireTarget": true,
"MPcost": 1,
"MoveType": 8,
"Effects": ["Angry"],
"ObjectSlug": "insult",
"Description": "Insult unit",
"MoveName": "Insult",
"Damage": 0,
"HitChance": 0.9
```

```
},
{
"RequireTarget": true,
"MPcost": 1,
"MoveType": 8,
"Effects": ["Afraid"],
"ObjectSlug": "scare",
"Description": "Scare unit",
"MoveName": "Scare",
"Damage": 0,
"HitChance": 0.9
},
{
"RequireTarget": true,
"MPcost": 5,
"MoveType": 7,
"Effects": ["Pain", "Poisoned"],
"ObjectSlug": "rustyknife",
"Description": "Stab unit with rusty knife",
"MoveName": "Rusty Knife",
"Damage": 4,
"HitChance": 0.9
},
{
"RequireTarget": true,
"MPcost": 5,
"MoveType": 20,
"Effects": ["Pain", "Burning", "Afraid"],
"ObjectSlug": "takersflame",
"Description": "Launch a cascade of blasphemous flames at a unit.",
"MoveName": "Taker's Flame",
"Damage": 5,
"HitChance": 0.9
},
{
"RequireTarget": true,
"MPcost": 3,
"MoveType": 9,
"Effects": ["Awe", "Humbled"],
"ObjectSlug": "order",
"Description": "Establish order over a unit. Take control over the situation.",
"MoveName": "Establish Order",
"Damage": 4,
"HitChance": 0.9
},
{
```

```
"RequireTarget": true,
"MPcost": 3,
"MoveType": 9,
"Effects": [ "Bleeding" ],
"ObjectSlug": "slash",
"Description": "Slash a unit",
"MoveName": "Slash",
"Damage": 3,
"HitChance": 0.7
},
{
"RequireTarget": true,
"MPcost": 4,
"MoveType": 9,
"Effects": [ "Blind" ],
"ObjectSlug": "faith",
"Description": "Blind a unit",
"MoveName": "Faith",
"Damage": 0,
"HitChance": 0.9
},
{
"RequireTarget": true,
"MPcost": 3,
"MoveType": 9,
"Effects": [ "Heal" ],
"ObjectSlug": "prayer",
"Description": "Heal a unit",
"MoveName": "Prayer",
"Damage": 0,
"HitChance": 1
},
{
"RequireTarget": true,
"MPcost": 3,
"MoveType": 9,
"Effects": [ "Bleeding" ],
"ObjectSlug": "stab",
"Description": "Stab a unit",
"MoveName": "Stab",
"Damage": 3,
"HitChance": 0.7
},
{
"RequireTarget": true,
"MPcost": 4,
```

```
"MoveType": 9,
"Effects": [ "Poisoned" ],
"ObjectSlug": "poisonDart",
"Description": "Poison a unit",
"MoveName": "Poison Dart",
"Damage": 0,
"HitChance": 0.9
},
{
"RequireTarget": true,
"MPcost": 2,
"MoveType": 9,
"Effects": [ "Heal" ],
"ObjectSlug": "potion",
"Description": "Heal a unit",
"MoveName": "Potion",
"Damage": 0,
"HitChance": 1
},
{
"RequireTarget": true,
"MPcost": 3,
"MoveType": 9,
"Effects": [ "Pain" ],
"ObjectSlug": "blast",
"Description": "Blast a unit",
"MoveName": "Blast",
"Damage": 3,
"HitChance": 0.7
},
{
"RequireTarget": true,
"MPcost": 3,
"MoveType": 9,
"Effects": [ "Fire" ],
"ObjectSlug": "burn",
"Description": "Burn a unit",
"MoveName": "Burn",
"Damage": 0,
"HitChance": 0.9
},
{
"RequireTarget": true,
"MPcost": 3,
"MoveType": 9,
"Effects": [ "Heal" ],
```

```
"ObjectSlug": "heal",
"Description": "Heal a unit",
"MoveName": "Heal",
"Damage": 0,
"HitChance": 1
},
{
"RequireTarget": true,
"MPcost": 4,
"MoveType": 9,
"Effects": [ "Headache" ],
"ObjectSlug": "whack",
"Description": "Whack a unit",
"MoveName": "Whack",
"Damage": 3,
"HitChance": 0.7
},
{
"RequireTarget": true,
"MPcost": 3,
"MoveType": 9,
"Effects": [ "Bleeding" ],
"ObjectSlug": "throwPebbles",
"Description": "Make a unit bleed",
"MoveName": "Throw Pebbles",
"Damage": 0,
"HitChance": 0.9
},
{
"RequireTarget": true,
"MPcost": 4,
"MoveType": 9,
"Effects": [ "Heal" ],
"ObjectSlug": "patchUp",
"Description": "Heal a unit",
"MoveName": "Patch Up",
"Damage": 0,
"HitChance": 1
},
{
"RequireTarget": true,
"MPcost": 3,
"MoveType": 9,
"Effects": [ "Pain" ],
"ObjectSlug": "shoot",
"Description": "Shoot a unit",
```

```
"MoveName": "Shoot",
"Damage": 3,
"HitChance": 0.7
},
{
"RequireTarget": true,
"MPcost": 2,
"MoveType": 9,
"Effects": [ "Confused" ],
"ObjectSlug": "confuse",
"Description": "Confuse a unit",
"MoveName": "Confuse",
"Damage": 0,
"HitChance": 0.9
},
{
"RequireTarget": true,
"MPcost": 3,
"MoveType": 9,
"Effects": [ "Heal" ],
"ObjectSlug": "regenerate",
"Description": "Heal a unit",
"MoveName": "Regenerate",
"Damage": 0,
"HitChance": 1
},
{
"RequireTarget": true,
"MPcost": 2,
"MoveType": 9,
"Effects": [ "Sad", "Crying" ],
"ObjectSlug": "insult",
"Description": "Insult a unit",
"MoveName": "Insult",
"Damage": 3,
"HitChance": 0.7
},
{
"RequireTarget": true,
"MPcost": 2,
"MoveType": 9,
"Effects": [ "Charmed" ],
"ObjectSlug": "charm",
"Description": "Charm a unit",
"MoveName": "Charm",
"Damage": 0,
```

```
"HitChance": 0.9
},
{
"RequireTarget": true,
"MPcost": 2,
"MoveType": 9,
"Effects": [ "Heal" ],
"ObjectSlug": "flirt",
"Description": "Heal a unit",
"MoveName": "Flirt",
"Damage": 0,
"HitChance": 1
}
]
```

D.3 Effects

Afraid	Make the unit afraid	Make the unit less likely to land a hit and critical hit
Angry	Make the unit angry	Increase the unit's damage but make them less likely to hit
Awe	The unit is awestruck	Make the unit less likely to hit
BadSmell	The unit smells bad	Make other units less likely to hit it
Bleeding	The unit bleeds	The unit receives damage at the end of each turn
Blind	The unit is temporarily blind	The unit is almost unable to land a hit
Burning	The unit is burning	The unit receives damage at the start of each turn
Charmed	The unit is charmed	The unit will deal less damage for
Confused	The unit is confused	The unit will be less likely to hit
Crying	The unit is crying	The unit will deal less damage and be less likely to hit
Dazed	The unit is dazed	The unit is less likely to critically hit
Emboldened	The unit is emboldened	The unit will deal more damage
Fire	The unit is on fire	The unit receives damage at the start of each turn
Frostburn	The unit is frostburned	The unit receives damage at the end of each turn and will be less likely to hit
Headache	The unit have a headache	The unit will be less likely to critically hit, and receives damage at the end of each turn, and when it is removed
Heal	The unit is healed	The unit has their HP restored when inflicted
Humbled	The unit is humbled	The unit will be less likely to hit and deal less damage
Trapped	The unit is trapped	(Not fully implemented) The unit will be unable to deal damage by attacks
Inspired	The unit is inspired	The unit will deal more damage
Pain	The unit is in pain	The unit will receive damage when removed
Poisoned	The unit is poisoned	The unit receive damage at the start of each turn
Sad	The unit is sad	The unit will deal less damage and receive more damage
Sleeping	The unit is sleeping	(Not fully implemented) The unit will be unable to act
Stunned	The unit is stunned	(Not fully implemented) The unit will be unable to make moves
SonicBoom	The unit has their eardrums ruptured	The unit will receive damage at inflict and be less likely to critically hit.