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Thesis Writing Simulator — A Choice-Driven Life Simulation Game

Bachelor's Thesis (9 ECTS)

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Abstract:

This thesis describes the development of an educational life simulation game called *Thesis Writing Simulator*. The game is meant to offer an immersive experience of a young adult's typical struggles. It looks to inspire players by giving them ideas on how to improve their health behaviors. To ensure adequate accuracy, the logic of the game is based on theory and empirical evidence. The game was tested twice, on five users each time. The results of the second testing showed significant improvement from the first.

Keywords:

Game development, game design, video game, Godot, life simulation game, choice-driven game, emotional well-being, physical well-being, young adult

CERCS: P170 Computer science, numerical analysis, systems, control

Thesis Writing Simulator — otsustepõhine elusimulatsioonimäng

Lühikokkuvõte:

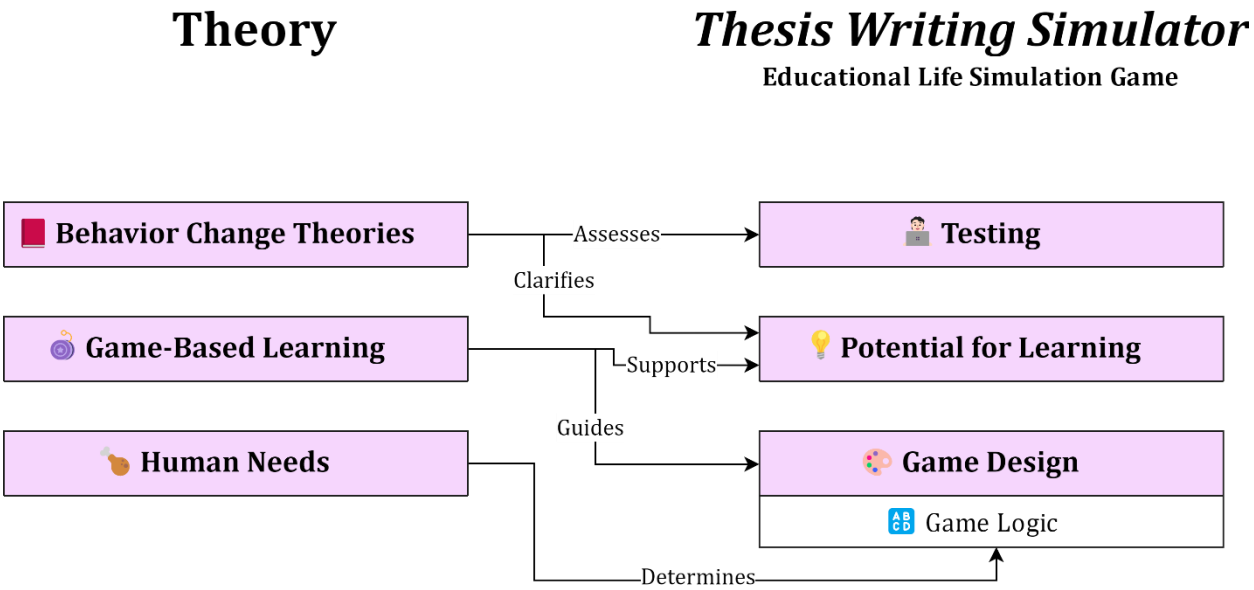
Käesolev lõputöö kirjeldab haridusliku elusimulatsioonimängu nimega “Thesis Writing Simulator” arendust. Mäng on mõeldud pakkuma kaasahaaravat kogemust noore täiskasvanu tüüpilistest heitlustest. See püüab inspireerida mängijaid, andes ideid selle kohta, kuidas parandada nende tervisekäitumist. Piisava täpsuse tagamiseks põhineb mängu loogika teoorial ja empiirilistel tõenditel. Mängu testiti kaks korda, mõlemal korral viie kasutajaga. Teise testimise tulemused olid esimesega võrreldes oluliselt paremad.

Võtmesõnad:

Mänguarendus, mängudisain, videomäng, Godot, elusimulatsioonimäng, otsustepõhine mäng, emotsionaalne heaolu, füüsiline heaolu, noor täiskasvanu

CERCS: P170 Arvutiteadus, arvutusmeetodid, süsteemid, juhtimine (automaatjuhtimis-teooria)

Visual abstract:



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1. Introduction

Games designed primarily with an educational purpose in mind have become more common in recent years (Djaouti et al., 2011; Hammady & Arnab, 2022; Lean et al., 2021). This is because they have been shown to be more effective than traditional methods of learning (Ahmad et al., 2013; Erhel & Jamet, 2013; Lean et al., 2021).

The game created as part of this thesis, *Thesis Writing Simulator* (Figure 1), aims to be an example of such an educational game. It is meant to be both fun, as well as useful. For that, it looks to encourage good health behaviors in a playful way.

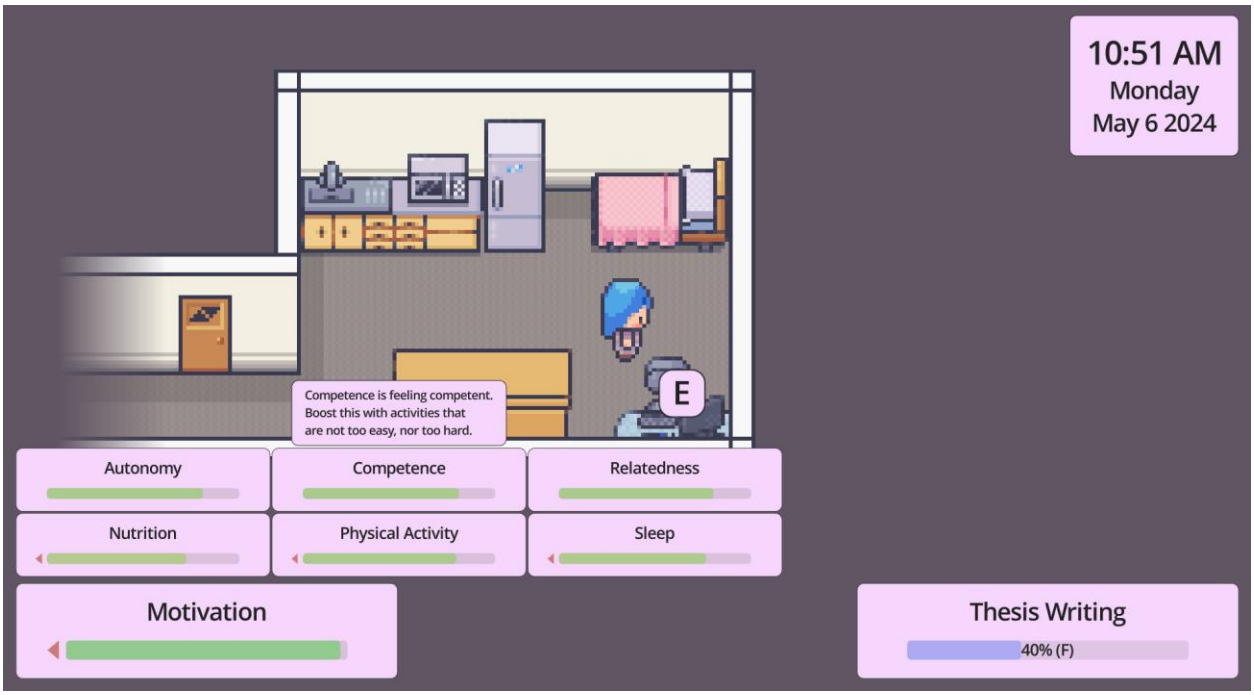

Figure 1. A screenshot of *Thesis Writing Simulator*.

The primary motivation for making *Thesis Writing Simulator* was noticing that in the Western world[1], the health of young adults is often neglected, and that they would benefit significantly from healthier behaviors (Park et al., 2014). Thus, the target audience of the game is also young adults of the Western world.

[1] Western world — a part of the world comprising primarily of various European, American, and Oceanian states (Shvili, 2021).

The next chapter describes the theory behind the logic of *Thesis Writing Simulator*. It also looks into research related to behavior change and learning through games. Chapter 3 looks at a few previously made games that are similar to *Thesis Writing Simulator*. Chapter 4 describes the development process, along with the tools used and the challenges faced. Chapter 5 goes over the design of the game, including how the theory was applied to the game. Chapter 6 talks about some of the technical implementation details. Finally, Chapter 7 describes how *Thesis Writing Simulator* was tested and presents the results of testing.

Appendix I holds a game design document that was created before the start of development. Appendix II specifies how AI was used to support writing the thesis and making the game. Appendix III contains a replica of the questionnaire used in testing. Appendix IV gives an overview of the contents of the accompanying files of the thesis. Appendices V and VI detail the responses to the non-verbal questionnaire questions of the first and second testing sessions, respectively. Appendix VII is a glossary explaining some of the technical terms. In Appendix VIII a link to the repository of *Thesis Writing Simulator* is provided. Finally, Appendix IX contains the license of the thesis.

No paragraphs of text in this thesis have been in any way — by way of creation or paraphrasing — produced by AI. However, *ChatGPT 4*[2] was used in various ways to support writing the thesis until February 23, 2024 (exclusive; see Appendix II). On this date the author became aware of the requirement to describe any and all use of AI in connection with the thesis in detail. Because documenting every conversation with AI would have nearly doubled the amount of time spent writing the thesis, use of AI was stopped completely after the specified date.

On April 2, 2024, the requirement to describe use of AI in detail was in large part lifted. Thus, use of AI in ways that no longer required any mention in the thesis, like for understanding the used technologies and their best practices better, was resumed. However, from here on out it was much more limited. There was considerable hesitation to use AI in fear of the requirements changing again.

[2] https://openai.com/gpt-4

2. Theory

When making a life simulation game, relying on available research allows for providing a more accurate experience than just guesswork. Thus, this chapter elaborates on the theory that is used as a basis for designing *Thesis Writing Simulator*. Firstly, the concept of human needs is explored — how to define them and what could be used in the game as a basic set of psychological and physiological needs. Each chosen need is assessed in terms of the impact its satisfaction has, and in terms of what impacts the satisfaction of that need. Then, an overview of behavior change theories[3] is given. Lastly, consideration is given to ways to effectively use games to facilitate learning.

2.1 Human Needs

Multiple conflicting attempts at naming a set of fundamental human needs have been made, as Pittman & Zeigler (2007) have explained. Many of them, like Self-Determination Theory (SDT) and Terror Management Theory (TMT), have underwent extensive empirical research and been proven to hold up. However, they differ fundamentally in what they offer as the most basic needs. For example, TMT considers self-preservation to be a basic need, while SDT makes no mention of anything similar at the level of core needs (Pittman & Zeigler, 2007). Therefore, there is no one way that is universally accepted as correct to name or categorize needs (Pittman & Zeigler, 2007).

Noticeably, while Pittman & Zeigler (2007) do mention physiological aspects in their exploration of existing theories (e.g., the bottom layer of Maslow's pyramid (Pittman & Zeigler, 2007: 478)), none of the approaches covered focuses primarily on physiology. Instead, psychological needs seem to always be at the center of attention in basic need theories. Abraham Maslow theorized a long time ago that no definitive list of physiological needs can be found, as depending on the exact criteria and how specific one wishes to be, they "can come to almost any number" (Maslow, 1943: 372). Modern science reflects that, as such lists often differ substantially in their length and in what needs are included. For

[3] Behavior change theories are theoretical frameworks that attempt to explain how and why change in behavior happens, as well as how change can be facilitated (Simpson, 2015).

instance, the ones by LibreTexts Medicine Library (2018) and Brookside Associates (2015) feature a total of ten needs, but only four of them are mentioned in both.

Therefore, while these theories can be utilized to emulate human psychology, a different approach is needed to back up an emulation of human physiology. Thus, psychological and physiological needs are considered separately in the following two subchapters.

2.1.1 Psychological Needs

SDT is used as a basis for psychological needs in this work, as it is arguably the theory that has garnered the most amount of supporting empirical research and interest (Pittman & Zeigler, 2007: 481; Ryan & Deci, 2017; Figure 2). Edward Deci and Richard Ryan have been continuously developing this theory for the better part of their academic careers (Deci & Ryan, 1985; Ryan & Deci, 2000, 2017).

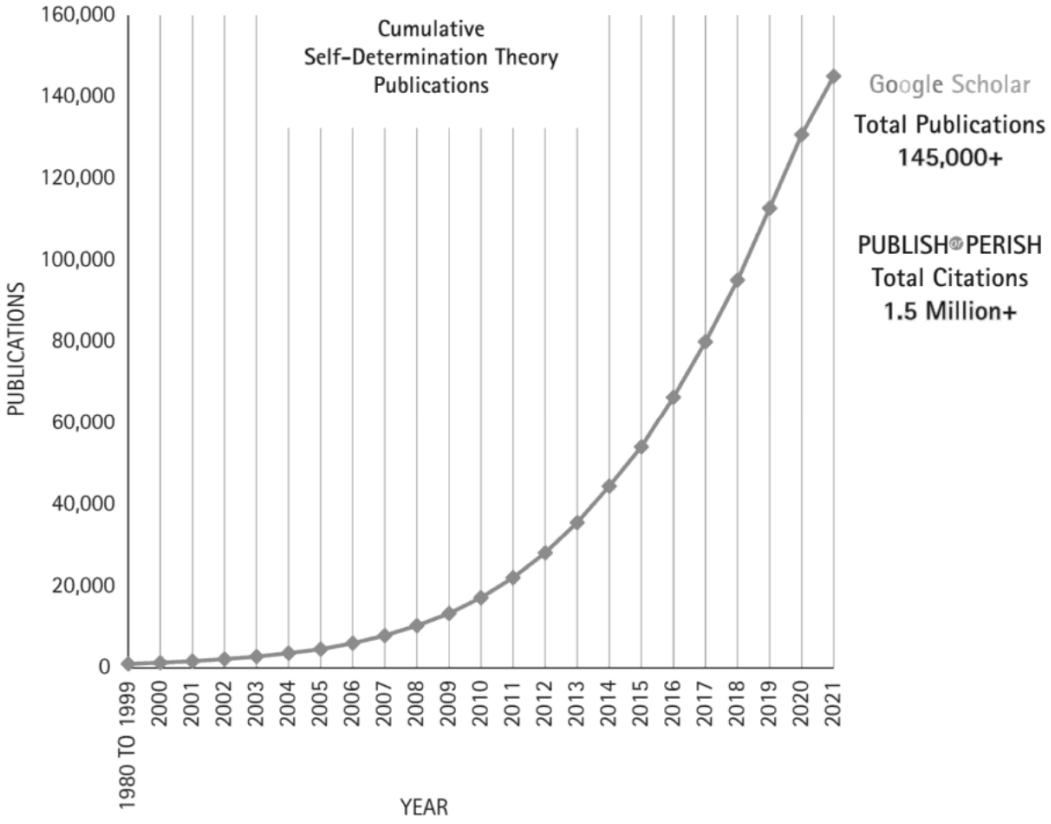

Figure 2. Cumulative SDT publications from 1980 to 2021 (Ryan (Ed.), 2023).

A need is defined by Ryan & Deci (2000: 68) as something that, when fulfilled, enables an individual to thrive, and when neglected, has the opposite effect. To thrive in this context means to have various desirable capabilities, such as to act according to one's will, to persist in demanding activities, to feel well and to have creative ideas, among others (Ryan & Deci, 2017). The three basic key psychological needs according to SDT are *autonomy*, *competence*, and *relatedness* (Ryan & Deci, 2000: 68). These needs are explained in Figure 3 in more detail.

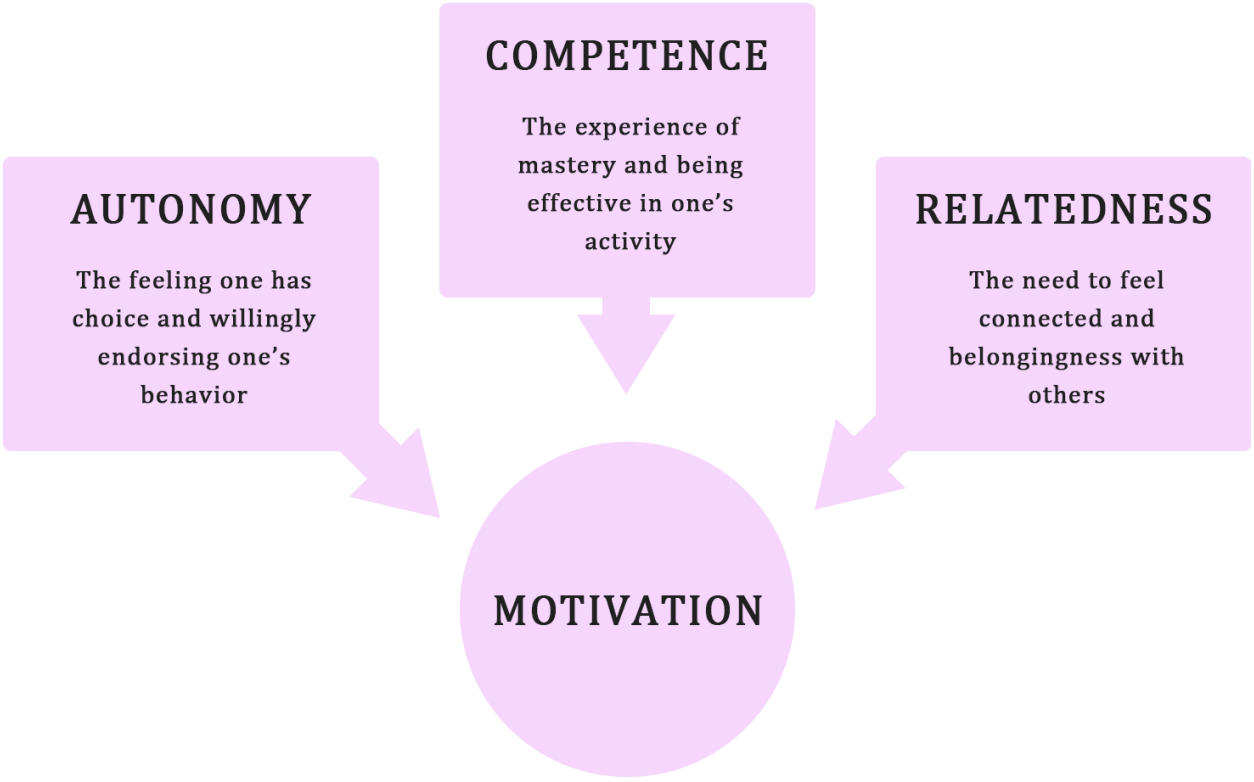

Figure 3. Key psychological needs that drive motivation according to SDT (based on University of Rochester Medical Center, 2019).

The *motivation* on Figure 3 that stems from satisfaction of these needs is referred to by Ryan & Deci (2000: 72) as *autonomous* motivation, also known as *self-determined* motivation. This is a concept postulated by these authors that they have contrasted with *controlled* motivation[4]. As per Ryan & Deci (2017), being autonomously motivated means to feel like

[4] *Autonomous* and *controlled* motivation are not to be confused with *intrinsic* and *extrinsic* motivation, which are related terms, but have different meanings (Ryan & Deci, 2017). Ryan & Deci (2017) consider the autonomous-controlled divide to be more meaningful and impactful than the intrinsic-extrinsic divide, which is why it is focused on here.

the reasons for acting come from within, like when an action is carried out out of pure interest or because the end result is deeply valued. In comparison, having controlled motivation for an activity means feeling like the reasons for acting come from the outside, like when a task is undertaken for the sake of a reward or when it is made mandatory by someone else. It has been shown that having autonomous motivation as opposed to controlled motivation boosts well-being, learning, productivity, feeling connected with others, as well as the likelihood to act autonomously, thereby also fueling itself (Assor et al., 2009; Ryan & Deci, 2017; Van den Broeck et al., 2010).

Besides using one's already present autonomous motivation to engage in activities, there are other ways to take care of the three basic psychological needs of autonomy, competence, and relatedness. To give some examples, autonomy can be supported by having a rationale for a task (Jang, 2008), and having choice (Bao & Lam, 2008). Competence can be supported by positive feedback administered in an autonomy-supportive way (Ryan et al., 2022: 19). It is also boosted by events perceived as informational as opposed to controlling or *amotivating*[5] (Koestner et al., 1984; Ryan et al., 2022: 15). Relatedness can be supported by feeling liked, respected, and valued by people one interacts with (Niemiec & Ryan, 2009: 139).

Similarly, there are also many factors that can thwart each of the basic psychological needs. For example, external rewards and deadlines have been shown to undermine autonomy (Ryan et al., 2022: 16). Further, competence can be lowered by events perceived as controlling as opposed to informational (Ryan et al., 2022: 15). Negative or lacking feedback has also been linked to lower levels of confidence (Ryan et al., 2022: 17). Lastly, interacting with others who act cold or harsh or display conditional positive regard can diminish feelings of relatedness (Howard et al., 2024). A visual overview of example factors that impact the three core psychological needs is given on Figure 4.

[5] *Amotivation* is a concept in SDT that represent a state in which a person lacks either competence or a reason to act (Ryan (Ed.), 2023: 14).

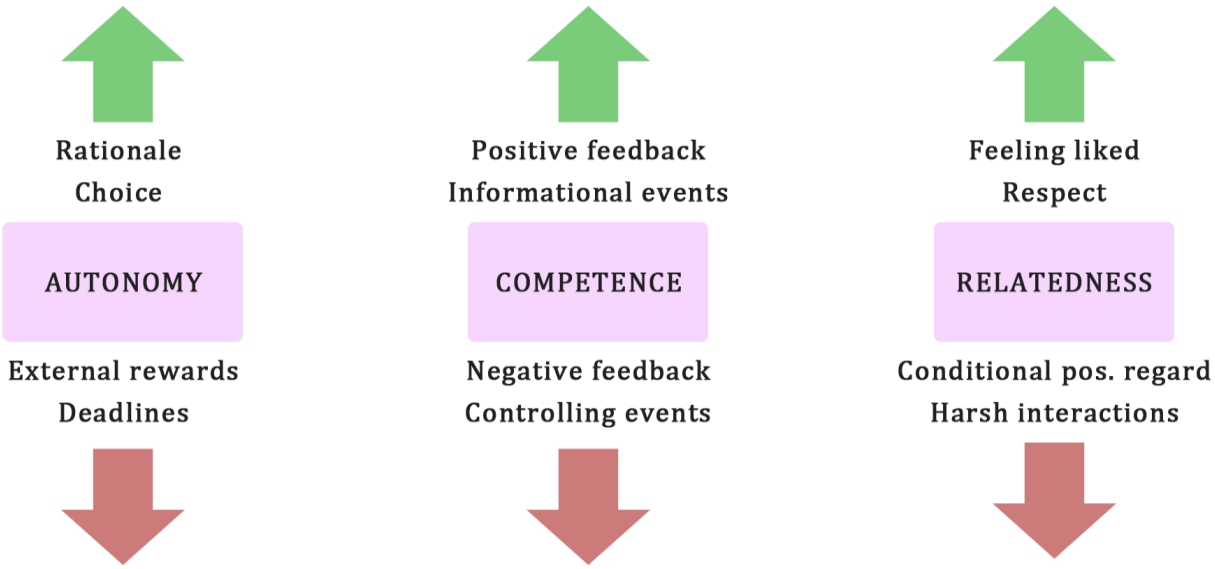

Figure 4. Examples of factors that influence the three core psychological needs of SDT.

With that, a set of core psychological needs has been established. It has also been examined how these needs influence one's feelings and actions, and how one can influence satisfaction of those needs. In addition, physiological needs also need to be explored in the same fashion. This is because a life simulation can hardly feel realistic without, for example, any need to eat or sleep.

2.1.2 Physiological Needs

As stated earlier, there does not exist a universal definitive list of core physiological needs. Therefore, a custom approach was used to determine which needs to focus on.

Firstly, an initial list of needs was still needed, to have somewhere to pick from. For that, the internet was searched for lists of physiological needs from sources that seemed at least semi-reputable. The two longest lists found were combined into one. List length was prioritized, because longer lists were expected to provide broader, more comprehensive overviews of possible needs to focus on.

The first chosen list was by LibreTexts Medicine Library (2018) and contained the following entries: *air*, *water*, *food*, *shelter*, *sanitation*, *touch*, *sleep*, and *personal space*. The second list was by Brookside Associates (2015) and contained *food*, *water*, *oxygen*, *elimination*, *clothing*

and shelter, and *activity*. By combining the lists via merging items with overlapping meanings, the following final list was obtained: *nutrition*, *oxygen*, *personal space*, *physical activity, sanitation*, *shelter*, *sleep*, and *touch*.

Due to the scope of *Thesis Writing Simulator*, the list was further filtered to contain only three physiological needs. To pick the three needs, they were assessed in terms of their potential to bring about positive change by being featured in *Thesis Writing Simulator*. For that, given the goal of the thesis and the target audience of the game, the following two questions were asked for each of the needs:

1. Is this need commonly neglected among young adults in the Western world?
2. Is it possible for young adults in the Western world to better take care of this need by making better everyday choices?

If for any need the answer to either question was negative, it would not be further considered. A custom method was used to determine the answers.

For the first question, it was assumed that if the answer was positive, it would not be difficult to find research on the topic. So, Google Scholar was queried with the search term "young adults [need]" for each need. The answer to the first question was considered negative, if the first ten results did not include any research that was:

- published in the 21st century;
- cited at least 100 times according to Google Scholar;
- indicating neglect of the need or an attempt to promote proper satisfaction of the need among young adults in the Western world.

Multiple such articles were found for *nutrition* (e.g., Chau et al., 2018), *physical activity* (e.g., Dowda et al., 2003), and *sleep* (e.g., Owens et al., 2014). One such article was found for *shelter* (Thompson et al., 2006). For *oxygen*, *personal space*, *sanitation*, and *touch*, no such articles were found. Therefore, after considering the first question, four needs remained: *nutrition*, *physical activity*, *shelter*, and *sleep*.

As for the second question, it is easy to imagine how our everyday choices can make the needs for *nutrition*, *physical activity*, and *sleep* better satisfied — for example, by exercising, by eating a healthy meal, and by getting a full night's sleep, respectively. However, if someone does not have a place to stay for the night, they do not typically have the power to fix that issue all on their own by making a simple decision. For that reason, *shelter* was excluded and the final list of basic physiological needs ended up containing **nutrition**, **physical activity**, and **sleep**.

It is further important to understand the impact satisfaction (or lack of it) of each of these needs has. In general, deprivation of physiological needs can have strong immediate effects, as shown in a study conducted by Yam et al. (2014). According to this study, a physiologically deprived person can become hyper-focused on satisfying the unmet need. That means they will not want to pursue other, unrelated goals, while the need is unsatisfied. They can, however, act unethically and engage in behaviors that are more extreme than normal, if it helps them satisfy that need. In addition to this general overview, each of the chosen needs is examined in more detail in the following paragraphs.

Starting with *nutrition*, unhealthy eating patterns like consuming too much sugar, salt, or trans fats have been linked to health issues like obesity, heart disease, diabetes, cancer, and stroke (Go et al., 2014; Mozaffarian et al., 2009; National Heart, Lung, and Blood Institute, 1998; Vartanian et al., 2007). Moreover, it has been demonstrated that junk food consumption is associated with depression, stress, lack of happiness, sleep dissatisfaction, and anxiety (Malmir et al., 2023).

As for *physical activity*, being physically inactive also increases the likelihood of developing many illnesses, such as heart disease, cancer, and diabetes, thereby also shortening one's lifespan (Lee et al., 2012; Figure 5). Other consequences include lowered cognitive performance (Hillman et al., 2008) and reduced capability to exercise (Biolo et al., 2005). Interestingly, subjective well-being is increased by moderate-intensity activity, but significantly decreased by vigorous-intensity activity, as Wicker & Frick (2015) have found.

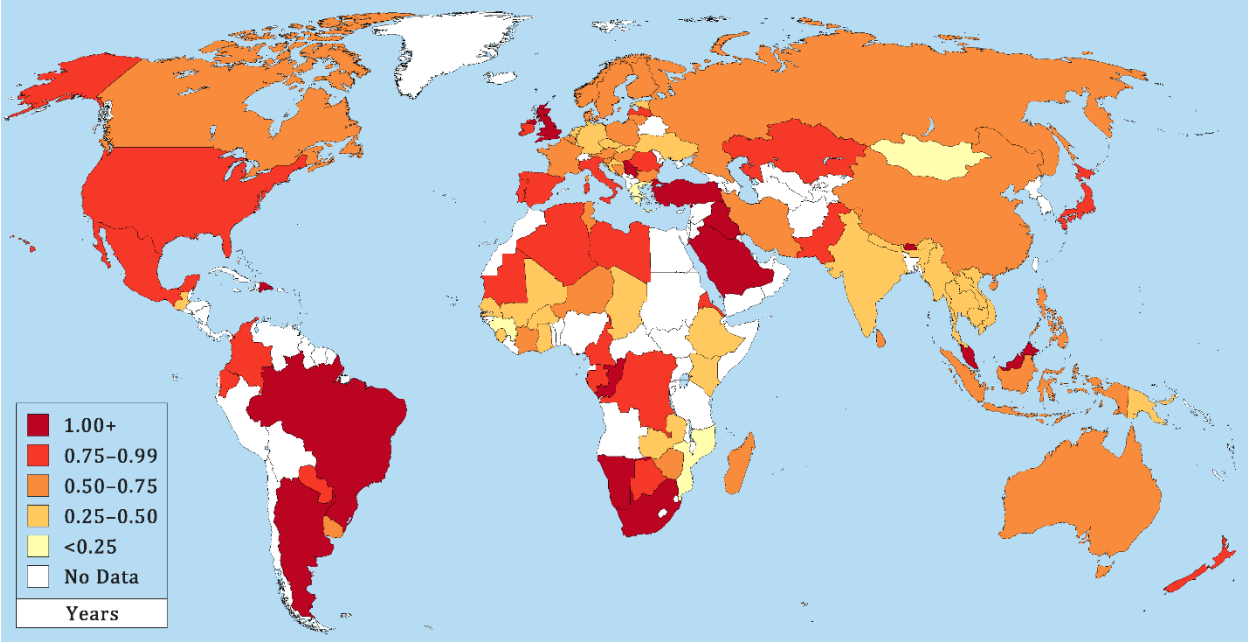

Figure 5. Map of the world showing estimated gains in life expectancy with elimination of physical inactivity (based on Lee et al., 2012).

Finally, for *sleep*, Owens et al. (2014) have linked lack of sleep to depression, obesity, and a higher risk of being involved in a traffic accident. Furthermore, according to Killgore (2010), sleep deprivation impairs alertness, attention, reaction time, learning, recall, sensory and emotional perception. In accordance with these findings, Chu et al. (2023) have demonstrated that when someone has been awake for 24 consecutive hours, their brain functions with less efficiency, equivalent to temporarily aging the brain by one to two years. Worse still, Huang et al. (2023) have shown that since sleep is necessary for the proper functioning of the immune system, people who sleep less die sooner. Based on this, sleep is clearly a critical human function and deserving of attention, especially since the average sleep duration has recently decreased — from 8 to 6.8 hours during the years 1942–2013 (Jones, 2013). Among adults, younger ones are especially likely to be dissatisfied with the amount of sleep they get (Table 1).

It remains now only to examine how to properly satisfy the three physiological needs. To satisfy the need of *nutrition*, it has been recommended to consume plenty of fruits, vegetables, good plant-based fats, whole-grain carbohydrates, protein, water, and vitamins, while limiting consumption of fruit juices, corn, potatoes, fats from meat and dairy, refined-

grain carbohydrates, red or processed meat, sugar, and alcohol (Willett et al., 2017). To cater for the need of *physical activity*, it has been recommended for adults to get at least 2.5 hours of moderate-intensity aerobic activity per week, the optimum being 5 hours, to spend some time strengthening muscles on at least 2 days per week, and to avoid excessive sitting (American Heart Association, 2024). To best take care of the need for *sleep*, a young adult should spend anywhere from 7 to 9 hours in slumber each night (the exact amount is dependent on genetics and environmental factors) and keep a consistent sleep schedule (Chaput et al., 2018).

Table 1. Opinions about amount of sleep needed, by age group (based on Jones, 2013).

Age group	Get as much sleep as needed (%)	Would feel better with more sleep (%)
18–29	48	51
30–49	46	52
50–64	63	35
65+	70	27

With that, a set of psychological and physiological needs has been established. The effects of catering for those needs, as well as the effects of one's actions on the satisfaction of those needs, have also been explored. This provides a foundation for adequate promotion of healthy behavior. The next subchapter explores the presentation side of such promotion — how to encourage healthy behavior.

2.2 Behavior Change Theories

There are a number of theories and models explaining how change in behavior happens (Simpson, 2015), which can help understand this process. In this subchapter, the potential of *Thesis Writing Simulator* to elicit change in players' behavior is explored in regard to a few of these theories.

One of the behavior change models is the socioecological model proposed by McLeroy et al. (1988), closely related to the better-known ecological systems theory by Bronfenbrenner

(1979). In that model, influences on behavior are divided into five successive categories, with each next category enveloping all the previous ones (Figure 6).

According to McLeroy et al. (1988), for change to happen effectively, ideally all levels need to be given attention — or at least considered — when making a change-promoting project, since they all influence one another. It also puts into perspective the limitations of the fullest possible potential for *Thesis Writing Simulator*, as it can only influence the first two levels (intrapersonal and interpersonal) at most.

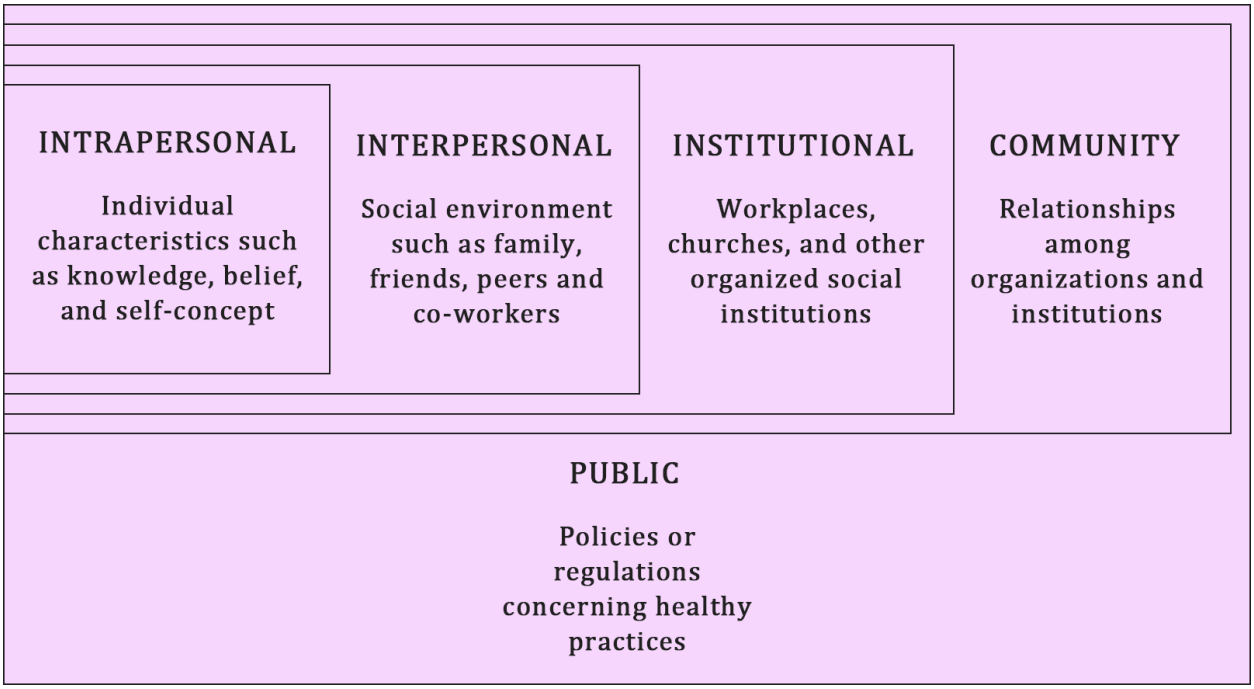

Figure 6. The socioecological model (based on Simpson, 2015).

A different perspective is provided by the transtheoretical model (Velicer et al., 1998), which describes the stages of change. It includes five stages — precontemplation, contemplation, preparation, action, and maintenance (Figure 7). Thinking about the impact *Thesis Writing Simulator* can have in this regard, since it is mainly trying to educate players on the effects of health behaviors, it can be assumed that it is best able to support those in the precontemplation stage. However, players can also conceivably get inspiration and motivation from the game on any other stage of change, as it provides a new sideline perspective to choices and behavior.

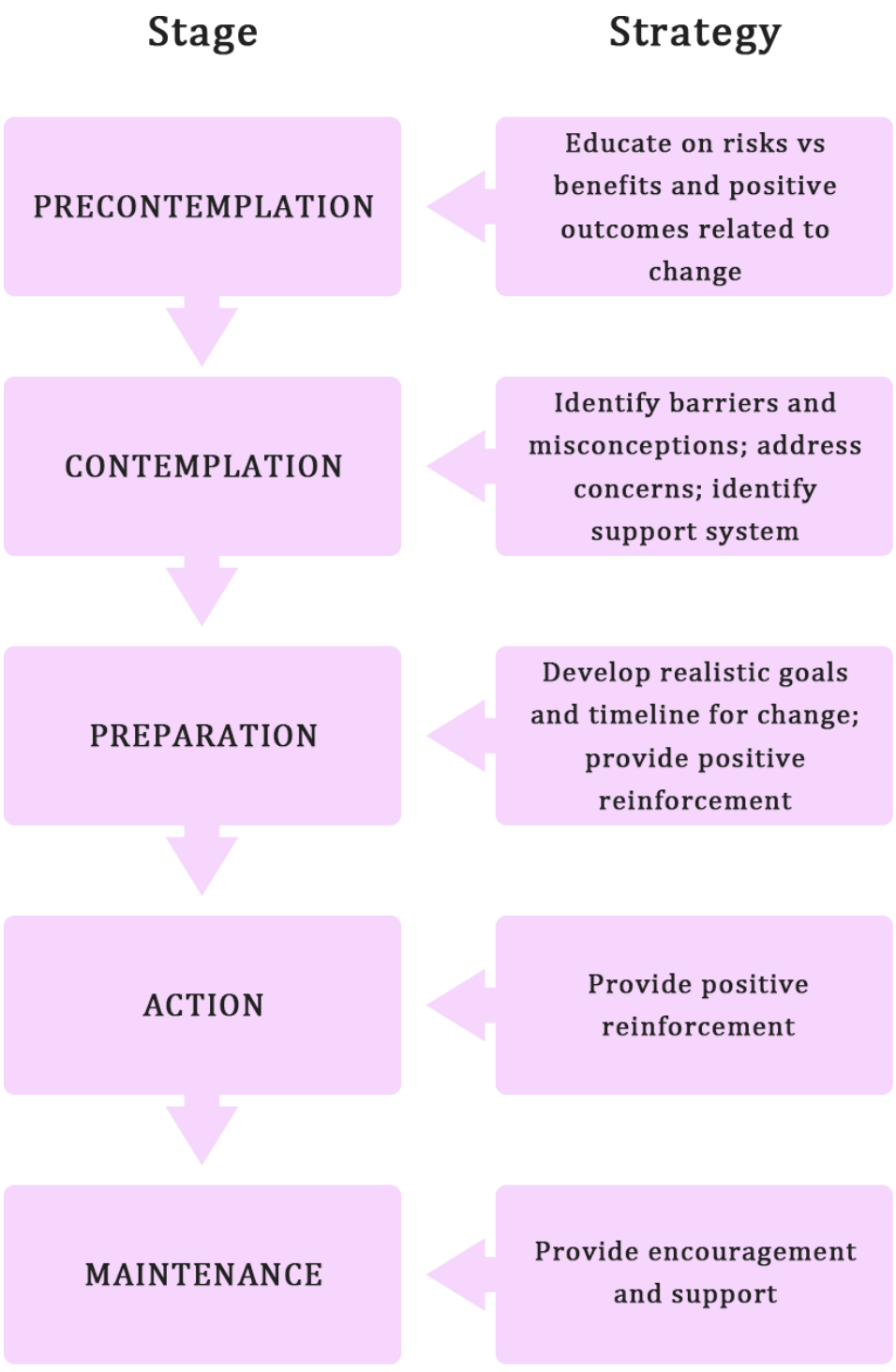

Figure 7. The transtheoretical model (based on Wang et al., 2019).

Lastly, the health belief model (Champion & Skinner, 2008) identifies four drivers of action when it comes to behavior change. These are as follows:

- perceived susceptibility to a negative outcome if change does not happen;
- perceived severity of that negative outcome;
- perceived benefits received from change;
- perceived barriers that prevent change.

Out of these, it is definitely possible to use *Thesis Writing Simulator* to demonstrate susceptibility and severity of unwanted outcomes, as well as simulate the benefits of healthy behavior. It can also be argued that it can make any potential barriers seem less inhibiting, or at least easier to comprehend, because in the game every aspect of real life is simplified.

Assessing these models has helped confirm that it is possible to promote healthier behavior using *Thesis Writing Simulator*. This overview has also given a better idea of how exactly and to what extent the game is able to foster change. For the last theoretical stop, attention is given to the specifics of using games for such a purpose.

2.3 Game-Based Learning

It is generally agreed that games can be an effective method to learn, as gamified elements tend to boost learners' motivation (Joyce et al., 2009; Strachan, 2011). In this subchapter a few aspects of games that are especially effective in a learning context are examined.

Firstly, it has been demonstrated repeatedly that giving the player *feedback* results in deeper learning (Erhel & Jamet, 2013; Lean et al., 2021). Both regular feedback during the game (Erhel & Jamet, 2013) and an interactive back-and-forth feedback session after a round of play (Lean et al., 2021: 200) have been found to be effective.

Secondly, *challenge* has been identified as a key element that can enhance gameplay in video games (Denisova et al., 2017). It is also one of the most frequent features present in serious

games[6] (Hammady & Arnab, 2022: 8). A game that is challenging in the right amount helps facilitate learning by boosting feelings of competence (Baranowski et al., 2013). It is also related to the flow state (Clark, 2023) and the strategy of deferral, which has been shown to increase time spent playing (Charles et al., 2005). This further proves that challenge can augment the potential magnitude of learning outcomes.

Thirdly, a *scoring system* is very often present in learning games (Hammady & Arnab, 2022: 8). While it can be thought of as a form of regular feedback, the benefits of which have been previously mentioned, it is more specific. Having a scoring system can boost player engagement (von Ahn et al., 2006: 60) and encourage repetition of tasks (Hammady & Arnab, 2022: 8), helping solidify gained knowledge. Repetition is relevant, because going over the same exact experiences multiple times has been shown to have a positive effect on learning outcomes (Schimanke et al., 2014).

Additionally, it has been noted by Wright-Maley (2015) that it is important to strike a balance between making a simulation realistic enough to be engaging, and simple enough to reduce unnecessary clutter and draw focus to what it is trying to teach. Therefore, *Thesis Writing Simulator* should aim to provide a sufficiently realistic experience, while maintaining focus on good game design, in order to be effective.

Along with theoretical considerations, it is worth taking into account other, finished projects with a similar goal, when making a life simulation game. This is because they are able to inspire in an immersive way, also providing a point of comparison. The next chapter focuses on such other games.

[6] Serious games — Games that are primarily designed for a purpose other than pure entertainment (e.g., educational games; Djaouti et al., 2011).

3. Similar Games

Making a life simulation game is not a novel idea. However, when making such a game, there are many different approaches one could take — many different goals to aim for. The end result could be a *cookie clicker*[7], could be a strategy game, could be an immersive adventure game with lots of choices. The game could be someone's creative idea brought to life just for the sake of self-expression, it could be a commercial product made to increase revenue, or it could be an attempt to educate the public on a specific societal issue (Kultima, 2018: 75). In this chapter there are a few examples of projects where the goal has been similar to that of the thesis at hand (to make a realistic life simulation game that focuses on health).

3.1 FULL ADHD

FULL ADHD — Täyttä elämää[8] (Figure 8) is a mobile game by Psyon Games released exclusively for the Finnish market in March 2021. It allows the player to experience life as someone with attention deficit hyperactivity disorder (ADHD).

Figure 8. Screenshot from *FULL ADHD* (Psyon Games, 2022).

[7] *Cookie clicker*, also known as an *incremental game*, or a *clicking game* — a video game, the gameplay of which consists mostly of simple repetitive actions such as clicking in one spot (Deterding et al., 2022). The player can typically purchase items and upgrades every once in a while to make their clicks appear more powerful.
[8] https://psyongames.com/full-adhd/

Similarly to *Thesis Writing Simulator*, *FULL ADHD* allows the player to make choices on what to do, while managing depleting resources that must be maintained to retain the ability to make the desired choices. It is also, like *Thesis Writing Simulator*, focused on promoting healthy behavior. The gameplay encourages it, as healthier choices have better outcomes. In addition, the game is also based on psychological theory (Skubich, 2024). *Thesis Writing Simulator* aims to present its theory to the player in a similarly non-intrusive way, blending it in with the core gameplay. It is different from *FULL ADHD*, however, in that it focuses on young adults more broadly, not specifically people with ADHD.

3.2 Legend of Homebody

Legend of Homebody[9] (Figure 9) is a life management and simulation game developed and published by CrazyPrince released in July 2021. It follows the lives of a few young individuals as they try and make it through the young adult life stage.

Figure 9. Screenshot from *Legend of Homebody* (CrazyPrince, 2021).

[9] https://store.steampowered.com/app/744260/Legend_of_Homebody/

This game is very similar in that it provides the player with a minimalistic home environment and asks them to make choices on what to do. It is also rather challenging, forcing the player to optimize actions to not go broke and lose. In addition, it has milestones to aim for, incentivizing the player to keep trying. It was attempted to carry over these elements of challenge and goals to *Thesis Writing Simulator*. In terms of differences, there is a much more narrow focus in *Thesis Writing Simulator*, which is teaching the player something about their own needs. *Legend of Homebody* is more an experience that enhances management skills, as it has many variables, but is not that realistic.

3.3 *The Sims* Series

The Sims[10] games are the most widely known examples of simulation games. The series has multiple entries and although the last major game — *The Sims 4* (Figure 10) — was released around nine years ago, the game has continued to receive updates since. The 15th expansion pack for it was released as recently as December 2023.

Figure 10. *The Sims 4* gameplay (Electronic Arts, 2024).

[10] https://www.ea.com/games/the-sims

As this series has received tons of feedback over the years and as it has been refined by many professionals to make sure it provides an enjoyable, engaging, and seamless experience, it made sense to use it as a reference point in design. Various elements in *Thesis Writing Simulator*, such as the need and motivation bars, were heavily influenced by their counterparts in *The Sims* games. Gameplay-wise, *Thesis Writing Simulator* differs in that it aims to be more realistic, challenging, and thought-provoking, rather than purely entertaining.

4. Development

This chapter outlines the tools and technologies used for developing *Thesis Writing Simulator*. Additionally, it describes the development process in general, as well as the challenges that came up during development.

4.1 Tools and Technologies

Godot 4[11] (Figure 11) was the game engine used for this project. It was primarily chosen for its simplicity and short loading times. Because it is nowadays also well documented and has a substantially large community, which helps resolve any questions that come up quicker, it was preferred over other simple, but lesser known game engines like Cocos, Construct 3 or DragonRuby. Since the game is very much lightweight, the more comprehensive capabilities of the only more popular game engines Unity and Unreal Engine were not required as they would have provided no additional benefit and would have slowed production down.

Figure 11. The logo of the Godot game engine (*Godot Engine*, 2024).

For setting up the background a plugin called Better Terrain[12] was used. This was due to the built-in autotiling[13] feature functioning improperly. While there are other similar plugins available like TileBitTools[14], they were not explored, as Better Terrain already provided a well-functioning way to set up the background of *Thesis Writing Simulator*. Additionally, since there was just one background to make for the game, any possible benefit from using a more efficient plugin would have been minimal at best.

A plugin was also used for setting up dialogue. This was because it would have taken considerably longer to implement a dialogue system manually. To choose the plugin, overviews of dialogue plugins for Godot 4 were queried for on Youtube. The first three were

[11] https://godotengine.org/

[12] https://github.com/Portponky/better-terrain

[13] Autotiling — a feature that allows for quicker design of level layouts by automatically choosing which exact tiles from a tileset to use.

[14] https://github.com/dandeliondino/tile_bit_tools

considered. It was assumed they would likely be some of the better ones, as they showed up on the top of the search results. Those three were plugins called Dialogic[15], EZDialogue[16], and Dialogue Manager[17]. After reviewing the videos, Dialogic was chosen, because it seemed to take the least amount of time to set up and work with.

The visual assets that were made by the author, such as the little arrows on the need and motivation bars, were created using Adobe Photoshop[18]. This editor was chosen because of familiarity with it.

4.2 Development Process

Initially, a design document (see Appendix I) was created, outlining preliminary features and aspects of the game, such as gameplay mechanics, story and setting, characters, art, audio, UI, budget, testing and development roadmap.

Next, game engines were evaluated in terms of suitability for developing *Thesis Writing Simulator*. For reasons outlined in the last subchapter, Godot 4 was chosen. Principles of this game engine in the shape of documentation and tutorials were frequently revisited before the start of development and during early iterations.

The practical work was carried out in three batches. The first one was started on January 26 and was completed by the end of February 20, 2024. The result was a simple room with objects, a controllable character, collisions, and a working game clock (Figure 12).

[15] https://github.com/dialogic-godot/dialogic
[16] https://github.com/real-ezTheDev/GodotEzDialoguePlugin
[17] https://github.com/nathanhoad/godot_dialogue_manager
[18] https://www.adobe.com/products/photoshop.html

Figure 12. Screenshot of *Thesis Writing Simulator* after the first batch of work on it.

The second stint happened from March 21 to April 25, 2024. During this phase the core logic and mechanics for needs and motivation, as well as carrying out activities, was implemented. The result was a working sandbox life simulation, but with no goal (Figure 13). Despite being incomplete, it was tested on random target group individuals on April 25, 2024, to gauge its usability and prioritize further work.

Figure 13. Screenshot of *Thesis Writing Simulator* after the second batch of work on it.

The third and final part of development took place from April 30, 2024 to May 10, 2024. During this phase a goal was added to the game, along with conditions for winning and losing (Figure 14). The goal was about writing a bachelor's thesis, giving the game its name.

Figure 14. Screenshot of *Thesis Writing Simulator* after the final batch of work on it.

In addition, some new activities were added. Usability was also improved on. For instance, alternative controls were added, such as arrow keys in addition to the *WASD* keys. Further, more information was put into the game to explain how needs and activities work. All of these changes were inspired by the observations of the first testing session.

Finally, to gauge the effectiveness of the changes, the game was tested again. This happened on May 11, 2024.

4.3 Challenges

The development process was not without its setbacks. This chapter gives an overview of challenges faced in connection with writing this thesis. The purpose of this is to give readers, especially future senior year students, an idea of what it takes to make a game like *Thesis Writing Simulator* as a thesis project.

Firstly, the most difficult parts of the work were the beginning and the end. The first big task was to gather theoretical resources to support the game, understand them, and mold them into a sensible format suitable for a thesis. It was unfamiliar territory, especially because a lot of the psychological theory involved was completely new information.

The final part of writing the thesis was challenging for personal reasons. The last week was riddled with illnesses, which made it difficult to submit the thesis on time. The issue was compounded by the fact that not much extra time had been planned. This was because of an unshakable belief that the received grade would be very important. That belief forced pushing the limits and working on each little task for as long as possible, for significantly longer than the nominal amount of time.

Secondly, a prevalent issue, although specific to the times, was the uncertainty about how AI could be used to support writing the thesis. Requirements were strict at first and got changed later. All of this caused confusion and reduced motivation to work on the thesis.

Lastly, technical issues also deserve a mention. Despite Godot 4 being significantly more powerful than Godot 3, it has its limitations, some of them not very obvious. For example, more than once the project became corrupt, seemingly for no reason. The error messages were indescriptive and therefore unhelpful (Figure 15). The first time it happened, it was difficult to find out what was wrong. After a long time, it became clear that the issue was with cyclic dependencies between files. Then, when researching it, there were mixed signals about whether this issue had already been solved or not. So, it was unclear whether it was possible to make the current file structure work in some officially supported way, or if it had to be reworked.

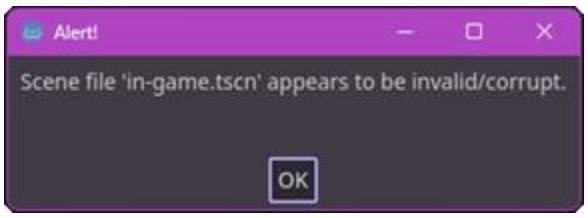

Figure 15. An ambiguous error message in Godot.

That being said, in general it was a smooth experience using Godot 4. The documentation was for the most part very clear and provided excellent examples. It all simply needed some getting used to, as during the earlier parts of development significantly more time was spent on researching the specifics of this game engine than during the later parts.

Overall, writing this thesis was definitely challenging. It was a learning experience, and often enough verged on the edge of the comfort zone.

5. Game Design

Game design comprises every decision that goes into making a game (Schell, 2008). Thus, it encompasses every part of that game, everything that game is. This chapter describes the game design of *Thesis Writing Simulator*. First, a general overview is given. Then, various design aspects, such as the art style and the game mechanics, are explored.

As a life simulation game, *Thesis Writing Simulator* allows players to control a human character and make choices on which activities to take on. However, they do not have absolute control. Sometimes the character will not feel like starting an activity, or keeping doing it for the full duration.

The character has needs, corresponding to the six needs identified in the theory chapter, which act as resources. The degree of satisfaction of those needs determines whether an activity can be started or not. Activities, in turn, influence the satisfaction of needs. Therefore, the player needs to thoughtfully manage the character's needs for them to be able to engage in the activities they want to take on. The logic for the interactions between needs and activities is in line with the theory laid out in the theory chapter.

5.1 Gameplay

This subchapter explains how *Thesis Writing Simulator* is played. In other words, it describes its gameplay.

In general, the actions taken in the game are all about the activities. The core gameplay loop (see Appendix VII), which can be seen on Figure 16, gives an overview of how the player gets from doing one activity to another. First, they move the character to a location where an activity can be started. Then, they open the activity select panel and choose an activity to start. Once this completes, they are free to walk to another location (or stay at the same one) to start another activity. This process is now explained in more detail.

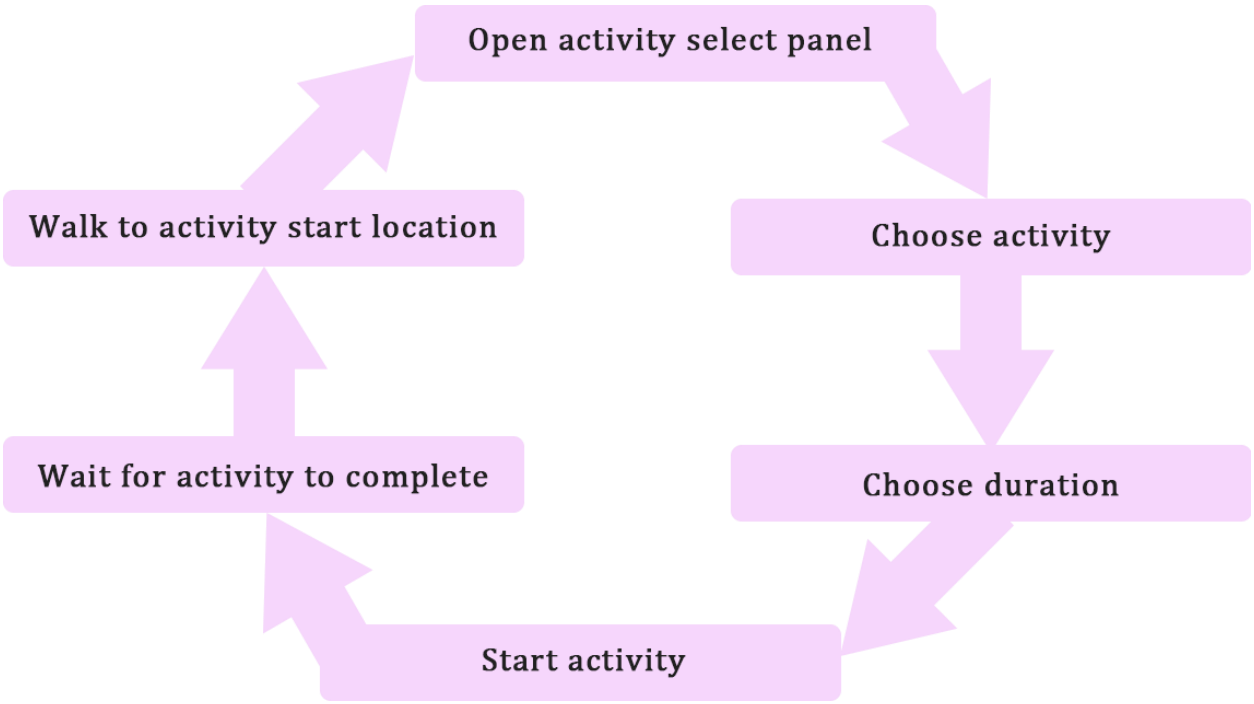

Figure 16. The core gameplay loop of *Thesis Writing Simulator*.

The player can move the character around the dorm room using the *WASD* keys. They are informed they can do this by a popup over the character's head at the start of the game (Figure 17). The popup permanently disappears when the player first moves the character.

Figure 17. The *WASD* popup.

Figure 18. The *E* popup.

Scattered around the room are activity start locations. When the player approaches any of those locations, a popup appears over the location, indicating that they can press the *E* key to make something happen (Figure 18). Upon pressing that key the activity select panel will open.

This panel (Figure 19) displays all the activities that can be started from the given location. The player can choose an activity to start by clicking on any of the buttons labeled with activity names. They can further select a duration for the activity using a slider. Each activity has a default duration, which is set upon selecting the activity. There are also minimum and maximum durations for each activity, which the

slider enforces. The player can choose to start the selected activity by pressing the button labeled “Start”. Alternatively, they can also choose to close the panel by pressing the *Q* key or the *Esc* key, as instructed by text on the panel. This restores their ability to move the character around to another location, as they cannot do so while the panel is open.

Figure 19. The activity select panel in *Thesis Writing Simulator*.

When the player does instruct the character to start an activity by pressing the “Start” button on the activity select panel, different things can happen depending on the character's current motivation for that particular activity. This motivation is calculated based on the base motivation that is always visible at the bottom left corner of the screen, as well as activity-specific modifiers that take satisfaction levels of each of the six needs as inputs. The resulting motivation for the selected activity is also shown to the player upon selecting an activity on the right hand side of the activity select panel. It updates in real time, so the player can see whether the motivation for the selected activity is increasing or decreasing.

Values of motivation for the selected activity are divided into three levels. Let us call these the red level, the yellow level, and the green level (Table 2).

Table 2. The three motivation levels of *Thesis Writing Simulator*.

	Red level	Yellow level	Green level
Motivation for activity	0 or lower	Between 0 and 1	1 or higher
Can complete activity	No	Maybe yes, maybe no, maybe partially	Yes

If the motivation for the selected activity is 0 or below (red level), the player will get an error message informing them that the activity can not be started (Figure 20). This represents the character really not being in the mood to carry out the activity.

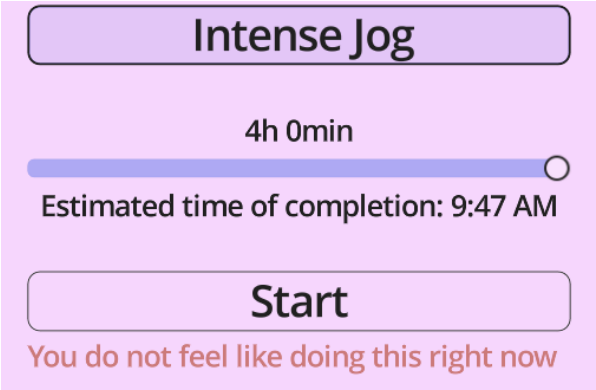

Figure 20. The error message saying the selected activity can not be started.

If the motivation for the selected activity is 1 or higher (green level), the character has no problem carrying out the activity, and so it will be executed as requested. Firstly, the room will fade out. Following that, the ongoing activity panel (Figure 21) will appear. It has a progress bar on it that will then linearly animate from empty to filled. While this is happening, the player is informed with text on the panel that the activity is being carried out. When the activity completes, a message saying "Done!" (Figure 22) appears below the progress bar. Some time after that, the ongoing activity panel disappears and the dorm room fades into view again.

Figure 21. The ongoing activity panel in *Thesis Writing Simulator*.

Figure 22. The "Done!" message on the ongoing activity panel in *Thesis Writing Simulator*.

If the motivation for the selected activity is between 0 and 1 (yellow level), the character will first spend some time trying to start the activity. As a result of this attempt, they may fail to start the activity, or they may be able to carry out the activity to partial or full extent. In this case, the ongoing activity panel will at first appear as on the green level. Instead of immediately starting the activity, however, a message will appear first, informing the player that the activity is being attempted (Figure 23).

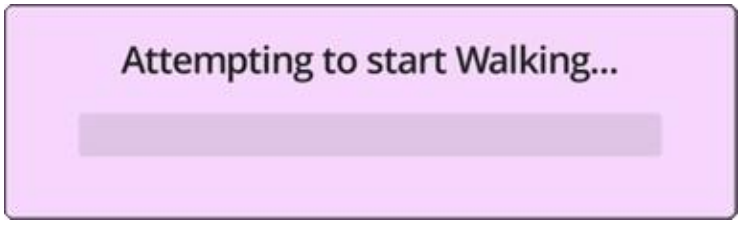

Figure 23. The activity attempt message in *Thesis Writing Simulator*.

Based on the exact motivation value, the outcome is randomly chosen from a curve (Figure 24). On this curve, the Y-axis value represents doing the activity for the respective percentage of the full duration. For example, 0.8 on the Y-axis represents doing the activity for 80% of the duration requested by the player.

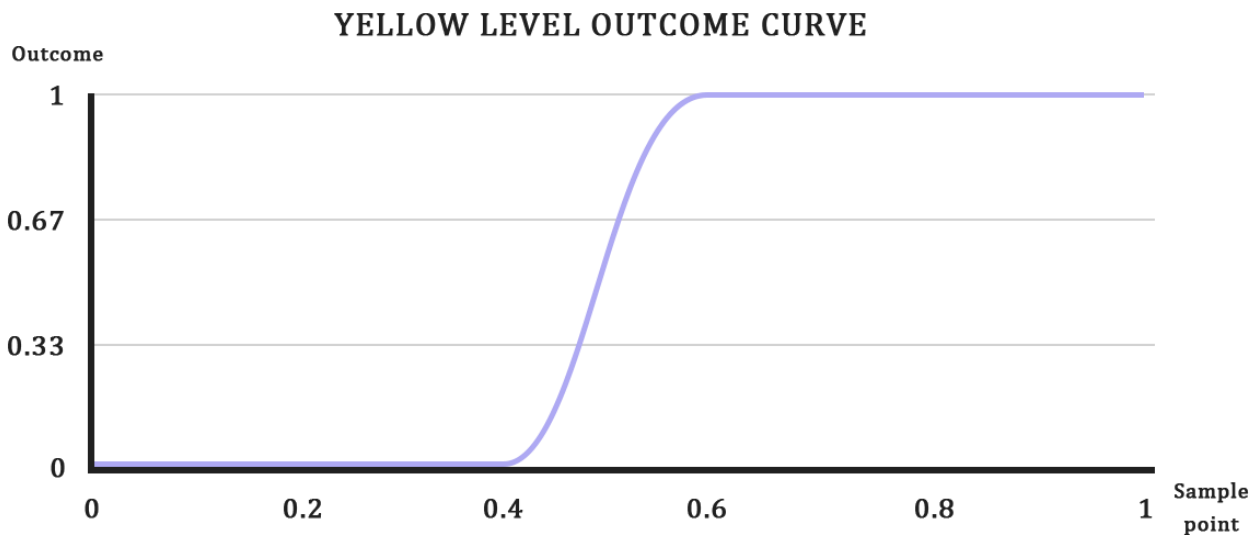

Figure 24. The yellow level outcome curve in *Thesis Writing Simulator*.

This curve is sampled in the following fashion, with the motivation for the selected activity as input. Firstly, based on the motivation, a center point on the curve is chosen. For this, the motivation value range (0, 1) is linearly mapped to the range (0.2, 0.8) on the curve's X-axis. Secondly, a random value is chosen from a range that reaches 0.2 to either side of the chosen center point. Finally, the curve is sampled at the selected random point. To better illustrate this, examples of sample ranges are given on Figure 25. This method ensures, in combination with the structure of the curve, that when motivation increases or decreases, the probabilities of outcomes change in a smooth fashion, i.e., there are no sudden jumps.

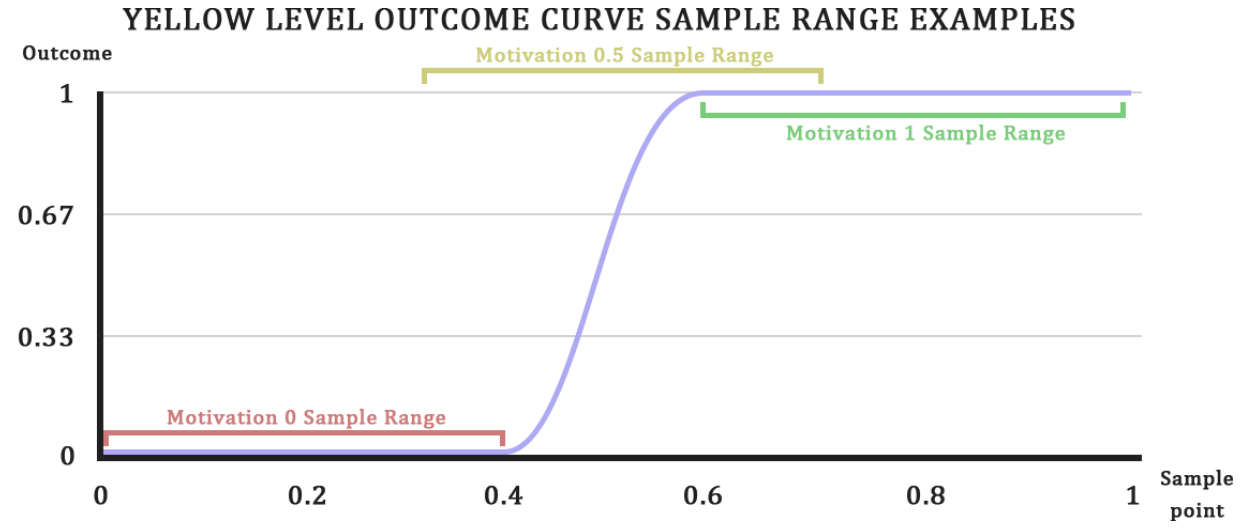

Figure 25. Sampling of the yellow level outcome curve in *Thesis Writing Simulator*.

If the sampled value is 0, starting the activity will fail. Text will appear on the ongoing activity panel informing the player of this (Figure 26).

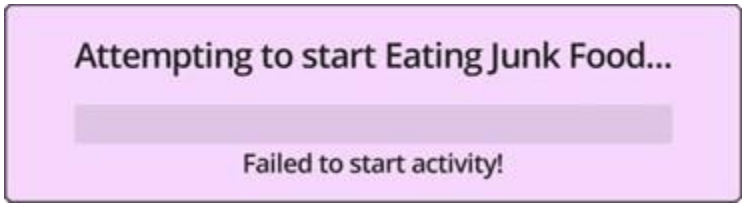

Figure 26. Text informing the player that starting the activity failed.

If the sampled value is 1, the activity will be fully carried out. In this case, after the message about the attempt is shown to the player, the activity will be executed as if on the green level.

If the sampled value is between 0 and 1, the activity will be partially carried out. The activity will start like normal, but the progress bar will stop at the respective percentage. The player is then informed with text that the activity could not be carried out fully (Figure 27). The exception to this is if the sampled value was between 0.95 and 1. In this case, the text will say "Done!" instead. This is because it was assumed that it would feel more natural to consider something almost completely done as done rather than partially done.

Figure 27. Text informing the player that the activity could not be fully carried out.

In any of these three yellow level cases, after what was described has been shown to the player, the ongoing activity panel will disappear and the dorm room will fade back into view. On both the yellow and green levels, once the room has faded in, the player regains control of the character's movement and is free to start another activity.

5.2 Need Logic

This subchapter describes how the six needs function in *Thesis Writing Simulator* — what effects they have and how to take care of them. This also demonstrates how the logic relates to the theory laid out earlier.

Firstly, the needs affect the base motivation, which is what is visible on the motivation bar, in a rather straightforward way. The base motivation is determined by the lowest need stat. This makes it difficult for the player to neglect any of the needs, as most activities are hard to start with low base motivation.

There is a configurable threshold for both the lower and upper ends of the base motivation level. For the lower end, it means that if the satisfaction of the most neglected need is at or below the threshold, the resulting motivation will be 0. The upper end threshold works in an analogous fashion. These thresholds were set up, because without them the base motivation would never reach either of the extremes, leaving some parts of the progress bar unused.

The base motivation is the most important factor for determining the motivation for an activity. This is in line with the SDT notion that autonomous motivation fuels itself (Assor et al., 2009; Ryan & Deci, 2017; Van den Broeck et al., 2010). The higher the base motivation, the easier it is to carry out activities that satisfy needs and therefore feed into the base motivation itself.

In the idle state, the base motivation tends to deplete. Relatedness, nutrition, physical activity, and sleep are all set to decrease when doing nothing. In contrast, autonomy and competence values are becoming more centered when idle. This is because satisfaction of these needs is primarily determined by recent actions. The longer idling goes on for, the more distant those recent actions are. Therefore, the less of an effect they will have. Also, it is assumed that idling is by itself not an autonomous nor a controlled activity, nor is it something the complexity of which can be assessed. So, it essentially does not impact these two needs.

Next, each of the six needs is examined in more detail. An overview of which activities have which effects on the needs can be seen on Figure 28.

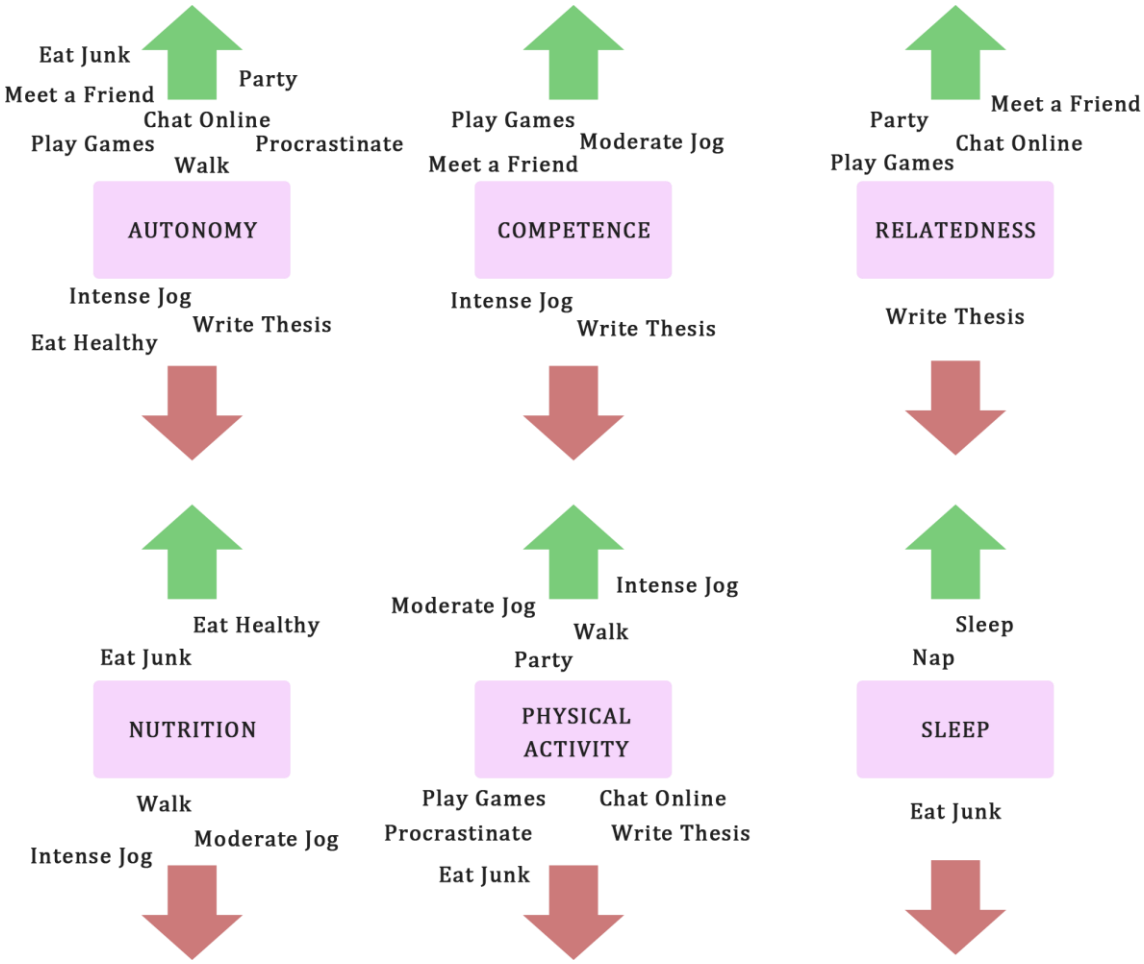

Figure 28. Activities that boost or thwart each of the six needs.

Looking more specifically at the need of *autonomy*, it is set to increase when doing activities that are normally done for fun or without external pressure, such as meeting a friend, eating, or partying. It is set to decrease when doing activities that typically do not have fully internal stimuli, such as an intense jogging session. There is, of course, tremendous amounts of variance between individuals, when it comes to which activities are carried out autonomously and which are not. In *Thesis Writing Simulator*, it was simply attempted to reproduce a typical case. As for the effects of this need, having low autonomy is set to increase the desire to carry out autonomy-inducing activities.

For *competence*, as the theory mandates, the activities that boost it are those that provide a challenge but are not too hard, such as playing video games. Activities that are too difficult,

such as writing the thesis, have a negative effect on competence. Having low competence slightly increases the desire to engage in easier activities.

As for *relatedness*, its satisfaction is increased by activities that were assumed to likely result in positive social interactions. Such activities include meeting a friend and partying. In a similar fashion to the previous needs, having low relatedness increases the desire to engage in activities that boost it. However, unlike the previous needs, having high relatedness slightly decreases the motivation for these activities. This is because it was assumed that a typical person would like to take breaks from social activities from time to time.

The need of *nutrition* is satisfied by eating, as one might expect. Eating healthy food satisfies it more than eating junk food, because it is assumed that junk food contains fewer useful nutrients. When the character is hungry, they do not wish to take on other activities besides eating. This is because, as the theory stated, having unmet physiological needs can cause them to be hyper-focused on (Yam et al., 2014).

One can engage in physical activities such as walking and jogging to increase the satisfaction of the *physical activity* need. Doing anything non-physical will make satisfaction of that need slowly deplete. Eating junk food will deplete it by a little more than usual, as it is assumed that this activity would contribute additional calories to be burned off. As the theory dictates (Biolo et al., 2005), having low physical activity will cause the character to be reluctant to carry out physical activities. The more intense an activity, the bigger this effect. To make sure the player is able to boost their physical activity when low on it, motivation for the low-intensity physical activity of Walk was boosted in this situation.

Lastly, *sleep* satisfaction is upped by sleeping. Napping, which is sleeping for a shorter duration, has a similar effect, but is not quite as effective. Being very tired will make the character not want to do anything besides sleep. An exception to this is if they are also very hungry, in which case they could be more willing to eat first.

There are a couple more tendencies worth mentioning. Firstly, low motivation has a slight positive effect on the desire to eat, especially for junk food, which can cause overeating. Secondly, being low on motivation slightly decreases the desire to sleep. These effects are

amplified if there are multiple needs with very low satisfaction. This emulates a vicious cycle, where unhealthy behaviors fuel other unhealthy behaviors.

5.3 Designing for Learning

In this subchapter, it is explored how *Thesis Writing Simulator* can be optimized for learning. For that, chapters 2.2 and 2.3 from the theoretical chapter are taken into account.

In chapter 2.2, it was discovered that the game can best help those who are not yet contemplating any change in their health behavior. Therefore, a learning objective of the game can be getting new ideas and inspiration.

In chapter 2.3, it was found that the elements of *feedback*, *challenge*, and *scoring system* are particularly relevant for learning through a game. Next, the relationship between each of those elements and *Thesis Writing Simulator* is discussed.

The element of *feedback* has been addressed in multiple ways. For example, need bars are color-coded and always show up when an activity is started. This makes sure the player can easily see the effect an activity has. Little arrows are also present on need bars, indicating change of value in real time. This helps players notice smaller changes in need satisfaction. Additionally, to make the level of motivation more tangible, the character is programmed to move slower when low on it.

There are still ways to improve the feedback system. For instance, there could be more visual feedback in the game, like an animation of the character depicting them carrying out the current activity.

As for the elements of *challenge* and *scoring system*, they are covered by the goal of the game. That is the topic of the following subchapter.

5.4 Game Goal

This subchapter describes the goal of the game, along with conditions for winning and losing. As the name of *Thesis Writing Simulator* suggests, the game is about writing a thesis.

When the game is started, firstly the pre-game dialogue appears (Figure 29). During this dialogue, the player finds out that they have ten days left to work on their bachelor's thesis. They are told that they have done their practical work, but still have a lot of writing to do. The player can choose to skip this dialogue. They are informed that they can do this with a notice located at the bottom right corner of the screen.

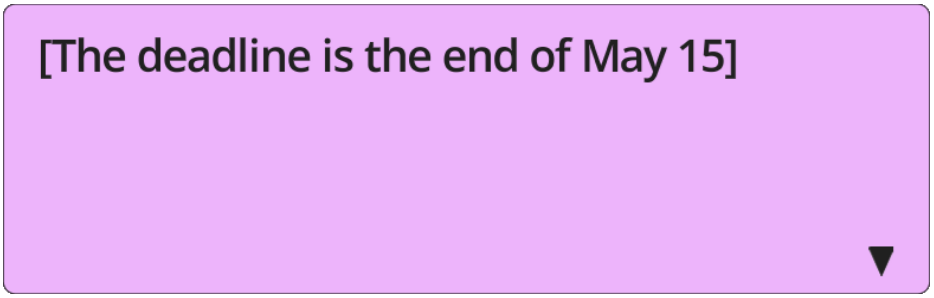

Figure 29. Part of the pre-game dialogue.

Once the dialogue completes or is skipped, the player finds themselves in the dorm room. At the bottom left corner of the screen, the progress of writing the thesis is shown (Figure 30). This starts out at 40% and is increased every time the player is able to successfully initiate the Write Thesis activity. A grade is also shown on the thesis progress bar. This is the grade the player would get for their thesis if the game ended immediately. They need to write at least 51% of the thesis for an E, at least 61% for a D and so on, up until at least 91% of the thesis for an A.

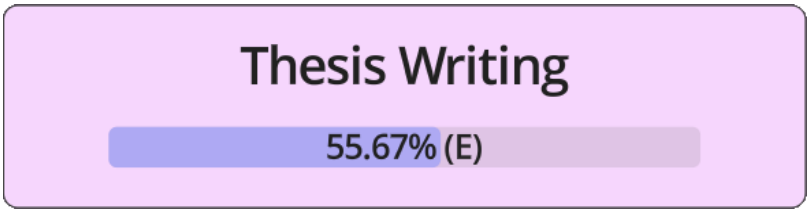

Figure 30. The panel showing the progress of writing the thesis.

When the player either finishes writing the whole thesis or runs out of time to do so, the game is immediately stopped. What follows is post-game dialogue (Figure 31). There are different branches in this dialogue for each of the grades achieved. Additionally, the dialogue is slightly different depending on if the player submitted their thesis early or not. If they did,

it will start with “You submitted your thesis.” If not, it will start with “You rushed to submit your thesis.”

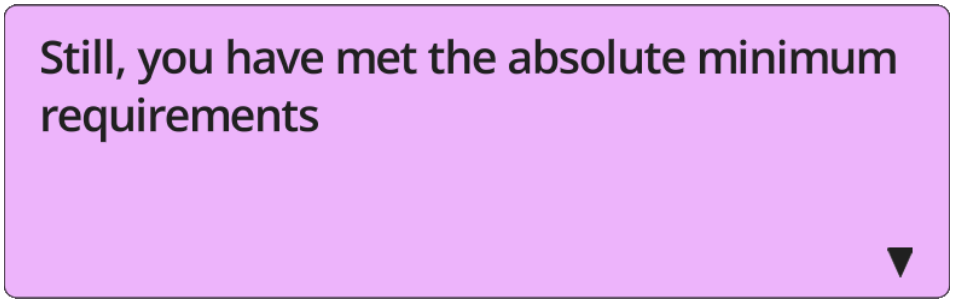

Figure 31. Part of the post-game dialogue.

The dialogue always ends with offering the player to click on the screen to play again. If they got a grade of B or lower, this will be preceded with the appropriate sentiment, such as “Perhaps if you could have spent more time writing the thesis…”

5.5 Setting

This subchapter describes when and where *Thesis Writing Simulator* takes place. The only location in the game is a small dorm room (Figure 32). The limited space for moving around is meant to add to the immersion. This is because it is assumed that a lot of young adults are students living in similar conditions.

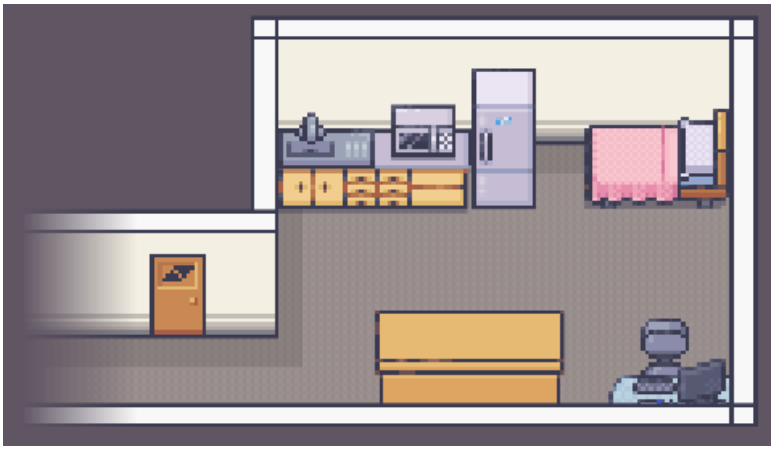

Figure 32. The dorm room of *Thesis Writing Simulator*.

The time period depicted is modern, with the events in the game happening from Monday, May 6, 2024 to Wednesday, May 15, 2024. The society model reflected in the game is the one of the Western world. The setting is such to make the game as relatable as possible to the target audience of *Thesis Writing Simulator*.

5.6 Main Character

For the same reason, the main character (Figure 33) is a young adult. This is implied by them living alone in a small space. On the one hand, people who are not adults yet typically do not live completely alone. On the other hand, people older than young adults are more likely to live in bigger spaces with other people, as they have had more time to establish families.

Figure 33. The main character of *Thesis Writing Simulator*.

The character does not have a backstory. This is because other game elements, like the logic related to the discussed theory in the theory chapter, were considered more important to work on.

5.7 Audio

Another game element that is missing from *Thesis Writing Simulator*, albeit not entirely (the only sounds in the game are those of typing during dialogue), is audio. The reasoning for this is also that other game elements were prioritized over it.

5.8 Art

This subchapter describes the art style of *Thesis Writing Simulator*, excluding styling of the UI. The latter is discussed later in the following subchapter.

The art style of the character and the environment in *Thesis Writing Simulator* was inspired by a horror RPG game with visual novel elements called *Paper Lily*[19] (Figure 34). The visuals were intended to be simple, to not distract from the main gameplay.

[19] https://leef6010.itch.io/paper-lily-chapter-1

Figure 34. A screenshot of *Paper Lily* (84).

Sprites for the player character, as well as the environment, are made by LimeZu[20]. To use them, a license granting rights to use them in any commercial or non-commercial project was bought. This was because it was considered more important for this thesis to have more time to implement the game's logic, rather than create art assets.

5.9 User Interface

Most of the communication between the game and the player in *Thesis Writing Simulator* is mediated by user interface (UI; see Appendix VII) elements. This subchapter explains various aspects of the UI of *Thesis Writing Simulator*, such as how it was designed and why.

The UI elements in *Thesis Writing Simulator* are designed to be simplistic in design, to not distract from the rest of the game. The color palette used includes many off-colors, which are meant to provide a softer feel (Figure 35).

[20] https://limezu.itch.io/

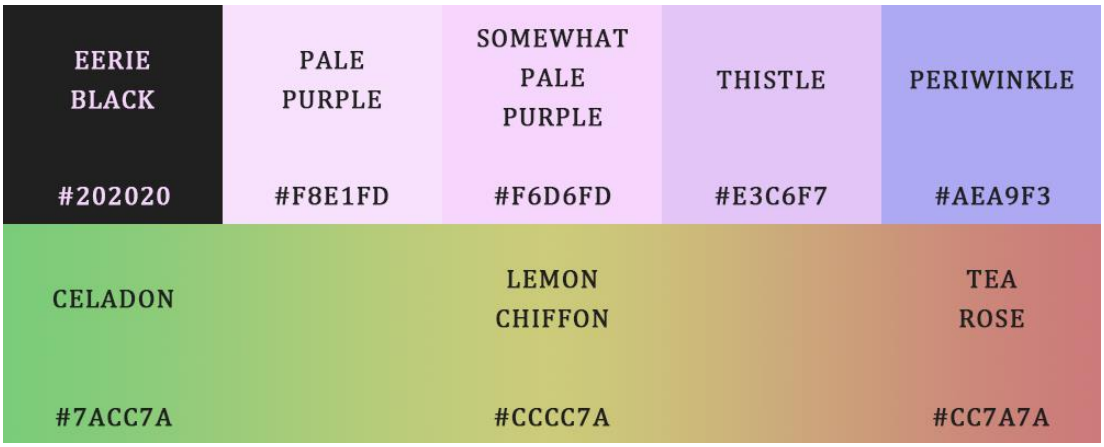

Figure 35. The color palette of the UI of *Thesis Writing Simulator*.

Each UI color is tied to a meaning or use case (Table 3). This is to make the UI more consistent and to allow the user to predict the meaning of UI elements.

Table 3. Meanings and use cases of UI colors in *Thesis Writing Simulator*.

Eerie black	**Pale purple**	**Somewhat pale purple**	**Thistle**
Borders, text	Highlighted UI elements	Background of UI elements	Selected UI elements
Periwinkle	**Celadon**	**Lemon chiffon**	**Tea rose**
Time, progress	Good, high, healthy	Average	Bad, low, unhealthy, error

The sole font used in the game was Open Sans Semibold (Figure 36). This was because its neutrality, legibility, and consistent smooth strokes seemed to align with the goal of creating a simple and non-intrusive UI design.

Figure 36. The Open Sans font[21].

For designing the UI the custom theme feature of Godot 4 was used. This feature allows the user to define preset looks, called theme type variations, for each of the UI elements, called control nodes. A type variation can then be selected for each control node used in the game. As a simple example, the "Label" node, which is used for displaying text, had multiple type variations defined with different font sizes and colors (Figure 37).

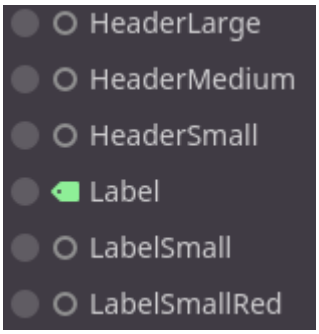

Figure 37. Type variations of the "Label" node in *Thesis Writing Simulator*.

The UI was mostly designed using built-in features of Godot. However, on occasion, new designs were also created from scratch. For instance, arrows indicating increase or decrease in a stat (Figure 38) were created in Photoshop.

Figure 38. Arrows indicating increase or decrease in a stat in *Thesis Writing Simulator*.

These arrows worked closely together with stat progress bars (Figure 39). For each such progress bar, up to three arrows would show up next to it to indicate a changing value. The more arrows, the more rapid the change in real-time. The filling of each progress

[21] https://fontsgeek.com/fonts/Open-Sans-Semibold

bar was programmed to change color based on how much of the bar was filled, with green indicating a full bar and red an empty one. Such bars never completely emptied, as having a bit of red showing seemed like a more intuitive way of conveying that a stat was very low.

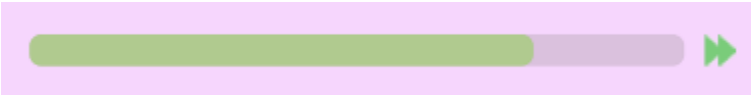

Figure 39. A stat progress bar in *Thesis Writing Simulator*.

The main in-game view features one of these progress bars — the motivation bar — at the bottom left corner of the screen (Figure 40). This bar can be clicked to toggle the visibility of need bars right above (Figure 41). Hovering over the motivation bar, the hotkey *R* for toggling the need bars is shown (Figure 42).

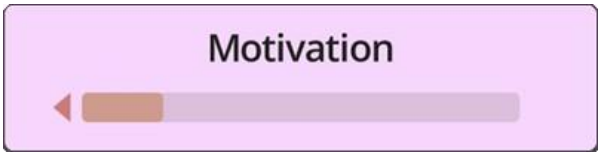

Figure 40. The motivation bar in *Thesis Writing Simulator*.

Figure 41. The toggleable need bars in *Thesis Writing Simulator*.

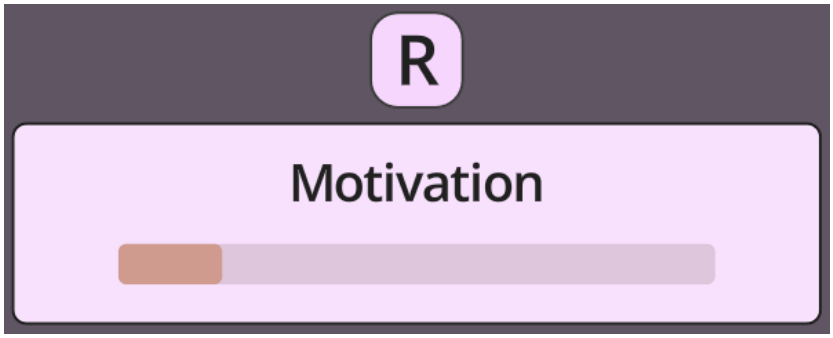

Figure 42. The *R* popup in *Thesis Writing Simulator*.

In addition to the progress bars, an in-game clock is shown at the top right corner of the screen (Figure 43). Lastly, as was mentioned before in subchapter 5.4, at the bottom right corner of the screen the progress with the thesis writing is shown. These are all the UI elements in the default in-game view (Figure 44).

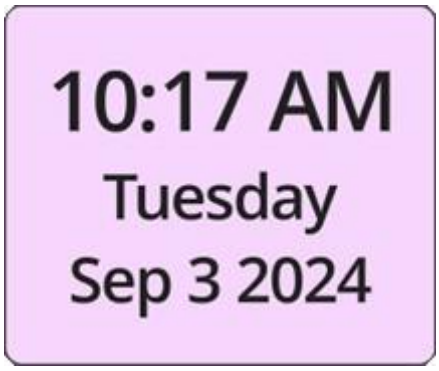

Figure 43. The in-game clock in *Thesis Writing Simulator*.

Figure 44. The default in-game view in *Thesis Writing Simulator*.

Alongside all such design decisions, the actual implementation is also an important part of the work. The next chapter goes over that in more detail.

6. Implementation

This chapter describes the technical side of the practical work conducted as part of this thesis, i.e., the implementation of *Thesis Writing Simulator*. Only a few more prominent aspects are explored, as dissecting the whole codebase would needlessly elongate the thesis. Those include the modular approach, the event system, and custom resources. More details on what they are are included in their respective subchapters.

6.1 Modular Approach

The modular approach (see Appendix VII) is a well-known design theory that is widely practiced in game development. This subchapter details how the modular approach was used in making *Thesis Writing Simulator*.

Firstly, in Godot, there are scenes. A scene represents a part of the game and is something that can be run. There is always a default scene that is run at game start.

Scenes consist of nodes. Nodes in a scene can be parented under one another, so a typical scene has a tree-like structure (Figure 45). If a node has multiple child nodes, they can be called branches.

Nodes can be anything from pieces of text to controllable characters. They can also be scenes. Therefore, here the modular approach can be used to make scenes more manageable by separating cohesive chunks of the game into their own scenes.

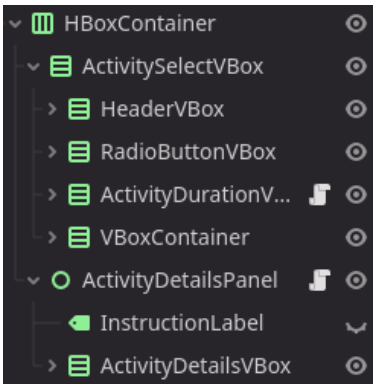

Figure 45. An example of the tree-like node structure in Godot.

This is what has been done during the development of *Thesis Writing Simulator*. For example, the main scene is called `in-game`. Inside it are subscenes `dorm_room`, `player`, and `in-game_ui`. The `in-game_ui` scene itself also contains multiple subscenes (Figure 46), and so on.

This approach is especially useful for cases where multiple branches of a scene are identical or nearly identical. If they are identical, one of them can be made into a scene of its own and then duplicated in the parent scene. This allows for editing the branch just once in its own subscene and having the changes affect all instances of it.

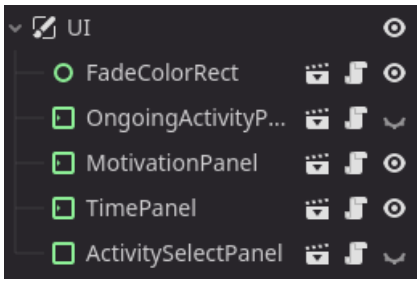

Figure 46. The structure of the `in-game_ui` scene. All the nodes under it are subscenes.

If they are only nearly identical, the differences between them can typically be managed using a script. Each node, and therefore also each scene, can have a script attached to it. That script can define changes to the node or scene it is attached to.

If the changes are not very complicated, they could be facilitated using export variables of the script. These are variables that the script can use and that can be configured in the Godot editor. For instance, in *Thesis Writing Simulator*, there is a scene called `need_bar`. This scene represents a UI element displaying the current satisfaction of a need. It has a text element on it for the name of the need, as well as a progress bar. The script attached to the `need_bar` scene has an export variable called `need`, so the need can be picked in the editor (Figure 47). When the game is run, the script will use the set export variable to determine the name of the need on the need bar. Its progress bar also receives updates in accordance with the set value.

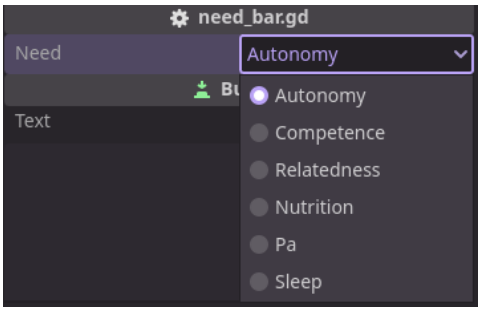

Figure 47. Using an export variable to pick a need in the Godot editor.

In addition to scene management, the modular approach was also used more generally to manage the code of *Thesis Writing Simulator*. The single responsibility principle[22] (SRP), which the modular approach mandates, was followed wherever possible. Whenever a script got too complicated and started to handle too many

[22] Single responsibility principle — the idea that every unit of code should have only one responsibility (Abba, 2022).

different tasks, it was split into smaller scripts. For example, a script called `globals` created at the start of development to handle parameters that needed to be globally available was eventually split into seven scripts. One of them was called `events`.

6.2 Events

The latter is a script, which essentially functions as a signal forwarder. Signals are something that can be declared and then emitted by any script. They can be bound to by another class and listened for. When binding to a signal, a function needs to be specified. That function will then execute every time the signal is emitted. Thus, the only thing the `events` script does is that it receives signals and then emits new signals with identical names. An example of a signal being forwarded through `events` to its destinations can be seen on Figure 48.

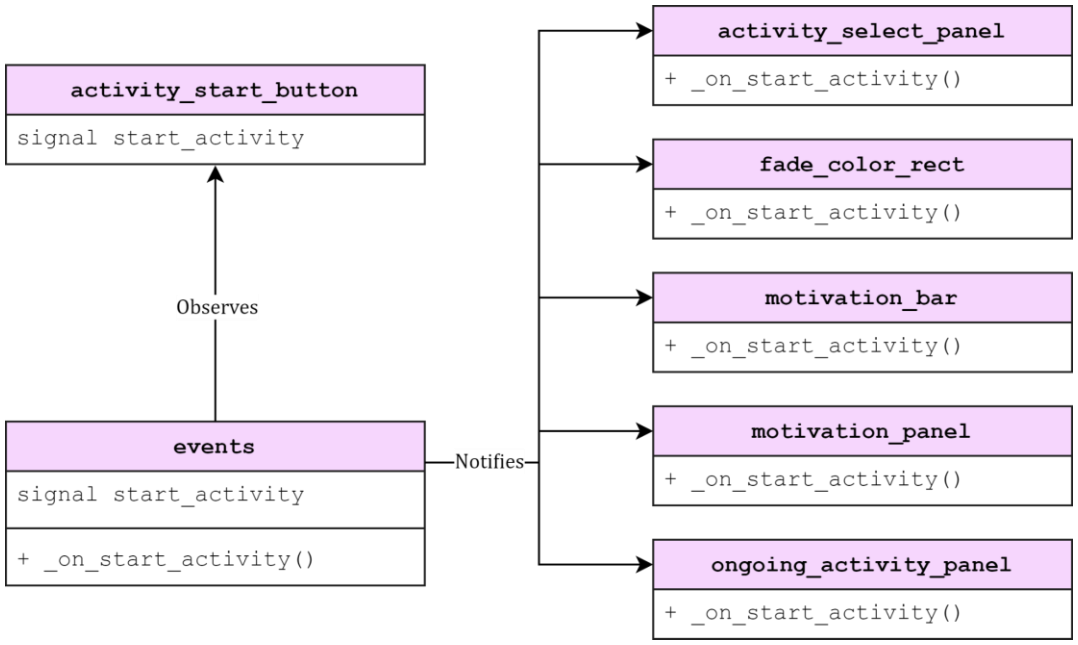

Figure 48. Forwarding the `start_activity` signal to its destinations via `events`.

This kind of a structure in code is called the observer programming pattern. As a result of using this pattern, when a script needs to propagate an event to other classes, it only needs to bind to its signal the globally available respective function from the `events` script. This will make the latter emit its own signal with the same name. That signal can then trigger anything that needs to happen in any other scripts. Therefore, any script that needs to

execute an action upon an event can simply bind a function to the respective signal of the `events` script.

The implication of this is that scripts are far more decoupled than they could be otherwise, which also works well together with the idea of modulation. It means that scripts that propagate events do not need to be aware of scripts that act upon those events, and the other way around.

6.3 Resources

Another thing that supported greater modulation was using resources in Godot. A custom resource is a script that essentially defines a custom data type. In that script one can define a constructor, variables, and functions. While not wholly different from a regular script, it does, for example, allow for another script to have an export variable of this data type. The variables of that data type can then be conveniently picked in the editor. Files that represent instances of a custom resource can also be created and then be dragged to such export variables. This is very useful for cases where there are many similar objects that each differ only by some static set of parameters.

For making *Thesis Writing Simulator*, a few types of custom resources were created. Firstly, `curve_data` acted as a wrapper for a curve (Figure 49). This type was made to be able to instantiate a curve along with points on it. Having this type available greatly facilitated using another custom resource described later.

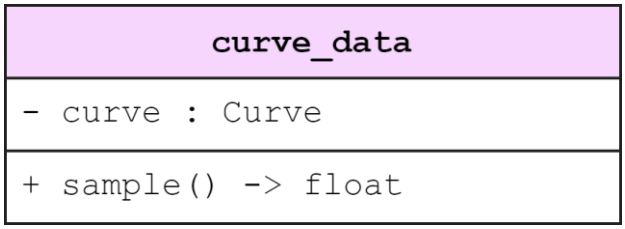

Figure 49. The `curve_data` script.

Secondly, the `effect_data` custom resource was constructed. Instances of it each represented an effect that an activity has on a need. A limited number of impact types were identified. They were put into an enum named `EffectType` (Figure 50). This enum was then used in the constructor of `effect_data`, along with a numerical value.

Lastly, the `activity_data` custom resource was made. This resource made use of both of the previously mentioned resources. Instances of this resource each represented an activity.

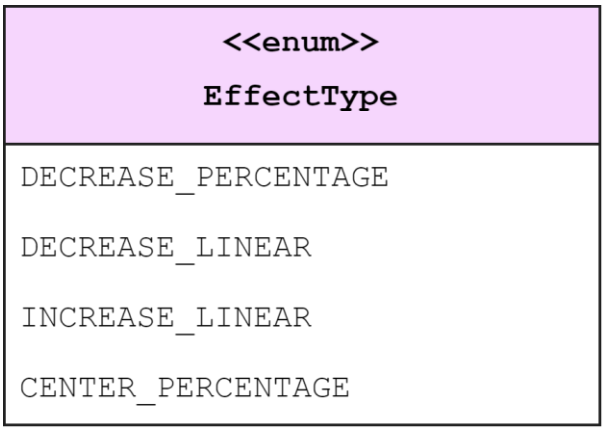

Figure 50. The `EffectType` enum.

Its constructor included multiple variables. Worth mentioning are the variables `modifiers` and `effects`. The `modifiers` variable represented the effects of need satisfaction on the motivation to start the activity. The default value of this variable was held in another variable called `default_modifiers`. It was a dictionary mapping from needs to curves (Figure 51). The `curve_data` resource was used here for the curves. This enabled the creation of activities in one go, without having to add points to the modifier curves later.

The curves were set up so that they could be sampled at a point corresponding to a need satisfaction value (X-axis), and that the result would be the respective motivation modifier (Y-axis). This modifier would later be added up with other modifiers and the base motivation to determine the total motivation for starting an activity.

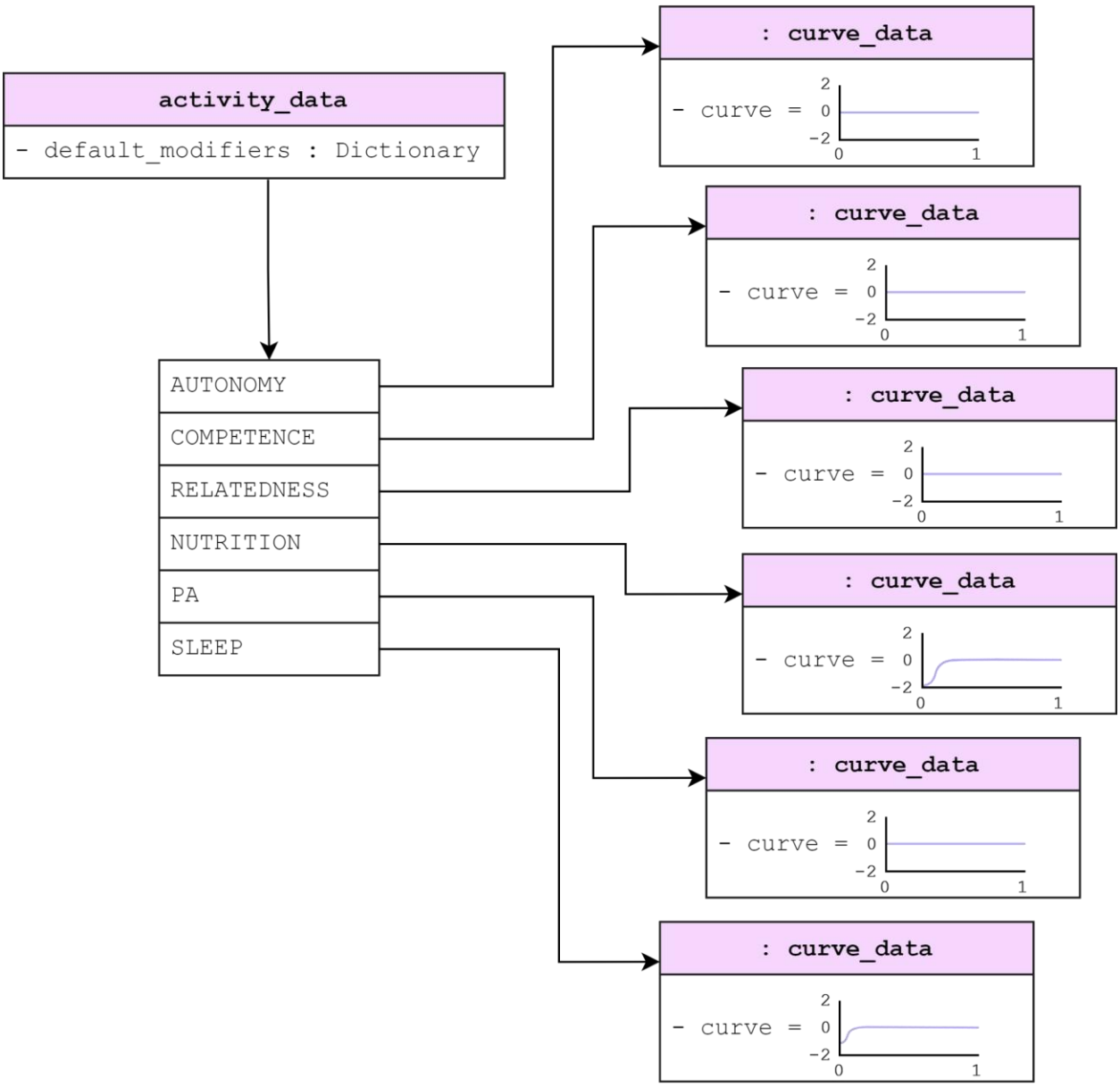

Figure 51. The `default_modifiers` variable.

The `effects` variable represented the effects of the activity on the satisfaction of needs. The default value for this variable was similarly kept in a variable called `default_effects`. It was a dictionary mapping from activities to `effect_data` instances (Figure 52).

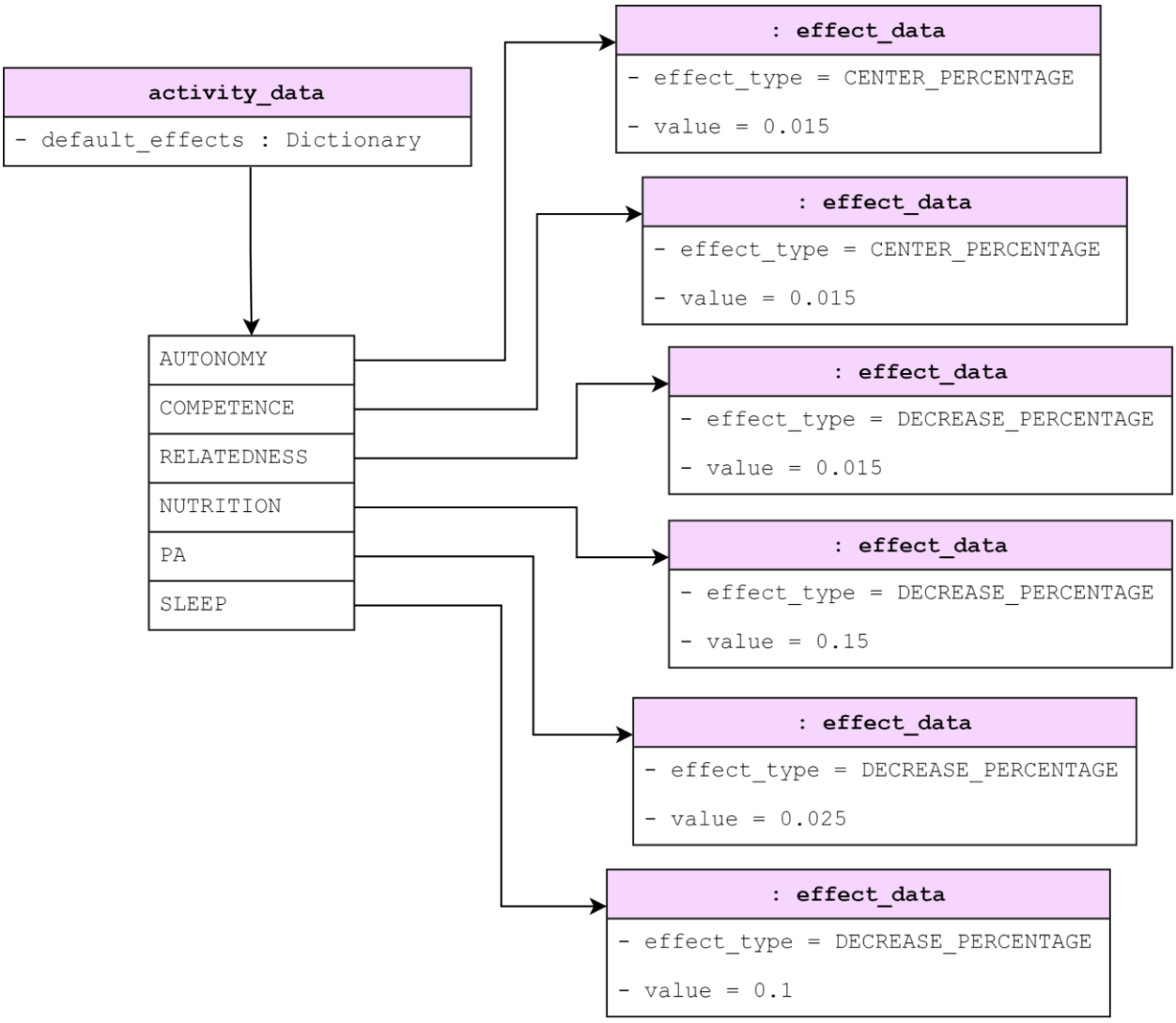

Figure 52. The `default_effects` variable.

Activities were defined in the `activities` script, in a dictionary mapping from an enum called `Activity` to instances of `activity_data`. The enum had one entry for each activity. The variables of `activity_data` are presented on Figure 53. The activities were not made into files or defined in the editor. This was because the variables that needed to be defined included other custom resources — `curve_data` and `effect_data`, and Godot at this moment does not support assigning custom subresources to resource data in this way.

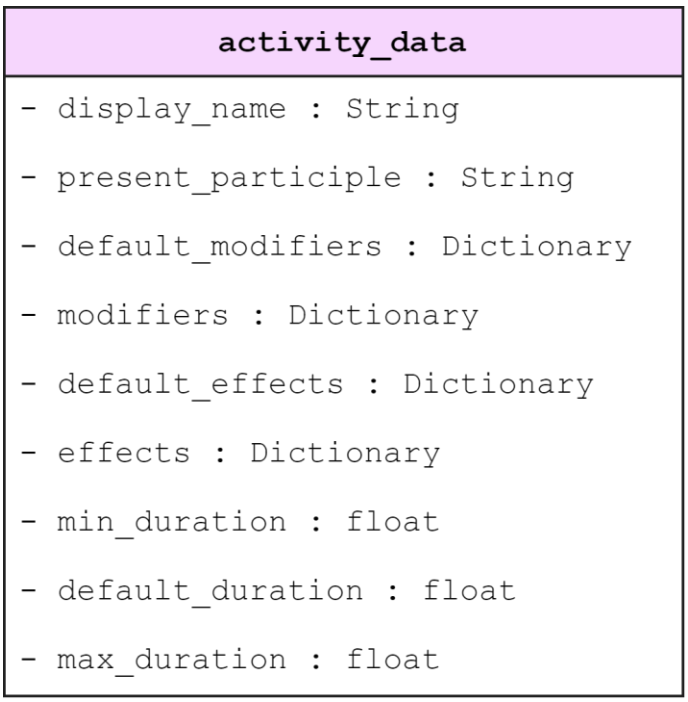

Figure 53. The `activity_data` script.

Having constructed the logic and the game, it was then tested. The next chapter describes this process.

7. Testing

Two qualitative testing sessions were carried out. The first one was conducted during the development of *Thesis Writing Simulator*, on April 24, 2024. At this stage the game was still lacking many key features, such as an end goal and explanations of needs. Thus, the testing was aimed more at assessing usability of the main mechanics and finding out which of the missing features were most important to focus on. Findings from this session were taken into account in further development. The second session, which took place on May 11, 2024, was then used to evaluate the effectiveness of the changes made to the game between the testing sessions. In addition, the game was also on occasion briefly tested informally on friends of the author to identify usability issues.

This chapter first defines testing objectives, as it is important to be aware of them before carrying out any part of testing (Mirza-Babaei et al., 2016; Schell, 2008: 392). Next, the testing procedure is described in detail in the methodology subchapter. Following that, participant selection is briefly elaborated on. Finally, results from the two testing sessions are presented, along with the changes they provoked in development.

7.1 Objectives

Two main objectives were identified for testing. Firstly, it was considered important to gauge how well the game met its overall objectives. As a quick recap of these objectives, *Thesis Writing Simulator* was intended to be both fun and educational. So, it was assessed how much the players enjoyed playing the game, as well as if and how much they learned from it.

The second objective was to identify the game's most prevalent shortcomings. That includes, for example, bugs and usability issues. This was considered important, because such problems can often significantly hamper the player's ability to experience the core parts of the game as intended (Lewis et al., 2010).

7.2 Methodology

Faizan et al. (2019) have conducted a literature review on evaluating simulation games. They have grouped game assessment types into three categories — pre-game, in-game, and post-

game. Based on their findings, they have proposed a testing strategy that incorporates all three categories (Faizan et al., 2019: 633). For each category, they have named elements they believe to be the most effective. Examples of those elements can be seen on Figure 54.

Figure 54. Categories of game assessment (based on Faizan et al., 2019).

Because this strategy is evidence-based and focuses on simulation games specifically, it was used for testing *Thesis Writing Simulator*. A simple format with a relatively small number of elements was chosen to accommodate for the limited scope of a bachelor's thesis. Each participant was guided through each of the pre-game, in-game, and post-game assessments sequentially, in one sitting. Pre-game and post-game evaluations consisted of questionnaire questions. Google Forms was used to create a single questionnaire spanning the whole process[23]. This technology was chosen, because it allowed for easily saving data, getting an overview of the collected results and performing basic analysis. A replica of the questionnaire can be seen in Appendix III.

The testing was performed at the Delta Centre of the University of Tartu, in a secluded study room in the students' study area. The testers were presented with a laptop and a mouse (Figure 55). The laptop had been set to record its screen using OBS Studio[24], along with audio from the built-in microphone of the laptop. The recordings (see Appendix IV) were examined after the testing, to find if anything had been missed during the observations.

[23] https://docs.google.com/forms/d/e/1FAIpQLSfoZvpMVPnuqfwRt-GwzOi2_dI80BKEyRfZzwcfQqzOfJfa9g/viewform?usp=sharing
[24] https://obsproject.com/

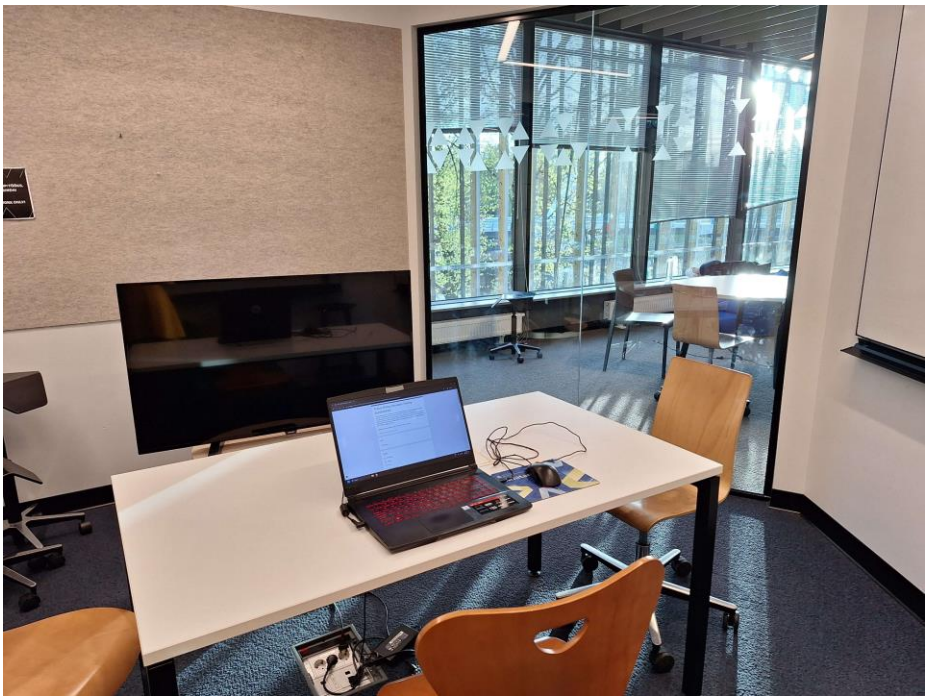

Figure 55. The setup of the testing room.

The pre-game part of the questionnaire consisted of ten questions. The first question was on age to see if the participant belonged to the game's target group of young adults. The second question was on gender. This was asked to ensure there is a gender balance, because it has been shown that gender is a major predictor of the nature of one's gaming habits (Chappetta & Barth, 2022; Romrell, 2013). So, with this question testing was made more inclusive. Lastly, the participants were asked about their amount of experience with life simulation games and how often they play video games in general. *The Sims* was mentioned as an example life simulation game, to make sure it was clear what was meant by *life simulation games*. These two questions were asked, because it was assumed that people who are familiar with life simulation games and who game a lot would naturally have an easier time navigating *Thesis Writing Simulator*. Therefore, it would introduce a bias in the results if it wasn't accounted for. Lastly, the testers were asked about their health behaviors regarding all six of the chosen basic needs — *nutrition*, *physical activity*, *sleep*, *autonomy*, *competence*, and *relatedness*. This was done with the assumption that people who are worse at taking care of their own needs have more to learn from *Thesis Writing Simulator*. So, it also mitigated the effects of a potential bias. The questions were on specific behaviors, because data from such

questions is generally more accurate compared to data from questions asking participants to subjectively evaluate themselves (Fitzpatrick, 2013).

For the in-game assessment, the participants were each presented with a laptop along with a mouse on which *Thesis Writing Simulator* was running. They were told they could play as long as they wanted. This was because it was assumed play duration would be correlated with the level of enjoyment of the game — and since the sessions were recorded, it was easy to later determine play duration. They were also instructed to feel free to vocalize their thoughts during the game. This instruction is similar to the Think Aloud method (Eccles & Arsal, 2017), in which participants are required to say what they are thinking, and which has been shown to be effective for identifying reasons for in-game behaviors (Wideman et al., 2007). However, compared to the Think Aloud method, it eliminates a factor of unnaturalness by being voluntary, assuming most people would not enunciate every thought during a solitary play session. The participants were visually observed playing the game and notes were taken on anything that seemed to hinder the pleasantness of the experience or its educational value. They only received assistance if it was necessary for them to be able to fully experience the game — for example, if they could not otherwise understand how to perform basic tasks in the game, like starting an activity.

Finally, for the post-game assessment, the testers were asked five questions. It was stressed in the page header for this part that the truthfulness of answers was more important than giving positive answers. This was done in an attempt to prevent participants from giving positive responses just to convey emotional support. One question was about whether they would play *Thesis Writing Simulator* again in their free time. It was assumed that it was a good indicator of the level of enjoyment they experienced, and that it would be easier for them to admit they would not play it on their own than that they did not like the game. Three questions were about gauging the game's educational value. When creating these questions, it was assumed that a lot of learning would be subconscious. It was also kept in mind that a game like *Thesis Writing Simulator* can make the most amount of difference for those yet to contemplate any change in their health behavior, as was found in chapter 2.2. So, instead of asking directly whether anything was learned, the participants were asked about whether they felt inspired and whether they got any new ideas from playing the game. They were also

asked to elaborate on those new ideas if they had any. Finally, the testers were asked to say anything else they might have had in mind about the game. This was done to cater for the potential situation where a participant has feelings or thoughts about the game that carry valuable information on how the game could be improved, but there is nowhere suitable to state it, so they do not do it. The open questions were verbal, i.e., it was explained that they should be answered out loud. This was done to make it easier and more hassle-free for the testers to provide a greater amount of information.

7.3 Participants

The first testing session was initially advertised in a Messenger group chat containing most of the more than 200 students who started their bachelor's level computer science studies at the University of Tartu in autumn 2021. It was then also pasted in a few other similar chats, as it received very little attention. It was mentioned in the advertisement that any testers should not know the author personally, to prevent bias, and that the testing sessions would be recorded. A Doodle poll was presented along with possible testing times. Each time slot could be selected by at most one respondent.

The first five respondents were going to be selected to be the testers, with the additional rule that a person would not be selected if three people of the same gender had already been selected, to ensure gender balance. However, nobody signed up, so for both testing sessions random people around the testing area were offered the chance to test *Thesis Writing Simulator* instead. This continued until the game had been tested by five testers. The gender balance rule was still followed. The limit for the number of participants was five, because it has been shown that testing on more users qualitatively gives rapidly diminishing returns, and that in a lot of cases five testers are sufficient (Nielsen, 2000).

Because the testing was conducted in the study area of the Delta Centre, it can be assumed that for each tester, they were likely a student at Delta. Therefore, they were likely studying

something related to computer science, economics, business administration, mathematics, statistics, or technology, as these are the fields taught there[25].

7.4 Findings of 1st Testing (T1)

The results of the first testing session helped identify usability issues and shape priorities for further development. Nothing too surprising emerged, but there were still a few things that were not predicted. In this subchapter, the first few paragraphs describe the most prevalent findings of this testing session. Then, the answers to the questionnaire questions are examined. Participants are denoted T1P1 to T1P5, in the order they were tested. An overview of all answers to each of the non-verbal questions can be found in Appendix V. For complete recordings of the testing session, see Appendix IV.

Firstly, the main key takeaway was that the game was completely useless without a goal, i.e., without conditions for winning or losing. The participants unanimously found little reason to keep playing for very long (Figure 56) without anything to achieve, any point to get to. While this was expected, it became apparent that it was much more vital than previously thought, as a player could hardly be expected to learn anything from *Thesis Writing Simulator* if they only played for a few minutes.

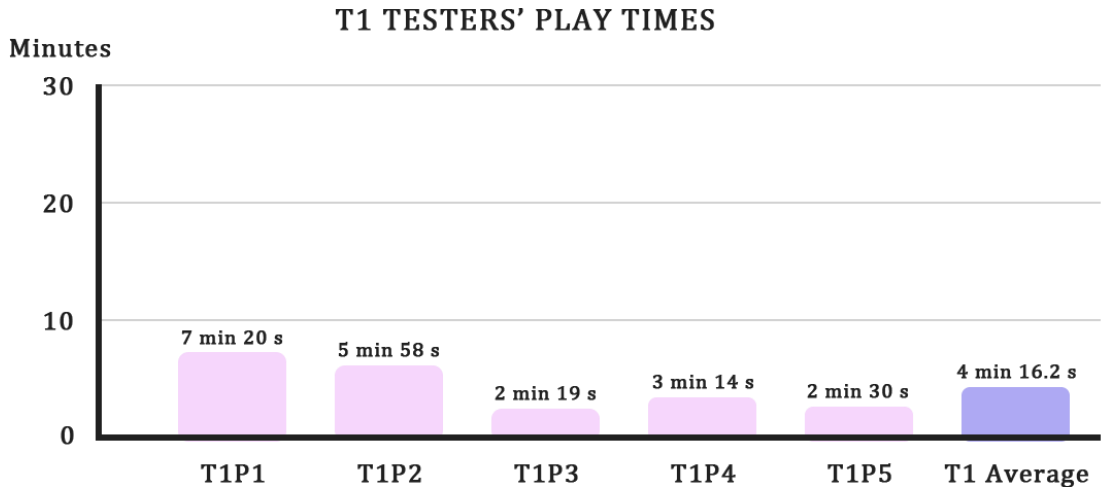

Figure 56. Play times of the T1 testers.

[25] https://delta.ut.ee/en/delta-centre

Second, usability was generally good and players were able to figure out most controls intuitively on their own. T1P3 said that the gameplay felt smooth. Still, there were controls that were difficult to understand and notice. The most prevalent of these was the activity duration slider in the activity start panel. T1P1, T1P3, and T1P5 did not use the slider. T1P4 could not figure out you could press *R* to open the motivation panel, as they never hovered over the bottom left to see the hotkey. T1P5 could not figure out how to move in spite of *WASD* being displayed on top of the character's head at the start of the game. All of this pointed to it being necessary to make the controls more obvious by tutorializing them in some way. This seemed especially important for catering for people with little experience playing video games, as T1P5, who was the only one to report no current habitual gaming at all, struggled the most with controls.

Third, the testers liked the aesthetics of the game. T1P1 found its looks cute. T1P2 said that the graphics were good and gave retro vibes. T1P5 said she liked how the game looked, which was the only positive thing she said about the game during the testing session.

In addition, there were some other, less noticeable findings. For example, the first thing T1P4 tried to do was go to sleep. That did not work as the sleep need was already satisfied at the start. However, the game was unable to communicate clearly enough why the action was blocked. A similar thing happened when T1P1 tried to sleep while hungry. This solidified an existing idea to display more details about the motivation for the currently selected activity.

On a few occasions, testers tried to use logical alternate controls to the ones displayed. For instance, T1P1 and T1P5 tried to use the arrow keys instead of *WASD* to move. T1P2 tried to use the *Enter* key to start an activity instead of clicking on the *Start* button. T1P5 tried to click off the activity start panel to close it instead of pressing *Q* or *Esc*. This prompted a new development goal of adding more alternate controls to the game.

Lastly, T1P4 reported that, while they would not play the game again, during playing they were able to roleplay as a better version of themselves. It showed that it was possible for the game to feel immersive.

7.4.1 Pre-Game

The answers to the pre-game part of the questionnaire provided some background information on the testers. Their age was in the narrow range of 20 to 23 years. Three of them were female, while two were male.

The testers generally reported an average amount of experience with life simulation games (Table 4). However, they claimed to play very little of anything nowadays (Table 5). That could have been a contributing factor to some of the confusion they experienced over the game mechanics.

Table 4. T1 testers' experience with life simulation games.

	T1P1	T1P2	T1P3	T1P4	T1P5
Over 1000 h					
100 to 1000 h					
10 to 100 h					
Less than 10 h					
No experience					

Table 5. T1 testers' frequency of playing video games.

	T1P1	T1P2	T1P3	T1P4	T1P5
Over 2 h / Day					
Up to 2 h / Day					
Up to 1x / Week					
Up to 1x / Month					
Never					

Responses to the questions on health behaviors were generally on the high side, with a moderate amount of variance between the participants. A breakdown of their answers is given on Tables 6 through 11.

Table 6. T1 testers' answers to the question: "When doing an activity, how often do you feel like you want to do it, as opposed to feeling like you have to do it?"

	T1P1	T1P2	T1P3	T1P4	T1P5
Always or nearly always					
Most of the time					
Not very often					
Never or almost never					

Table 7. T1 testers' answers to the question: "When doing an activity, how often do you feel like it is easy to do it (i.e., you feel like you know how to do it)?"

	T1P1	T1P2	T1P3	T1P4	T1P5
Always or nearly always					
Most of the time					
Not very often					
Never or almost never					

Table 8. T1 testers' answers to the question: "How often do you engage in social activities, such as meeting up with friends?"

	T1P1	T1P2	T1P3	T1P4	T1P5
More than twice a week					
Twice a week					
Once a week					
Less than once a week					

Table 9. T1 testers' answers to the question: "How often do you eat healthy food as opposed to unhealthy food?"

	T1P1	T1P2	T1P3	T1P4	T1P5
Always or nearly always					
Most of the time					
Not very often					
Never or almost never					

Table 10. T1 testers' answers to the question: "How much exercise (physical activity that gets your heart rate up) do you get per week?"

	T1P1	T1P2	T1P3	T1P4	T1P5
More than 5 hours					
4 to 5 hours					
3 to 4 hours					
Less than 3 hours					

Table 11. T1 testers' answers to the question: "How much sleep do you usually get per night?"

	T1P1	T1P2	T1P3	T1P4	T1P5
More than 8 hours					
7 to 8 hours					
6 to 7 hours					
Less than 6 hours					

After answering the pre-game questions and playing the game, participants were given a few post-game questions to answer. The next subchapter breaks down their answers.

7.4.2 Post-Game

From the post-game questions, it could be gathered that the game had very little impact on the testers. The game was rated as rather uninspiring. The average score for whether the game was inspiring on a scale of 1 to 4 was 2.2 (Figure 57). Thus, the game carried very little educational value for the testers. Only T1P4 said they got new ideas from the game. As previously mentioned, when playing the game, they tried to roleplay as a better version of themselves. It is perhaps notable that the participant with the lowest health behavior scores, T1P2, was also the one who reported getting the most inspiration from the game. This tendency was predicted beforehand, although because of the small sample size it can not be proven. In fact, it could also simply be explained by the fact that T1P2 also had the most amount of experience with life simulation games.

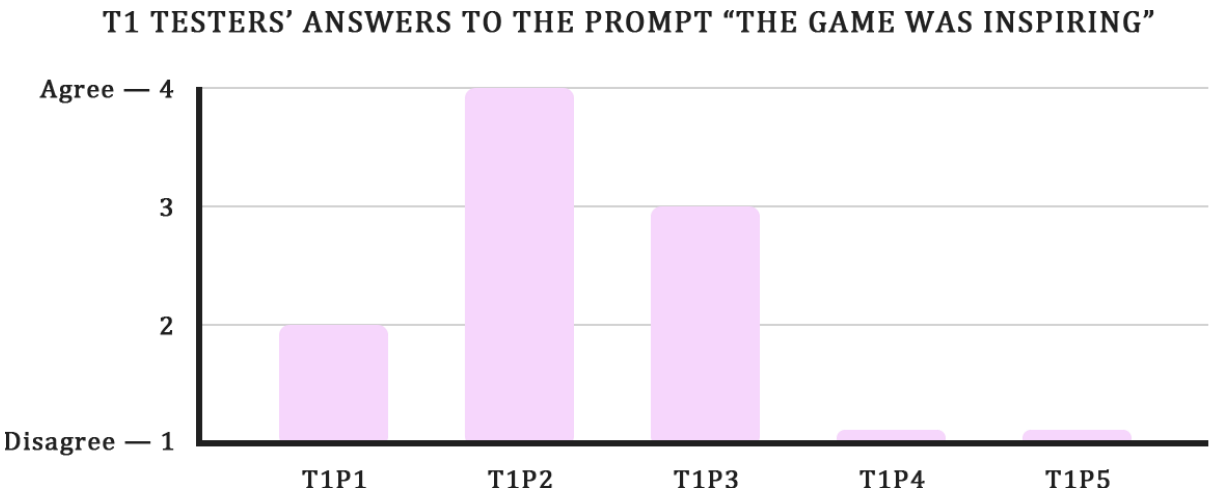

Figure 57. T1 testers' ratings on whether *Thesis Writing Simulator* was inspiring.

The participants were generally very uninterested in playing the game again in their free time. The average score for whether they would do so was 1.8 on a scale of 1 to 4 (Figure 58). An outlier was T1P2, who gave the highest rating.

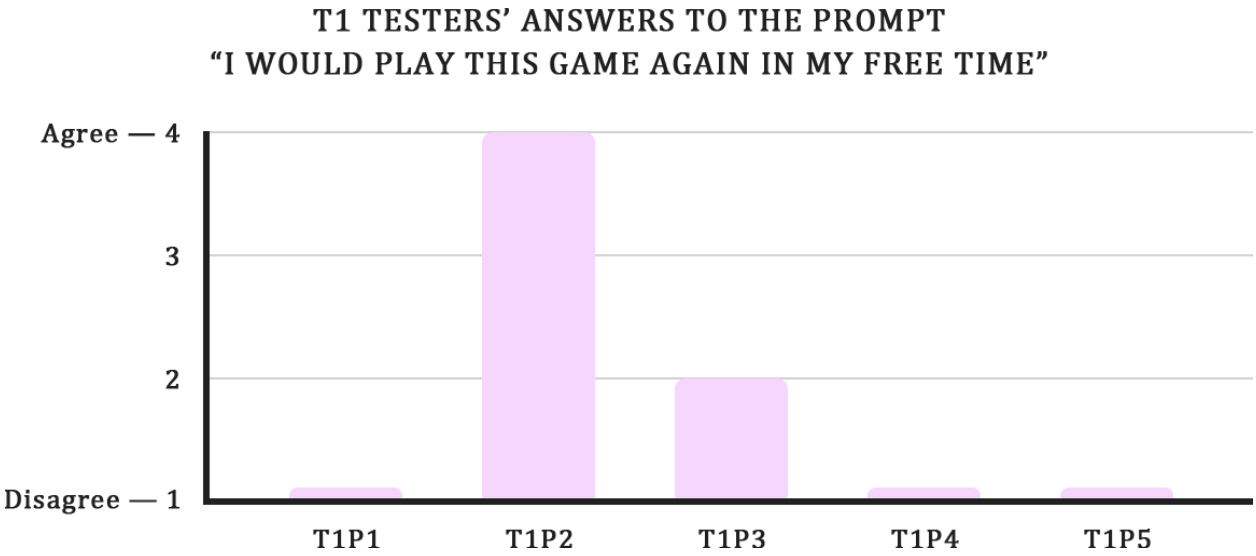

Figure 58. T1 testers' self-rated willingness to play *Thesis Writing Simulator* again in their free time.

Results of T1 showed that *Thesis Writing Simulator* was not yet functional as a fun, nor educational game. After further development, the game was tested again. This was done to see if it had improved.

7.5 Findings of 2nd Testing (T2)

The results of the second testing session provided a way to assess the impact of the changes made to the game between the testing sessions. While the impact was generally positive, new prevalent issues did emerge. This subchapter details the findings of this testing session. First, an overview of the most prevalent findings is given. Then, the answers to the questionnaire questions are looked at. Participants are denoted T2P1 to T2P5, in chronological testing order. An overview of all answers to each of the non-verbal questionnaire questions can be found in Appendix VI. For recordings of this testing session, see Appendix IV.

Firstly, the main issue with the game was that it was too hard. This was due to one particular design decision. According to theory, being physically inactive reduces one's capability to exercise (Biolo et al., 2005). This was reflected in the game. In order to avoid a deadlock, where the player is low on physical activity and is not able to increase that need, motivation for the mildly physical activity of Walk had been increased when low on physical activity. It

was hoped that this would solve the problem. However, none of the participants were able to figure out that they needed to do the Walk activity when low on physical activity.

Everyone but T2P4 did seem to notice that it was the best way to boost their physical activity in that situation. They all got into a state where physical activity was the only low stat and went looking for a way to improve it, choosing to try walking. That did not help them, however, as they felt it unnatural to let the character go walking for a long period of time, or to do that activity repeatedly. They also assumed that doing an activity for a shorter amount of time would require less motivation. That was not the case, although it likely should have been, as T2P1, T2P2, T2P3, and T2P5 all explicitly mentioned that it would have felt more natural. Therefore, they only did the Walk activity for a short period of time and then did not come back to it for a while. That was not enough to boost their physical activity. T2P1 and T2P5, who played for longer than others, were given the hint that they should walk for a longer amount of time. The hint was given at around halfway through the game and helped both to finish the game with the non-negative grade of E. The other three testers gave up trying to boost their physical activity and quit before they could reach the end of the game.

Secondly, and perhaps surprisingly, given the major issue just described, the participants seemed to get quite a lot out of the game. They were willing to play for much longer than participants of the first testing session (Figure 59). T2P1, T2P3, and T2P5 said the game was very realistic, as writing a thesis is difficult for most people. T2P1 said the game was fun.

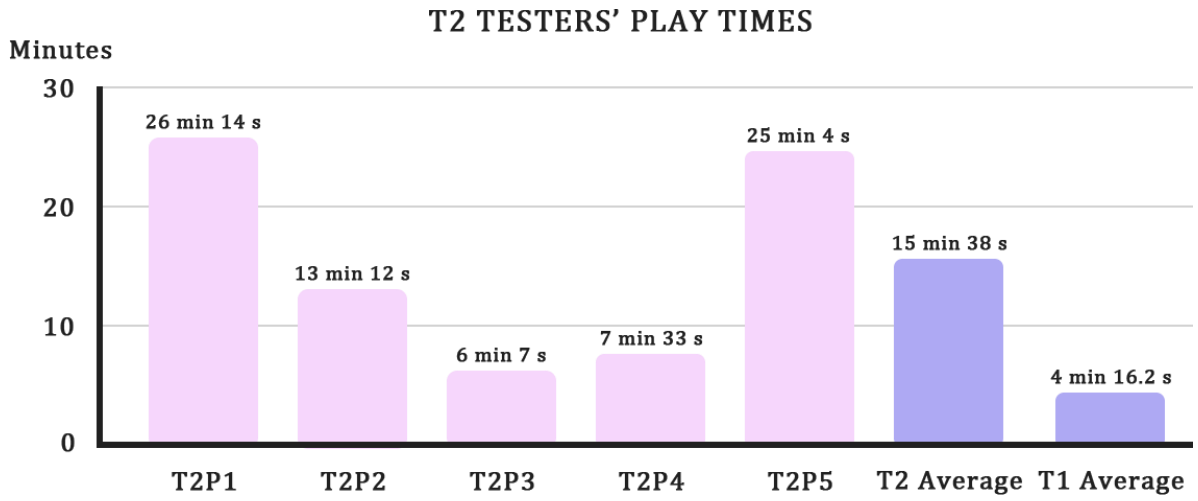

Figure 59. Play times of T2 testers, with the average T1 time for comparison.

Thirdly, usability had improved. T2P1, T2P2, and T2P3 were able to figure out all the controls on their own. T2P5 did not notice that they could change activity duration. T2P4 needed help with moving the character around. This can be explained by the fact that they claimed to have very little experience with games. Despite this, they could figure out most of the controls on their own once they got the hang of movement. While alternative controls were not very popular, T2P3 discovered them immediately and only used the keyboard for the whole duration of play.

Everyone made use of the newly added extra information on activities on the activity select panel to determine what activities to take on. So, that change to the game can be considered a success. However, T2P2 said they would have liked to have had more of a tutorial-like introduction to the game's logic at the start of the game, instead of figuring out how the activities work on their own.

7.5.1 Pre-Game

The answers to the pre-game part of the questionnaire provided some background information on the testers. Their age was mostly in the range of 19 to 23 years, with T2P4 the only one outside of that range at 29 years. Three of the participants were male and two were female.

Just like T1 participants, T2 testers generally reported an average amount of experience with life simulation games (Table 12). They claimed varying frequencies of playing video games (Table 13). This stands out in comparison with T1 data, where testers said they hardly played anything. The higher willingness of T2 testers to play games could have contributed to longer play times and greater satisfaction with the game.

Table 12. T2 testers' experience with life simulation games.

	T2P1	T2P2	T2P3	T2P4	T2P5
Over 1000 h					
100 to 1000 h					
10 to 100 h					
Less than 10 h					
No experience					

Table 13. T2 testers' frequency of playing video games.

	T2P1	T2P2	T2P3	T2P4	T2P5
Over 2 h / Day					
Up to 2 h / Day					
Up to 1x / Week					
Up to 1x / Month					
Never					

The responses to health behavior questions were generally average. There was a lot of variance for some questions such as those pertaining to relatedness (Table 16) and sleep (Table 19). For some others, like those about autonomy (Table 14) and competence (Table 15), there was nearly no variance. A breakdown of all the answers is given on Tables 14 through 19.

Table 14. T2 testers' answers to the question: "When doing an activity, how often do you feel like you want to do it, as opposed to feeling like you have to do it?"

	T2P1	T2P2	T2P3	T2P4	T2P5
Always or nearly always					
Most of the time					
Not very often					
Never or almost never					

Table 15. T2 testers' answers to the question: "When doing an activity, how often do you feel like it is easy to do it (i.e., you feel like you know how to do it)?"

	T2P1	T2P2	T2P3	T2P4	T2P5
Always or nearly always					
Most of the time					
Not very often					
Never or almost never					

Table 16. T2 testers' answers to the question: "How often do you engage in social activities, such as meeting up with friends?"

	T2P1	T2P2	T2P3	T2P4	T2P5
More than twice a week					
Twice a week					
Once a week					
Less than once a week					

Table 17. T2 testers' answers to the question: "How often do you eat healthy food as opposed to unhealthy food?"

	T2P1	T2P2	T2P3	T2P4	T2P5
Always or nearly always					
Most of the time					
Not very often					
Never or almost never					

Table 18. T2 testers' answers to the question: "How much exercise (physical activity that gets your heart rate up) do you get per week?"

	T2P1	T2P2	T2P3	T2P4	T2P5
More than 5 hours					
4 to 5 hours					
3 to 4 hours					
Less than 3 hours					

Table 19. T2 testers' answers to the question: "How much sleep do you usually get per night?"

	T2P1	T2P2	T2P3	T2P4	T2P5
More than 8 hours					
7 to 8 hours					
6 to 7 hours					
Less than 6 hours					

Just like during T1, after answering the pre-game questions and playing the game the participants were given a few post-game questions to answer. The next subchapter details those answers.

7.5.2 Post-Game

T2 testers' answers to the post-game questions were significantly more positive than those of T1 testers had been. The game was rated as inspiring, with the average score of 3.4 on a scale of 1 to 4 (Figure 60), up from the average rating of 2.2 of T1. Three participants, which is two more than during T1, claimed to have gotten new ideas from the game. They were T2P1, T2P2, and T2P4. Although none of them were willing to elaborate on those ideas specifically, they did give statements that could help explain those answers. T2P2 likened the game to a simulation by a company he had worked with. He further stated he tried to figure out how the logic in the game worked. T2P4 said she tried to carry out activities according to a regular daily schedule.

T2P3, T2P4, and T2P5 said that they roleplayed as the character and made decisions based on what they thought was realistic. This could have contributed to the high ratings.

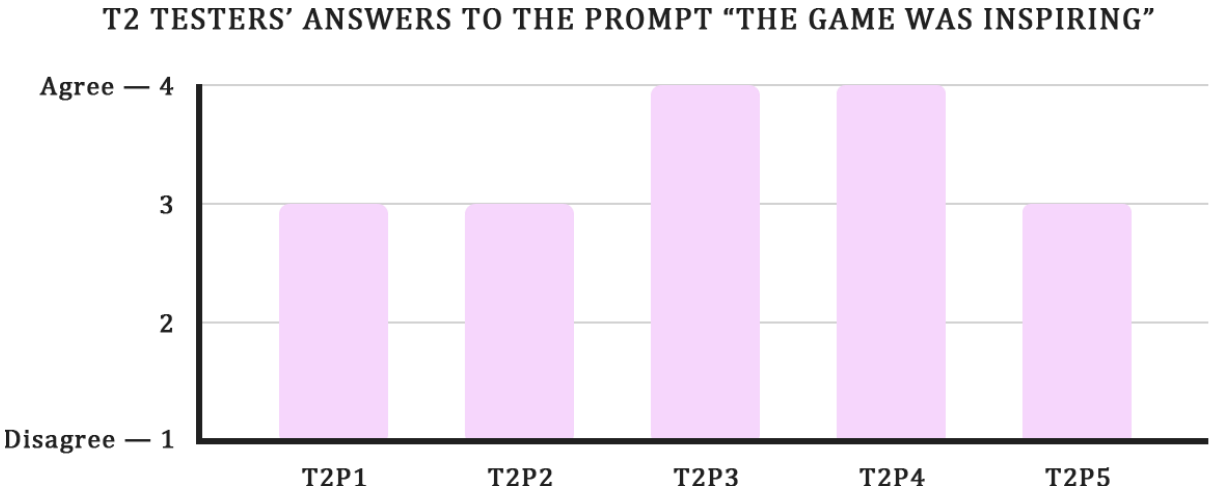

Figure 60. T2 testers' ratings on whether *Thesis Writing Simulator* was inspiring.

The participants claimed to be very interested in playing the game again in their free time. The average score for if they would do so was 3.6 on a scale of 1 to 4 (Figure 61), up significantly from the average rating of 1.8 of T1. T2P5 hypothesized that the game would be more fun on subsequent playthroughs, as the mechanics and logic would already be known. She also asked if the game was available publicly.

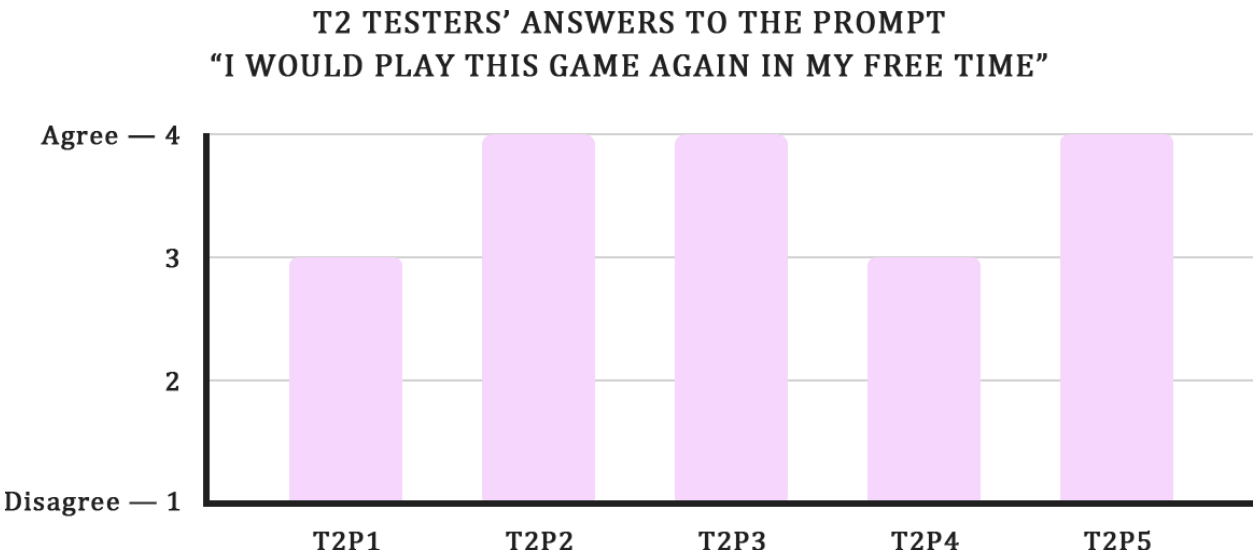

Figure 61. T2 testers' self-rated willingness to play *Thesis Writing Simulator* again in their free time.

The results of T2 showed significant improvement in both the fun factor and the potential educational value of *Thesis Writing Simulator*. Participants were immersed in the game and inspired by it. However, there were still some issues. Clearing them up would likely make the playing experience even better. That, however, is beyond the scope of this thesis.

8. Conclusion

This thesis was about developing a life simulation game called *Thesis Writing Simulator*. The game aimed to be both fun and educational. The logic of the game was based on theory, including Self-Determination Theory, and empirical evidence from various sources.

The concept of human needs was explored. As a result, six needs were chosen to be used in the game: *autonomy*, *competence*, *relatedness*, *nutrition*, *physical activity*, and *sleep*. To boost the effectiveness of *Thesis Writing Simulator* as a learning game, more general research was also examined. That research was about behavior change theories and game-based learning.

Similar games such as *The Sims* were given some thought and compared to *Thesis Writing Simulator*. This was done to show how the latter differs from already existing products.

The Godot game engine was used to develop the game. It was chosen as a popular, but lightweight tool, as these qualities were deemed relevant for making a simple game like *Thesis Writing Simulator*.

The game was designed to have *challenge*, *feedback*, and a *scoring system*, as mandated by theory. The design decisions reflected the examined theory, while making sure *Thesis Writing Simulator* remained viable as a gaming experience.

In the implementation of the game, the modular approach was used. The observer programming pattern and the custom resources of Godot were also made use of.

The game was tested twice. Feedback for the game showed significant improvement in the viability of *Thesis Writing Simulator* as a fun and educational experience between the two testing sessions.

Still, some new issues were uncovered in the second testing session. It shows that there is potential for further improvement, given additional development time.

I would like to thank my supervisor, Mark Muhhin, for valuable feedback that helped direct development of *Thesis Writing Simulator*.

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Appendices

I — Game Design Document

This document was created before the start of development in order to get an overview of what the finished product could look like. It does not describe the actual game.

Game Overview

Thesis Writing Simulator is a simulation game about young adults for young adults (around 18–25 yo people). It aims to realistically simulate the day-to-day struggles and happenings, highs and lows of the young adult life. Specifically it focuses on the health aspect as that is something that often gets overlooked by young adults themselves, especially when it comes to feeling good or understanding why things aren't going as great as they could be.

Gameplay Mechanics

The player has a character they control in a 2D environment, viewed from a diagonal-looking ¾ perspective. They can move on a plane and interact with the environment around them.

The core gameplay consists of deciding what activities to take on. For that the player needs to move to the appropriate spot and then press the appropriate key to start the activity.

There is a catch, however. Depending on the mood and general status of the controlled character, the action requested by the player might be difficult or impossible to realistically carry out.

To simulate it, randomness and/or little minigames can be used. In case of minigames, if the player manages to win, they get to make their character do the chosen action. The minigames are the more difficult, the more unfeasible it is for the character to be able to carry out the action. Factors that go into deciding how difficult it is to start an action include fatigue, recent social interactions, motivation, hunger, whether the character has been sufficiently physically active etc.

Story and Setting

The game has three playable characters, each with their own narratives and traits. The game follows them over a period of three school years each, 2021–2024.

They live in the small university town of Dorpat. Some of the locations seen in each character's story are shared.

Characters

The player gets to name their character, although they each have a default name. Then they choose between sets of traits and attributes, each of which is bundled with their own story:

1) Carmine
    - female
    - parents didn't know it's a male name
    - starts at 22 yo
    - just started CS studies with a minor in business
    - lives alone in a dorm room
    - no real friends around
    - difficult childhood, aggressive-demanding family
    - moderately gifted, good memory
    - often depressed, emotionally unstable
    - does not trust people easily
    - swears a lot
    - good looks

2) Hector

- male
- starts at 20 yo
- works at a construction company
- lives with family in a private house
- fearful
- self-unaware
- has ADHD
- doesn't think about looks and doesn't look too good

3) Madonna

- female
- starts at 19 yo
- studies hairdressing at a vocational school
- lives with family in a small apt
- low ambitions
- average childhood, average family
- not very smart
- average looks
- used to partying every weekend

Art and Audio

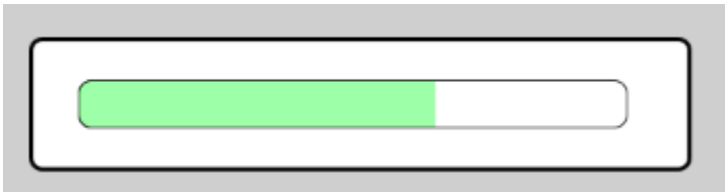
The music is non-intrusive and supportive of what's going on as in Paper Lily. The style of music and SFX is also in general similar to Paper Lily.

Visually it's 16-bit pixel art. Low-cost assets from LimeZu are used for both the world and the characters. For closeups of characters some other paid artist is commissioned.

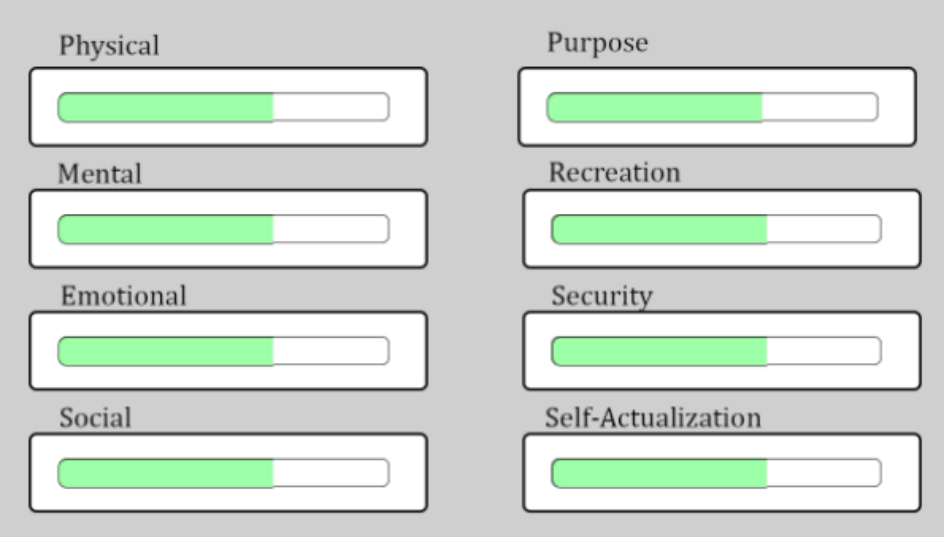
User Interface

The font used is Cambria:

During the game there is just one bar in the bottom left, something like this:



This is your overall happiness. You can hover over it to see how it's broken down. The subbars will appear above the main bar, something like this:



The player can further hover over the subbars to see what exactly is affecting the need at that moment.

Nothing else is part of the main UI, to avoid cluttering. That's aside from any screen-wide distortion effects that stem from feelings.

There's an overlay where the player can access all of the game options and see current status and stats in more detail. They can access it by pressing a specified button. The overlay includes a partially transparent background through which the game is visible and some panels on top of it. Initially there is just one panel in the top left, something like this:

Hovering over any of the options will reveal more details (when applicable) in another panel to the immediate right.

Other UI elements include notifications that pop up. They represent all sorts of thoughts and whims the character experiences. Often they require player input (or inaction).

Technology

Godot 4

Development Roadmap

This is mostly outlined in the GT tasks.

There is an initial work phase Jan 29 – Feb 3 during which the MVP is made, first testing is conducted and anything else there is time for (expected work around 30 hours).

After that, the second practical work phase is around Feb 21 – Mar 6 (here, not all the time is spent on development, expected work around 30 hours).

The final shift happens Mar 14 – Apr 20 (expected work around 70 hours).

Budget and Resources

Whatever it takes is paid, up to €1000. World and character sprites are bought from LimeZu for around €10. Possible other expenses include closeups of characters and audio (if there is no time to create it on my own)

Testing and Feedback

There are multiple tests conducted.

Test 1 happens right after completion of the MVP, during the first “Practical Work X/Y Done” task.

Test 2 happens during the “Practical Work Tested” task.

Test 3 happens during the “Practical Work Done” task.

Post-Launch Plans

Most likely there will not be any updates to the game after submission of the thesis as I need to continue my studies.

II — Use of AI

ChatGPT 4 was widely used to aid in writing this thesis up to February 23, 2024 (exclusive). None of those conversations were documented as the requirement for doing so that was in place at the time was not known before the given date. However, in general, the prompts given to AI can be divided into the following categories, which each express a type prompt:

- How to find motivation for writing the thesis
- What to title the thesis
- How to structure the thesis
- What to work on next regarding the thesis
- How to make a Game Design Document
- What [formatting or style option] could I use to write the thesis
- How to use Google Docs for writing the thesis
- How to use Zotero for writing the thesis
- What are some good academic sources for [description of chapter or paragraph]
- How to cite this in APA style: [citation]
- What is [description of a game element] called
- What [technology type] would make sense to use for writing the thesis
- What are some games similar to *Thesis Writing Simulator*
- How to find games similar to *Thesis Writing Simulator*
- How to use Godot for making *Thesis Writing Simulator*
- How to use Git for managing the repo of *Thesis Writing Simulator*

- How to test *Thesis Writing Simulator*

No AI was prompted in connection with the thesis from February 24, 2024 to April 20, 2024 (both inclusive). After this, it was used sparingly, since the requirement to document all AI usage in detail was largely lifted on April 2, 2024. It was not used for anything that required any mention in the thesis.

III — Testing Questionnaire

This is a replica of the testing questionnaire that was used to test *Thesis Writing Simulator*.

Page 1

Thesis Writing Simulator Testing Questionnaire

This questionnaire is for testers of *Thesis Writing Simulator,* a game developed by Mihkel Roomet as a bachelor's thesis at the University of Tartu (UT) in spring 23/24.

All testing data will remain fully anonymous. However, please be aware that the computer screen is being recorded along with audio from the built-in microphone. The recordings will be bundled with the thesis on submission and will therefore be publicly available through the UT DSpace digital archives.

Age

_____ (text box; validation: number between 18 and 122)

Gender

☐ Female

☐ Male

☐ Non-binary

☐ Prefer not to say

How much experience do you have with life simulation games, such as The Sims?

☐ No experience (never played any such games)

☐ Very little (less than 10h)

☐ A little (between 10h and 100h)

☐ A good amount (between 100h and 1000h)

☐ A lot (more than 1000h)

How often do you play video games (including casual and mobile games)?

☐ Never

☐ Once a month at most

☐ Once a week at most

☐ 2h a day at most

☐ More than 2h a day

How much sleep do you usually get per night?

☐ Less than 6 hours

☐ 6 to 7 hours

☐ 7 to 8 hours

☐ More than 8 hours

How much exercise (physical activity that gets your heart rate up) do you get per week?

☐ Less than 3 hours

☐ 3 to 4 hours

☐ 4 to 5 hours

☐ More than 5 hours

How often do you eat healthy food as opposed to unhealthy food?

☐ Never or almost never

☐ Not very often

☐ Most of the time

☐ Always or nearly always

How often do you engage in social activities, such as meeting up with friends?

☐ Less than once a week

☐ Once a week

☐ Twice a week

☐ More than twice a week

When doing an activity, how often do you feel like you want to do it, as opposed to feeling like you have to do it?

☐ Never or almost never

☐ Not very often

☐ Most of the time

☐ Always or nearly always

When doing an activity, how often do you feel like it is easy to do it (i.e., you feel like you know how to do it)?

☐ Never or almost never

☐ Not very often

☐ Most of the time

☐ Always or nearly always

Page 2

Now you can play the game

You can play for as long as you like. Feel free to vocalize your thoughts while playing. When you are done playing, come back here and click 'Next'.

Link to the game

Page 3

Post-game questions

Please answer the following questions as truthfully as possible. Positive but untrue answers do not help me in any way.

The game was inspiring

☐ 1 — Disagree

☐ 2

☐ 3

☐ 4 — Agree

I would play this game again in my free time

☐ 1 — Disagree

☐ 2

☐ 3

☐ 4 — Agree

While playing the game, did you get any new ideas?

☐ No

☐ Yes

Page 4

If you did get any new ideas, please describe them out loud, in as much detail as you dare.

Page 5

Finally, if you would like to say anything else about the game, please say that out loud as well.

Page 6

All done! Thank you very much! 😊

IV — Accompanying Files

This appendix details the contents of the accompanying zip file. These are as follows:

- ThesisWritingSimulator_v1.0.exe is a file that can be run to play *Thesis Writing Simulator*
- Gameplay.mp4 is a video of sample gameplay of *Thesis Writing Simulator*
- /"Testing Recordings" contains recordings of the two testing sessions

V — Answers to Non-Verbal Questions of 1st Testing (T1)

Here are all the answers to the non-verbal questionnaire questions of each of the first testing session participants.

	T1P1	**T1P2**	**T1P3**	**T1P4**	**T1P5**
Age	20	20	23	20	21
Gender	Female	Female	Male	Male	Female
How much experience do you have with life simulation games, such as The Sims?	Very little (less than 10h)	A good amount (between 100h and 1000h)	Very little (less than 10h)	A little (between 10h and 100h)	A little (between 10h and 100h)
How often do you play video games (including casual and mobile games)?	Once a month at most	Once a month at most	Once a month at most	Once a month at most	Never
How much sleep do you usually get per night?	7 to 8 hours	6 to 7 hours	7 to 8 hours	More than 8 hours	More than 8 hours
How much exercise (physical activity that gets your heart rate up) do you get per week?	3 to 4 hours	Less than 3 hours	More than 5 hours	More than 5 hours	More than 5 hours
How often do you eat healthy food as opposed to unhealthy food?	Always or nearly always	Always or nearly always	Most of the time	Most of the time	Most of the time
How often do you engage in social activities, such as meeting up with friends?	Twice a week	More than twice a week	Twice a week	More than twice a week	More than twice a week

	T1P1	T1P2	T1P3	T1P4	T1P5
When doing an activity, how often do you feel like you want to do it, as opposed to feeling like you have to do it?	Most of the time	Most of the time	Not very often	Most of the time	Most of the time
When doing an activity, how often do you feel like it is easy to do it (i.e., you feel like you know how to do it)?	Most of the time	Not very often	Most of the time	Always or nearly always	Most of the time
The game was inspiring (scale of 1 to 4)	2	4	3	1	1
I would play this game again in my free time (scale of 1 to 4)	1	4	2	1	1
While playing the game, did you get any new ideas?	No	No	No	Yes	No

VI — Answers to Non-Verbal Questions of 2nd Testing (T2)

Here are all the answers to the non-verbal questionnaire questions of each of the second testing session participants.

	T2P1	**T2P2**	**T2P3**	**T2P4**	**T2P5**
Age	23	23	21	29	19
Gender	Male	Male	Male	Female	Female
How much experience do you have with life simulation games, such as The Sims?	Very little (less than 10h)	A little (between 10h and 100h)	A little (between 10h and 100h)	A little (between 10h and 100h)	A little (between 10h and 100h)
How often do you play video games (including casual and mobile games)?	2h a day at most	Once a month at most	2h a day at most	Never	Once a week at most
How much sleep do you usually get per night?	More than 8 hours	7 to 8 hours	6 to 7 hours	More than 8 hours	7 to 8 hours
How much exercise (physical activity that gets your heart rate up) do you get per week?	4 to 5 hours	3 to 4 hours	4 to 5 hours	Less than 3 hours	4 to 5 hours
How often do you eat healthy food as opposed to unhealthy food?	Most of the time	Most of the time	Most of the time	Most of the time	Most of the time
How often do you engage in social activities, such as meeting up with friends?	Less than once a week	More than twice a week	Twice a week	Less than once a week	Once a week

	T2P1	T2P2	T2P3	T2P4	T2P5
When doing an activity, how often do you feel like you want to do it, as opposed to feeling like you have to do it?	Most of the time	Most of the time	Most of the time	Not very often	Most of the time
When doing an activity, how often do you feel like it is easy to do it (i.e., you feel like you know how to do it)?	Not very often	Most of the time	Not very often	Not very often	Not very often
The game was inspiring (scale of 1 to 4)	3	3	4	4	3
I would play this game again in my free time (scale of 1 to 4)	3	4	4	3	4
While playing the game, did you get any new ideas?	Yes	Yes	No	Yes	No

VII — Glossary

This appendix explains some of the technical terms mentioned in this thesis. They are listed here in alphabetical order.

Core gameplay loop — the most prominent and frequent repeatable sequence of actions and events in a game (Brazie, 2023).

Modular approach — a design theory that states that a system should be divided into small, independent, reusable pieces (*3 Pillars in Game Engineering*, 2020). Ideally, every component of the system should solve only a single problem. This makes it easier to make changes to the system and to make sense of it.

User interface — a section of a program, e.g., a game, that allows for human-computer interaction (Hassen et al., 2021).

VIII — Repository

The repository of *Thesis Writing Simulator* along with all development files and a link to play the game can be found here.

IX — License

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