GAMIFICATION IN EDUCATION

Testing the Effects of Implementing Gamification to Flashcards

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Synopsis:

This work serves to prove the effects of gamification in an educational exercise. Through extensive theoretical analysis gamification is defined and a fitting approach is discussed. A case-specific approach with flashcards (learning Dutch words) is used to test these effects. Two versions of a flashcard exercise are implemented and tested — one without gamification and one with gamification. Users test both versions and their performance is measured after each play through via a test that will show how many words they have learned to spell. A questionnaire is filled out and the two different versions are evaluated in terms of the enjoyment and motivation of the users. The tests show that although the test participants do not seem to learn more from the gamified version, they enjoy themselves more and are more likely to play it again — thus an increase in motivation and therefore user retention can be infered.

Supervisor:
Martin Kraus

Preface

This report is composed as a result of a 10th semester Medialogy project by group 1030 at Aalborg University during spring of 2013. This project is a master's thesis.

Reader's Guide

This report works as a study in effects of implementing gamification in an educational context.

References

Square brackets containing a number are used when referencing the sources in this report. If the reference bracket is placed before a full stop, only the phrase itself is based on the source from the reference. If the bracket is placed after a full stop, the paragraph preceding is based on the source. All referenced sources will be placed in alphabetical order by the author's surname in the chapter "References".

DVD

The appendix DVD contains the following folders:

- **Documentation:** This report and an A/V production
- **Data for analysis:** The data used for analysis, including the quiz tests and the questionnaire from the test.
- **The game:** Both the Unity work files and the executable game

Acknowledgments

Thanks to Martin Kraus for supervising the project and thanks to all the test participants. Also, thanks to Stine for supporting me and enduring those long discussions about gamification.

Contents

Summary

Dette projekt omhandler gamification i en undervisningsmæssig kontekst. Med dette menes, at den analytiske tilgang er fokuseret på gamification (og lignende begreber) og på, hvordan dette implementeres med det formål at lære. Gamification forbindes oftest med marketing og websider, hvor det bruges til at skabe højere brugerfastholdelse. Det bliver gennemgået, hvordan gamification relaterer sig i forhold til leg og spil ligeså vel som andre lignende begreber som eksempelvis serious gaming og edutainment. Det diskuteres, hvorledes forskellen består — set ud fra brugernes og ud fra designernes synspunkt. Det konkluderes i analysen, at der ud fra designerens synspunkt, hvor fokus ligger, ikke er nævneværdig forskel på at designe spil og gamification, og at tilgangen/metoden må være den samme i begge tilfælde. Gamification går ud på at bruge spilelementer (oftest spilmekanikker) i en ikke-spillemæssig kontekst både såsom tidligere nævnte websider eller i andre sammenhænge, hvor brugere på den ene eller anden måde skal udføre opgaver eller lignende, hvor de mangler en indre motivation for at gøre det — altså at selve aktiviteten i sig selv ikke er underholdende nok til, brugerne gider at beskæftige sig nok med det. Det analyseres, hvordan gamification kan have et potentiale i forbindelse med læring i forhold til at øge motivationen og underholdningsværdien ved at deltage i læringen. Der udvikles et produkt på baggrund af gamification-teori applikeret på flashcards. Da dette er blevet redesignet ved hjælp af spilelementer, implementeres det først ved hjælp af Unity Engine og testes derefter på en målgruppe bestående af unge mennesker mellem 20 og 30 år. Selve de to versioner består af 25 spørgsmål i form af flashcards, som præsenteres på forskellige måder. Målet med begge implementationer er, at brugerne skal kunne lære 25 hollandske ord. Brugerne gennemgår både en gamificeret udgave af flashcards og en normal, digitaliseret udgave (med inspiration fra websider såsom www.quizlet.com) i skiftende rækkefølge. Den skiftende rækkefølge gør, at den ene halvdel af testpersonerne først gennemgår en gamificeret udgave med spørgsmål fra sæt A og derefter en ikke-gamificeret udgave med spørgsmål fra sæt B. Den anden halvdel gennemgår først en ikke-gamificeret udgave med sæt A og dernæst en gamificeret udgave med sæt B. Resultatet af testen viser at selvom brugerne foretrækker den gamificerede udgave, så præsterer de i en efterfølgende test, hvor de bliver stillet overfor 25 engelske ord, som de vi ved hjælp af fire svarmuligheder skal finde det korrekte tilsvarende hollandske ord til, bedre når de har spillet den normale flashcard-øvelse fremfor den gamificerede øvelse. Dette kan tyde på, at selvom de implementerede elementer gør opgaven sjovere, så virker de (eller nogle af dem) måske forstyrrende på det læringsmæssige — selv forskellen mellem de to udgaver ikke var udpræget stor. Som nævnt viser svarene på spørgeskemaet (med fokus på intrinsic motivation),

at testpersonerne (med 95% sandsynlighed) foretrækker den gamificerede udgave fremfor den ikke-gamificerede udgave. Til sidst diskuteres det, hvordan produktet og testen kan forbedres set i lyset af resultaterne og i forhold til fremtidig videreudvikling af produktet og teori i forhold til gamificering i undervisningsmæssige sammenhænge.

GAME
SCORE
10,000

Level One

In this part, a theoretical framework is established including central litterature within the field of games, play and gamification. The research question is presented as well as the specific focus of this project.

Chapter 1

Introduction

This report is written as a part of a tenth semester master's thesis on applying gamification in an educational setting. The potential for gamification is considered to be very large [11]. When reading material written by, for example, Jane McGonigal [26] and Jesse Schell [38] it becomes clear that games (or at least game elements) can have a huge effect on motivation. One of the reasons why gamification seems to have such a large potential compared to its predecessors (edutainment and serious games) is that this concept, although only recently defined, has been used for many years. Game elements are used in many contexts — setting goals for weight loss and watching one's progress is an example of this as opposed to just trying to lose weight without having any goal or clear track of record. The difference between the two is that the former encourages the user and provides motivation while the latter lacks these features — it lacks the organisation and structure provided by the game elements.

In mainstream box office video games, the inclusion of story and narrative is very common these years, and the tendency is that it is only becoming more common. There are different opinions on the matter of which affordances each medium offers, but what is sure is that each medium affords something unique compared to other media [9]. Contrary to popular belief, some are of the opinion that story and narrative are not the driving forces of games, but rather an invention for commercial and monetary gain (as stories in the context of marketing and shorter games are not never-ending, like Tetris, the player is left with a need to purchase more games) [19]. Instead, the greatest force is assumed to be the game mechanics [44]. The game mechanics is what differentiates video games from other popular media platforms. Game mechanics are the ways the user interacts with a game — what happens when the player performs certain actions and which actions the player has to perform to succeed. Based on the assumption that game mechanics are the prevalent factor of games, this project will take this factor and implement it in educational material in accordance with the gamification definition.

Lastly, this project is implemented digitally (as opposed to tangibly/physically) in accordance with the study guidelines of Medialogy for which it is made. It is interesting to do more research in the field of gamification and to try and define what the terminology means. In recent years, many companies have applied elements stemming from game design into their products. In many cases, however, their reasoning seems lackluster and rushed, and therefore, a deeper understanding of what gamification is seems essential in order to create proper applications thereof. This also means that the project is based on a precise framework for gamification and furthermore an application is implemented and tested in order to verify whether or not this framework/understanding and the application thereof is beneficial to a product. Specifically, gamification is

applied to the field of education and, therefore, tested in an educational setting.

Chapter 2

Introduction to Gamification

Jane McGonigal illustrates the benefit of gamification with a story [27]. The story was first told by Herodotus and is about a king of an ancient population called the Lydians. His kingdom was struck by famine for 18 long years, and he had to do something to motivate the citizens. Because of this, he introduced dice games to the population which turned out to be a very good idea. The gameplay would engage the population in a new activity which was much less resource demanding than their usual activities and furthermore, the immersion of the games would prove to lower the amount of food taken in. Scientific proof and research has later supported the story told by Herodotus and even the final claim that after the 18 years of games, the population decided to have a final large game that would decide which half of the population would have to migrate and which would have to stay — for the benefit of the greater good. In fact, the research showed that the half leaving Lydia ended up settling in Italy, developed into the Etruscan civilization which ended up being the single most important influence on Roman culture and thereby the entire western civilisation as known today.

What this story showcases are two very prevalent features of games. First of all, it is the ability to engross, engage and immerse players. The second ability is the ability to motivate and entertain. Games can make tedious tasks worth the wait or effort. For example, in the story, they would work one day in order to be able to spend the next playing games, thus enforcing an incentive to perform the hard tasks in order to enjoy the benefit of playing games. In fact, this grand plan in itself is gamification — having the population work in order to achieve something pleasurable. The latter of the two features is a very desireable one from a societal perspective whereas the former can give rise to problems. Being immersed is, in itself, not problematic but as the story showed, the population became very comfortable with their situation and waited 18 years before they decided to do something about it — besides making the waiting time more pleasurable.

Flash forward more than 3,000 years, and games have become an integrated part of our daily lives and the trend is that gaming is becoming more and more frequent. Below, a few of the statistics [10] regarding the use of video games are mentioned:

- Video games are played in 65% of American households.
- Half of gamers are between 18 and 49 years of age. One quarter is younger, and the last quarter is older. The average age of a gamer is 35.
- 40% of gamers are women.
- The average gamer spends 18 hours a week on gaming.

- The average gamer has been playing games for 13 years.
- The average age of the most frequent game purchaser is 40.
- 63% of parents believe video games to be a positive addition to their children's lives.

At the same time, the famous MMORPG game *World of Warcraft* still has 9.6 million active subscribers worldwide [1], half a billion of the world's population play video games more than one hour a day and overall, a total of three billion hours a week are spent playing video games for the whole world [29].

These statistics show that the old-fashioned view of the video game player as a 14-year-old adolescent is outdated. In fact, women aged 18 or older represent a significantly larger portion of gamers than males aged 17 or younger. Playing video games has become a regular activity. This signals that the broad population has accepted games and furthermore, this implies that video games must have something that appeals to most of us. In Chapters 3 & 4, the appeal of video games will be discussed further to gain an understanding of how and why video games are entertaining.

Gamification is, in its essence, the inclusion of game elements such as game mechanics into every day chores in such contexts as work or education. The benefits of this inclusion is that the users become more engaged and more efficient at problem solving. Also, this inclusion can have a huge motivational effect. [44] & [6]

Although gamification existed before, the term itself was not invented until 2002 by Nick Pelling. In 2010, the term became popularised and entered the mainstream hall of fame for popular buzz words succeeding edutainment and serious games as the new aspirant for the inclusion of games in more serious contexts. Gamification elements have been used and implemented for a long time before even the term was invented back in 2002. As an example, American Airlines has implemented such a system by allowing earned frequent flyer miles to grant bonuses and benefits as well as creating social status.

The word gamification refers to the act of making a game out of something. This is in many aspects of every day life such as when the parents of a small child simulate an "airplane" when trying to feed the child something which he or she might dislike. The reason why gamifying a task, an experience or a product works is, essentially, that games are fun [45]. This will be described in more detail in Chapter 4. The term also refers to applying game elements to a specific chore, in order to make a game out of it. This can very easily be confused with edutainment. The difference between gamification of education and edutainment is that the latter can be a complete game experience (as well as anything else both entertaining and educating such as documentary films), whereas the former only contains specific game elements applied within some existing framework and more importantly is not focused on education, but rather on fun and motivation. Therefore, the gamification of education does not have to, for example, be a video game — it can be the same education as usual only added the element of, for example, a leaderboard or achievements.

A reason why game elements can be used for learning purposes is described in Katie Salen and Eric Zimmerman's book Rules of Play [33]. Whether you look at games as a part of play or at play as a part of games, the difference between the two is the same. In this report, games are defined as structured play to which rules, boundaries and goals have been applied. In accordance with Hans Mogel [**?**], games are perceived as the highest form of play. Play can be observed many times in children and even in young animals. Young cats or dogs play in order to train their skills at, for example, hunting or to train social skills. Playing teaches these youngsters how to behave and increases their cognitive capabilities. Play is the incentive to do something that will be beneficial in the long run (as well as short term). Games are the structuring of play as rules are applied. However, the rules are carefully selected for the purpose of maximising the amount of fun an individual will gain from partaking in this structured play activity.

In this work, various game elements are implemented and tested. The purpose of the experiment is to validate if there is an advantage concerning the use of game elements in everyday tasks. The focus of the project is on the effects of gamification for educational purposes and therefore, the experiment is centered around this. A simple educational exercise is compared to a gamified version which has been added different game elements. The effects of gamifying the exercise is measured and statistically validated.

In order to implement various game elements, it is relevant to first define what gamification really is and how gamification is different from game design as some confusion on the subject has been observed. Based on this, the following two chapters discuss play, games and gamification.

Chapter 3

Play and Games

This work is focused on gamification, but before moving ahead the concepts of play and games are useful to discuss in order to gain a broader understanding of the relevant concepts within the field of games.

This chapter, as well as Chapter 4 serves to provide a theoretical understanding and basis that will enable the author of this project to implement and test hypotheses in connection to the subject of gamification. Firstly, it is important to realise the difference between such concepts as play, games and gamification in order to have an understanding of what gamification is and, equally as important, what gamification is not.

In order to gain an overview of gamification, it is important to have the necessary knowledge of the mechanisms and designs which are integrated in games in order for them to be successful. Games are, essentially, derived as part of play. This means that games are facilitated by play through an application of such features as rules, borders and goals (optionally also narrative or story). When a game is set up properly, it will allow for meaningful play to occur. Meaningful play, according to Salen and Zimmerman, can be defined in two separate, but related, ways. The first is the descriptive understanding:

> "*Meaningful play in a game emerges from the relationship between player action and system outcome; it is the proces by which a player takes action within the designed system of a game and the system responding to that action. The meaning of an action in a game resides in the relationship between action and outcome.*" [34]

This first definition describes **what** happens in all games, but does not tell us **when** meaningful play occurs. For this purpose, the authors use a second definition — an evaluative one:

> "*Meaningful play occurs when the relationship between actions and outcomes in a game is both discernable and integrated into a larger context of the game. Creating meaningful play is the goal of successful game design.*" [35]

This second definition describes the goal of successful game design — meaning what is needed for the player to emotionally and psychologically find meaning in the game design. In other words, the game has to be believable. In some ways, this is closely related to suspension of disbelief — the implicit contract to which a viewer engages when, for example, watching a film

or playing a game. The players have to accept the outcome of their actions within the universe of the game. Salen and Zimmerman describe this as discernable and integrated outcomes [36]. This means that the player must be able to understand the results of performed game actions (discernable) and that this is also integrated into a larger context of the game, such that there are not only immediate outcomes (for example that pressing a certain button makes the avatar hit an opponent), but also that, for example, choosing a certain ability/skill in an MMORPG has significance later in the game. This brings tactics and strategy into the game experience.

There are many different views on the relationship between play and games, but the three being used to define games in this project have been put forward by Johann Huizinga, Hans Mogel [12] and Salen & Zimmerman [37]. The theory by Hans Mogel is concerned about the relation between games and play. He states that play exists in six different forms; each more advanced than the previous. The most advanced form of play is Regelspiel (rule-based play). This is, essentially, games and is a kind of play that facilitates meaningful play (along with, for example, constructive play). This is the most advanced form of play and includes all the lower level forms of play with added rules and goals. The definition by Salen and Zimmerman describes only what a game is and is not concerned with the relation to play. This gives a much more precise definition of what a game consists of:

> "*A game is a system in which players engage in an artificial conflict, defined by rules, that results in a quantifiable outcome*" [37]

Having clarified the relation between play and games, it is important to know what makes both fun. The same principles for this can be applied to both play and games considering that games are just the highest level of play — through the appliance of rules and goals. The reason for applying rules and goals are not only to facilitate meaningful play, as mentioned earlier, but also to make it possible to play with others. The rules and goals enable participants to engage in a playful activity that resembles a competition in the sense that it becomes possible to determine winners and losers by quantifiable outcomes. Therefore, games are a structured way of play — a way to make sure everyone is on the same page concerning the play activity. It is important to remember that video games are only a relatively new addition/evolution of games, hence the rules are applied for multiplayer purposes as most games prior to video games would need more than one participant. The definitions provided by Mogel as well as Salen & Zimmerman applies to both digital as well as analogue games.

Having a definition of **what** games and play is as well as an understanding of meaningful play, the next question is **why** it works — why play activity (which according to the earlier mentioned definition includes games) is even relevant. To answer this question, the following quote from Johann Huizinga is useful.

> "*We have only to watch young dogs to see that all the essentials of human play are present in their merry gambols. (...) They pretend to get terribly angry. And — what is most important — in all these doings they plainly experience tremendous*

> *fun and enjoyment. (...) Here we have at once a very important point: even in its simplest forms on the animal level, play is more than a mere physiological phenomenon or a psychological reflex. It goes beyond the confines of purely physical or purely biological activity. It is a significant function — that is to say, there is some sense to it. In play there is something "at play" which transcends the immediate needs of life and imparts meaning to the action. All play means something.*" [14]

This quotation serves as a way to explain how play is not something we (humans) have made up but is something fundamental for all higher life forms. Furthermore, Huizinga touches upon the question of the importance of all play which he states "means something". Therefore, play must be assumed to have a practical purpose beyond that of entertaining. He also mentions pretend play which fits with Mogel's view that pretend play (roleplay) is an important form of play. This factor is also important in order to facilitate the beneficial overall purpose of play — that transcends entertainment — the purpose of educating or training oneself. Play allows the player to create an imaginary world which is still safe within the physical boundaries of the real world. This gives the player an opportunity to interact with this pretend world and learn what happens within the imaginary world. This teaches the player many skills such as social capabilities and, for the example, within young dogs, hunting skills. Huizinga has also stated a definition of play which is as follows:

> "*(...) a free activity standing quite consciously outside "ordinary" life as being "not serious," but at the same time absorbing the player intensely and utterly. It is an activity connected with no material interest, and no profit can be gained by it. It proceeds within its own proper boundaries of time and space according to fixed rules and in an orderly manner. It promotes the formation of social groupings, which tend to surround themselves with secrecy and to stress their difference from the common world by disguise or other means.*" [16]

The quotation above describes what Huizinga refers to as "the magic circle" [15]. What Huizinga asserts here, beyond what has already been mentioned, is that play has its own time and space — it has its own boundaries that are separate from the real world. Also, he puts forth, in his definition, that play proceeds according to implicit or explicit rules and that play promotes social groups, which corresponds to what was mentioned earlier about how play is used for, amongst other things, social purposes. He mentions that, within play, the goal is not materialism or profit, but play itself. Huizinga refers to the play activity being meaningful as it is not a part of the real world, not a part of regular daily life, but is an entity of its own — the process of play itself must therefore have some meaning to it [17].

An interesting aspect of play is that it seems to have to be some otherworldly experience (some activity taking place in an imaginative and abstract time and space). According to the various definitions of games put forth, the same must necessarily also apply to games. Jane McGonigal writes that we are rewarded by chemical releases in our brains when performing tasks or completing difficult activities [28]. These chemical releases (such as dopamin) can be hard to come

by in everyday life, and often this feeling of success, which is accompanied by the chemicals, is sought in play (mostly by children). Games, and especially modern video games, are specifically designed to give players tasks and activities to perform, and the level of difficulty is designed to make the players complete these tasks and activities. A common method used to design a game for this is the flow theory proposed by Mihaly Csikszentmihalyi [4]. The theory states that the participant must be kept in a state in which the difficulty level of the exercise at hand is neither too high nor too low compared to the skills of that specific participant. This means that the game must always be designed such that the participant (the player) is always in a state of flow and therefore, the difficulty level of the game should rise as the player progresses his or her skills. This ensures that the player will constantly feel pleasure from solving difficult tasks. If the tasks are too difficult or too easy, the player will lose interest due to frustration or boredom.

Csikszentmihalyi describes two kinds of motivational factors — autotelic and exotelic [5]. These are the same factors which Zichermann and Cunningham describe as intrinsic and extrinsic factors [46]. The first is when someone has a drive from within oneself to, for example, perform routine tasks such as eating, working, interacting with people, etc. This kind of people do not need any further sentiment to do something other than the reward they gain from achieving internal flow from performing these tasks. The second motivational factor (exotelic) is when the motivational drive stems from something outside the activity itself. A good example of this is a person who does not like to go to work but does it anyway because of the monetary reward at the end of each month. Csikszentmihalyi describes people as mostly being one or the other, although for game design it may not always be that black and white. To many, it depends on the kind of tasks to be performed.

An interesting thing about play and games is how they are related to each other. There is some sort of symbiosis between the two entities. For this project, based on the previously mentioned sources, the understanding of play and games is described below.

> *Play is an activity, which has a cultural and instinctive purpose. The purpose lies within the activity itself and has to, in one way or another, be entertaining for the player. Games are structed play — play with rules and goals.*

This means that although the two things are closely related, they are not the same. You can have play without game, but this would only be what Mogel is referring to as the lower levels of play. You cannot have games without play, as play is a prerequisite for games. There must be a difference between game design and designing for gamification as the first is focused on structured play (in order for the player to have as much fun as possible) whereas the latter is focused on copying only the structurisation, but not necessarily the play. From reading Gamification by Design [47], it becomes apparent that the goal of gamification is to apply these rules and goals of games in order to facilitate play, so the hope is that play will arise from the application of these elements.

Another interesting aspect is brought up by Salen and Zimmerman. They propose that play can be categorised into three different categories which can be seen in Figure 3.1.

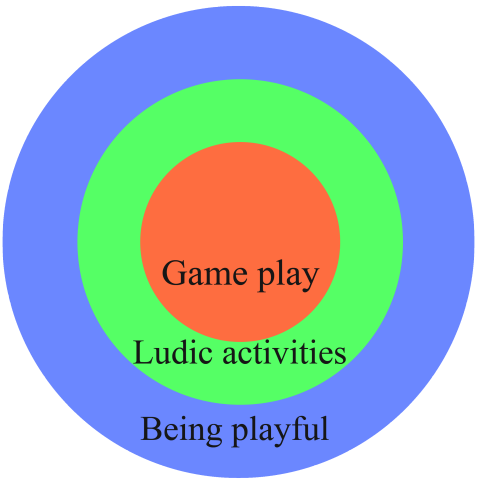


Figure 3.1: Figure from page 304 in Rules of Play by Salen and Zimmerman. The figure explains the hierarchy of play.

What Salen and Zimmerman try to convey with this figure is the relationship between the different categories of play. They define Game Play as something that takes place only when the player sets the rigid rules of the game into motion. This is a learning process that provides a space in which the user can test him- or herself in and among the more rigid formal structures of the game. They define Ludic Activity as play without rules, although it still is play — think of bouncing a ball and trying to see how many times you can do it or try to do tricks, etc. Such an activity is a play acitivity with such elements as physics, but the thought behind it can be applied to how simulation games work — the fundamental idea of this category is that the user plays with limitations of the ball such as movement, speed, strength, agility, etc. This is still very much a learning process. The last category is Being Playful and this is all about doing something playfully like whisteling while walking down the street or just walking funnily. This is more about playing with rigid social and anatomical structures which has defined the proper way of walking. Looking at Figure 3.1 Game Play is visualised as a subset of Ludic Activities which, again, is a subset of Being Playful. Therefore, in game design, the creator must design the Game Play for the purpose of creating play. For gamification, this would have to be different as it is not a game, but only the use of elements from game design. For the users to be able to accept and embrace the game mechanics and game play used in this regular activity, the user must at least be playful. This leaves us with the idea that gamification is the opposite of game design — meaning that instead of using rules, borders and goals to create a game experience, which can result in meaningful play, the designer creates a product that requires playful behaviour for the user to participate. Also, remembering intrinsic and extrinsic motivation, it is clear that playing a game is an intrinsically motivated activity in itself — a game is played for the purpose of the game activity itself. Gamification is usually applied to an activity that requires extrinsic motivation — this can be many different mundane activities such as work, cleaning, browsing a webpage, etc.

This application is supposed to make the task interesting or at least worth while in itself and not rely on extrinsic motivation.

Another difference between game design and gamification is that the magic circle is and has to be much easier to step in and out of in gamification as opposed to games. Think of the consequences of one's actions in each scenario: in games, the consequences only take place within the universe of the game but for gamification, the actions of a player can affect things in the real world as the time and space of this magic circle is within the real world. It should be mentioned that it can often be observed that it is not always so — that a person fails a task in the game but continues to be emotionally affected by this afterwards and of course in case of physical games, an injury will also have lasting effects after the player has left the magic circle. Looking beyond these examples, as there are no consequences in terms of the experience points (XP) gained or monsters killed having any real effect, this is one of the things that, in the opinion of this author, really differentiates these two concepts from each other. The real question can also be if there really is a magic circle in gamification. But following Huizingas definition of play and the previously mentioned description of gamification, there has to be playful behaviour on the part of the users and therefore, some form of magic circle will be formed.

To sum up; the difference between play, games and gamification has been outlined in this chapter and some of the issues that have to be kept in mind when designing for gamification have been asserted. In the next chapter, designing for gamification as well as a definition of the concept will be described. Important knowledge has been gained by researching play and games as this has showed aspects that need to be taken into consideration when designing for gamification — the difference between designing for a game or for gamification. What needs to be discussed further, now, is whether this theoretical basis changes anything concerning the implementations of gamification or if it only serves as a theoretical approach to the different concepts at hand. The implementation for this project will, under any circumstances, not be a full implementation and not be tested thoroughly due to the restraints of a master's project and the extent thereof.

Chapter 4

Defining Gamification

Gamification, as opposed to usual game design, normally looks away from narrative structure and is only focused on the game elements and the gameplay experience. Whereas game design is about creating games that facilitate the element of play as well as being structured play in itself, gamification results in an activity, that requires a playful approach and contains game elements. This is of course a simplification and by all means only the view of the author of this work — as there are no comprehensive definitions of this. As mentioned in an earlier chapter, games and play are interrelated and more of a symbiosis than anything else. Play is part of games and games is part of play — although only in the form of being the highest level of play, but also the most fulfilling and meaningful kind of play.

Throughout this chapter it will be discussed how to design for gamification experiences. In the previous chapter the difference between designing for games and designing for gamification was clarified — therefore it is interesting to research how to design specifically for gamification. Firstly, the definition of gamification will be examined further.

There are several different definitions of what gamification is. Some of the definitions are from game designers, some are from marketing people and then some are from journalists and theoreticians. The following three defintions are most interesting considering the authors are both skilled theoreticians and practice game development themselves — one of the definitions stems from authors who also take a marketing approach.

> "*The process of game-thinking and game mechanics to engage users and solve problems.*" [48]

This first definition is probably the most used definition of gamification. This definition focuses on the use of game elements in order to solve problems. Also, they mention that the users must be engaged which means that the aim is also to motivate hence the overall goal of gamification should be to motivate users and/or solve problems. This definition is vague considering the use of terms like game-thinking — which could be everything related to games. During the previous chapter the concept of games was described and based on this the understanding of this term (game-thinking) is that the designers must create the gamified acticity to engage the users in the magic circle of the game, thus seperating the activity from the real world. The definition can be said to lack the element of applying game mechanics in order to create intrinsic motivation — it is important to distinguish between intrinsic and extrinsic motivation due to the effects they each have on motivation and engagement.

The next definition is from the website called Badgeville. This is a site that provides gamification solutions for websites. By default this must mean that they are of the opinion that you do not have to apply gamification as an integrated part of the strategic process from the start, but instead must be able to apply it to an already existing product. This would fit with the wording "gamification" which would imply that to already existing non-game material game mechanics are applied and according to Zichermann and Cunningham, game-thinking. The definition is as follows:

> "*Gamification is a modern business strategy that uses proven techniques from social gaming to measure and influence behavior.*" [2]

What this definition adds is that apparently gamification is a business strategy (a marketing strategy). This, however, should not discount the use of gamification in other contexts but rather be seen as the result of using motivational techniques which can benefit financially, but can also be utilised in other ways such as for educational purposes. They mention that the techniques come from social gaming, which would mean that they believe there is a social element to gamification. This means that the game elements used for gamification should be focused on the social aspects of games like status, leaderboards, scores, comparing, competition, co-operation, etc. Lastly, the creators of Badgeville state that the goal of gamification is to influence behaviour. This can be closely related to the first definition which stated that the goal was to engage users. Engagement and influence can both be said to be considered impetus. This means that the users are pushed towards a specific goal and can thus be compared to persuasive design which is focused on altering attitudes/behaviours of users. For the remainder of this report this part of gamification will be referred to as impetus.

The last definition that is mentioned in this chapter (there are many more definitions available) is that of Deterding et al.:

> "*"Gamification" is the use of game design elements in non-game contexts.*"[7]

This definition is very broad and as the only one of the three mentioned, it does not have any specific target or goal for the use of gamification. The definition simply states that game design elements are used in non-game contexts. This could end up making the new activity a game, but this should fit with at least the word "gamification" which would refer to making a game out of something that is not already a game.

What can be gathered from these three definitions is that gamification can be described as:

> *A context-specific strategy that utilises the intrinsic motivational benefits of game design elements, in particular social gaming, in order to provide impetus in non-game contexts*

This definition does not single the outcome down to for example problem solving, but keeps options open for all non-game related activities (problem solving most likely being an important

part in many cases such as education). Game design elements mostly cover game mechanics (and not narrative or to some extent graphics) as the author of this work is in support of ludologists such as Jesper Juul and therefore view the advantages of games as being the game mechanics (including rules, goals, boundaries, etc.). This means what happens when the player does whatever action available and what are both the immediate and long-term outcome of this. This does also translate to rewards, benefits, social status, etc.

Jane McGonigal argues that playing games is a positive thing, but to fully utilise the resources provided by millions of gamers world wide, gaming has to be considered in another way than today. As mentioned earlier a game gives rise to meaningful play and the great quality of meaningful play is that it allows players to have fun and find a purpose in doing even tedious and grinding tasks during video games. A good example of this is how many users will perform grinding tasks like collecting wood or mine for gold in MMORPG games such as World of Warcraft.

Figure 4.1 shows how game mechanics can be applied to different activities. You use game mechanics to provide impetus. The activities that game mechanics are applied to are in a non-game context and are most often activities that, for most people, do not carry any inherent intrinsic motivation — meaning that most people are not intrinsically motivated when performing these tasks and in therefore game elements (mainly game mechanics) are applied in order to provide this via meaningful play.

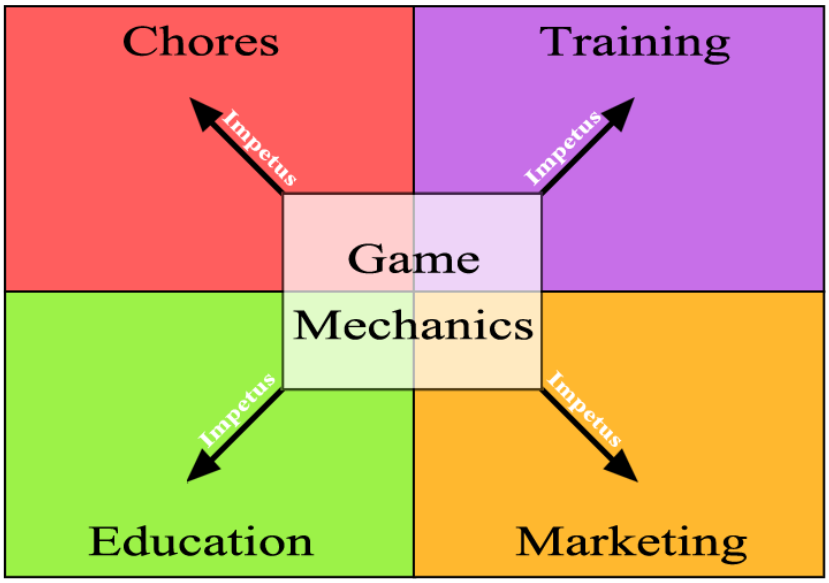


Figure 4.1: Game mechanics can be applied to a series of different tasks and for different purposes. Preferably the game mechanics should be used similar to the use in social gaming.

The figure shows how game mechanics are applied and what this does to the activity — it provides impetus or at least this should be the goal of the application. The idea, then, is that impetus will create user retention — meaning that the users will stick around for longer time than if the activity had not been gamified.

The challenge for designers is to apply the correct game mechanics to the activity at hand. This will differ from case to case depending on, for example, the age group, user segment and the context of the activity — is it for marketing purposes or education? All of these factors play their part just as is the case for traditional game design. It is evident that the gamification is designed for the purpose and this might easily be an iterative or at least creative process that requires the designers to design for the users in question and strive to enhance their experience. Often, like in the case of Badgeville or Gamify [8] you will see that general solutions are applied in different contexts and according to Michael Wu, this is a slippery slope that will only end up hurting the industry:

> "*The gamification community can learn a great deal from game designers and the gaming industry, because people will get tired of the same games over and over again. Eventually people will get tire of points and badges. These simple game mechanics will become annoyances and ultimately be despised. Companies that use points and badges will be treated the same way as those that still use pop up ads and spam mail today. When that happens, we will need to borrow and evolve new game mechanics/dynamics from the game designers in order to continue to engage the players. The gaming industry will usually do a much better job coming up with creative and engaging attributes of game play, because they get paid just to do that.*" [43]

What can be learned from this is that users should be in focus when creating a gamified experience as well as they should be when designing a video game. The process ought to be iterative or at least focused on gathering information about the end users and try to accomodate them as best as possible using the game mechanisms at hand correctly. This should be evident although the word "gamification" implies otherwise. The word implies a gamification of something existing hence this separates gamification from game design as well as interaction design, persuasive design and user experience design. It seems gamification in this matter is more related to user centered design, although the product is already existing — hence the marketing aspect that some definitions of gamification hint at. Gamification can be seen as a means to promote an existing product or activity by making it more entertaining than originally.

A great challenge for gamification may lie at the very premise for the success of gamification. Daniel H. Pink argues in his book "Drive: The Surprising Truth About What Motivates Us" [30] that tasks such as work are not as easy to motivate for as previously thought. In fact the traditional method of offering a bonus in the form of monetary payment by the end of a work period (extrinsic motivation) will only lessen the intrinsic drive over time. It may work short term, but in the long term the person of interest will lose inner motivation and interest in the activity even though the individual may have found it interesting prior to this. This gives rise to a problem. Giving this extrinsic monetary reward will make the user lose interest long term because the activity in some sense becomes involuntary — it is not something the user does for the sheer entertainment of doing it. The action becomes involuntary. As gamification originates from marketing, it is something that is pushed onto the user — also for educational purposes it will most often be pushed onto the users. This is the same issue as for serious games which

also have a different premise than traditional games which are voluntarily played for the sheer entertainment value they offer and nothing else. On the other hand we have other games such as gambles which completely rely on extrinsic motivation, but create an unhealthy addiction within the user. The problem for gamification is that if the users does not voluntary choose to partake in the activity it is more than likely that intrinsic motivation will be diminished in the long run — even though gamification has been developed for the purpose of maintaining and increasing intrinsic motivation. This is a dilemma that, hypothetically, should be a nuisance and a paradox that should prevent gamification from being successful and therefore it would be interesting to see if an implementation of gamification to a previously existing product would change the motivation of the users positively as many creators of gamification solutions such as gamify.com and badgeville.com would have us believe. At least the assumption of these companies is that meaningful play will arise and prevent the aforementioned psychological issues by creating a state of flow for the users who will, although not completely voluntary, enter a magic circle of sorts.

As mentioned in the introduction, the term gamification was first termed by Nick Pelling in 2002 [Marczewski]. The tendency has been that, although gamification is not a new concept, the industry is growing and in fact a total of 70% of Forbes Global 2000 plan to use gamification for marketing purposes or for customer retention [11].

In 2010 the concept really took off after the huge succes of social games mostly related to Facebook. These games proved that it was possible to create games that would leave customers (although only one out of ten would pay money) happy to pay lots of money in order to gain status over their friends. Those who did not pay money at least spent way more time than they would care to admit on a game that was essentially very primitive. Many of the different game mechanics used for these kind of games have been implemented throughout the whole digital industry from AAA video games to websites.

Gamification can easily be viewed as the next step of user centered design as well as the development of serious games or edutainment all depending on the context.

Chapter 5

Concept Hierarchy

There are a lot of different terms and concepts used within the realm of games and entertainment. Sometimes it can be difficult to distinguish between the different concepts and at times they are also very alike or even overlapping. This chapter contains a concept hierarchy which is based on the discussion in the previous two chapters and other sources. Concept diagrams are made in order to show how each relevant concept is defined for this project. This will serve to show the differences and similarities between the many concepts and to clarify which approach to take when creating a gamification experience.

5.1 Games

Firstly, the concepts of play and games is described and defined. The concept of games is illustrated in Figure 5.1.

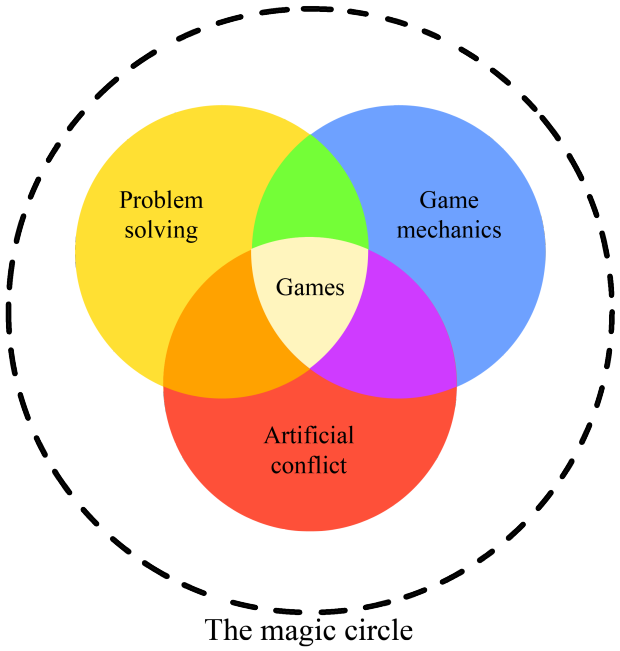


Figure 5.1: Games is a combination of problem solving, game mechanics and an artificial conflict.

What is important to note is that everything that goes on in a game (for the purpose of this project; a video game) does so within the magic circle. The game does not directly concern itself with the real world; only at an abstract level, as mentioned earlier in the description of play and games. This means that the issues that take place in the game (What Salen & Zimmerman refer to as 'an artificial conflict') are only issues within the magic circle — they do not relate to reality in any way that influences the game play. The meaningful play arises from within the game and is only present within the magic circle — from an outsider it might seem pointless to perform the in-game tasks as they only make sense in the game world (within the magic circle). The circle named "game mechanics" also covers concepts such as interaction and rules. Game mechanics can be described as follows:

> "*game mechanics are methods invoked by agents, designed for interaction with the game state.*" [39]

and

> "*"Game mechanics are rule based systems/simulations that facilitate and encourage a user to explore and learn the properties of their possibility space through the use of feedback mechanisms.*" [3]

As can be interpreted from these two definitions, game mechanics describe a system that enforces the rules of the game. This means that for every single action there should be a reaction which the game mechanics will provide the player as feedback. The feedback can consist of many things from simple movements to points and further to the losing or winning conditions of the game (goals). Looking at Figure 5.1 one might wonder why play is not a part of the figure. This is due to the nature of a game. Although games are made for the grand purpose of entertaining, the entertainment is not part of the game itself, but more what arises from the framework provided by the game. For both this figure and those following in this chapter there is also another part missing, which is players/participants. This has been left out as it has been deemed self explanatory. A game will be a game whether or not players participate in the activity, although the game cannot commence without players.

Narrative and story, as well as audiovisual graphics, are not fundamental parts of a game and hence do not help to constitute a game. These elements are merely additions which can provide a better gaming experience albeit experts such as Jesper Juul note that narrative and story are not the strengths of games (where there is an inherent struggle between the actuality of interaction and the recounting of narrative), but rather strengths of books and films [20].

5.2 Serious Games

The difference between a game and a serious game is simply, as the name refers to, that a serious game deals not with entertainment, but with a serious subject and maybe also in a serious man-

ner. What this means is that when you create a normal game it will always be centered around the purpose of offering the user some form of entertainment — some fun. The game will be designed to provide meaningful play and that meaningful play must be entertaining — otherwise the player will not play the game and move on to another one. A serious game does not concern itself with entertainment (it may be entertaining, but this is not the primary focus) but with teaching, training, etc. Examples of serious games are for example flight simulators that train pilots before they are allowed to fly an airplane by themselves. This method is valuable and saves time, money and eventually lives as simulators are also used, for example, to train surgeons for difficult surgical procedures. These examples showcase the benefits of serious games, although the example of simulators lacks some of the fun motivators such as points and scores.

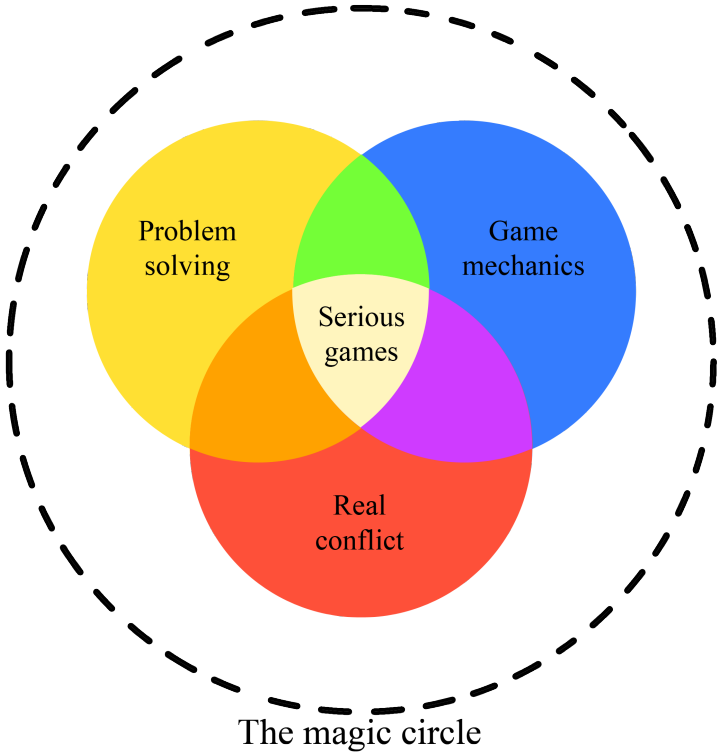


Figure 5.2: Serious games are a combination of problem solving, game mechanics and a real conflict.

In Figure 5.2 you can see a diagram showing the different components of a serious game. Note how the line symbolising the magic circle is dashed. This is because although there still is a magic cicle, as the pretend takes place in the game environment, which is a fictive and artificial environment, the game play is directly related to the real world. This can be either via simulating the real environment or imparting useful knowledge via the fictitious game world.

As a definition, serious games will, in this project, be regarded as described below.

> *An interactive computer application, with or without a significant hardware component that: has a challenging goal, is fun to play and/or engaging, incorporates some concept of scoring and imparts to the user a skill, knowledge, or attitude that can be applied in the real world.*

Of course a normal video game can also impart to the user some skills or knowledge that is applicable in the real world, but the difference between the two is mainly where the focus is. It can be compared to the difference between a film and an informative film clip.

5.3 Edutainment

This will, like serious games, be mentioned although it is not used in the report, because of its close resemblance to gamification — it is not only important to know what gamification is, but also what it is not. Edutainment can in fact overlap gamification and in certain aspects be the same thing. In the case of this project, where focus is on using gamification for educational purposes the resemblance is striking. Edutainment literally is a portmanteau consisting of the two adjoining words "education" and "entertainment". As can be seen in Figure 5.3 edutainment occurs whenever education overlaps entertainment. The medium of entertainment can be anything from digital mediums such as films and games to analog mediums such as physical play or pop quizzes.

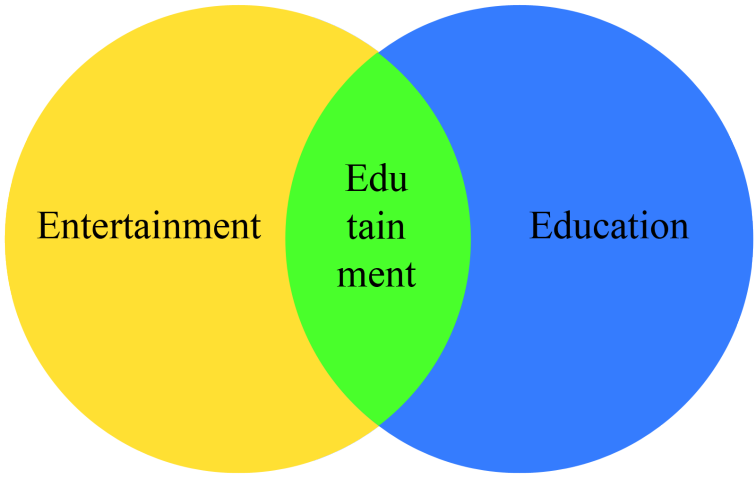


Figure 5.3: Whenever education overlaps with entertainment (in whatever form) it is considered edutainment.

The broad definition of edutainment makes it overlap many other terms such as serious games and gamification. Edutainment can even be toys or role playing with an educational purpose — as long as something is learnt in an entertaining way... which then begs the question of what people find entertaining since this is subjective. Edutainment bears a close resemblance

to infotainment, which is concerned with informing users in an entertaining fashion. The main difference between edutainment and serious games is that serious games are focused on learning (fun comes second) while edutainment is focused on both — equally. Gamification is focused on using game elements in real world scenarios/activities and is, in principle, only focused on using game elements to motivate or enhance the affects of whatever property or activity it has been applied to. If you apply game elements to usual classroom ordeals you would enter an overlapping area since this is gamification, but can also easily be edutainment since this entails the use of films, games, play — everything that might be considered entertaining.

5.4 Gamification

The last term to be described and put in place in the concept hierarchy is gamification which has already been described in the preceding chapter. In this chapter, gamification will be described in comparison to the other very similar concepts. As mentioned earlier the difference between games and gamification is that gamification only uses game elements (game mechanics). These elements are what constitutes the framework for a game, but only some of the elements are used in gamification and therefore a fictitious game world is never created. This is the main difference — that games take place in an artificial world whereas gamification is situated in the real world. If you take a look at Figure 5.4, you will see that conflict has been removed from games and serious games in order to make it gamification.

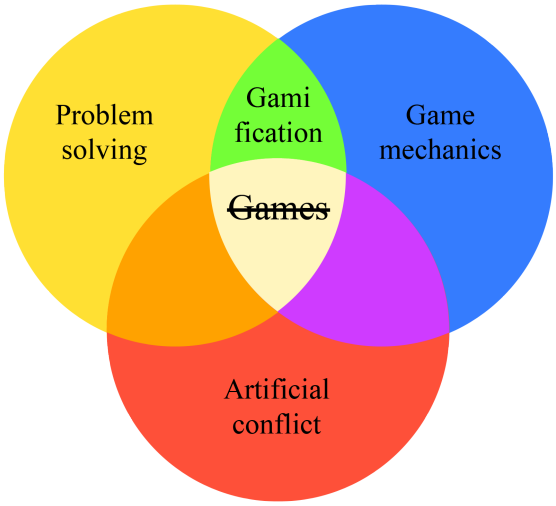


Figure 5.4: Some of the difference between games (including serious games) and gamification can be seen in the figure.

It can easily be discussed whether problem solving should be a part of gamification. The main objective of gamifying a product is to provide the user with intrinsic motivation to use a product or partake in an activity that might otherwise have been too boring. Therefore gamification is most often used in an attempt to salvage a product or activity that users have been reluctant to purchase or partake in. Therefore the users does not necessarily solve problems, but gamification is used to solve problems — for example a lack of user retention, low motivation, etc.

What makes gamification so difficult to define is the broad definitions of the concept and the wide use of it. Gamification can be used for just about anything — to more or less success. The main use for gamification, however, should be to motivate users more — to provide an impetus that will drive the users forward and make them want to spend more time, explore or achieve more. The real use of gamification is to create intrinsic motivation (autotelic) or compensate for the lack thereof and thereby making the experience more enjoyable and meaningful to the users.

A good example of gamification is for example the way that American Airlines introduced their frequent flyer miles. To some people it became more interesting to achieve more miles and thus their competitive needs were awoken. American Airlines also recognised that not only did it help to provied frequent flyers with these financial benefits, but they also provided status benefits, which really helped their sales. They did this by introducing the visible status symbol of a red

carpet laid out before those who had more than one million flyer miles to their name and they were provided with special cards. This made it visible to others that they were frequent flyers and thus gave them some sort of status although be it that they had in reality not gained any status or advantages compared to the prior financial benefits. What this tells us is that status, rewards and social aspects are important to people.

Examples of educational or motivational designs that are not gamification are, for example, documentary films, which are edutainment and do not contain game mechanics, thus making them something else than gamification. An interesting example is that of The Fun Theory [42]. This is a site dedicated to creating fun solutions to altering peoples behaviour. Some of these examples, like that of Bottle Bank Arcade Machine [40] (where users achieve scores from recycling bottles) are gamification while others such as Piano Staircase [41] are examples of persuasive design rather than gamification — here emphasis is not on motivation by using game mechanics, but rather on providing the users with fun and thus creating a framework for being playful which serves the purpose of making people take the stairs instead of the escalator. The reason why this is not gamification is simply the lack of game elements such as score, rewards and goals — this is rather playification than gamification.

Chapter 6

Delimitation

In this chapter the scope of the project will be defined. This means that a focus will be applied to the project in order to be able to fully research and implement the idea(s) involved in creating and testing a small gamified experience.

Previously, the relationships and differences between different terms such as play, games, gamification, edutainment and play were discussed. It became clear that gamification is an invention for the purpose of gaining users and having user retention in a marketing context, but that gamification has qualities which also apply to other areas. This is due to the fact that what gamification truly provides is impetus (motivation, engagement and behaviour) which can help the designers give intrinsic value to an activity that might otherwise have been boresome. Because of this, the use of gamification might prove advantageous for educational purposes where students and pupils easily lose motivation for the subject or task at hand. A good example of this is how more than one forth of the pupils at the Danish elementary schools are not able to read properly [31]. Less than 10% of the Danish population are actually suffering from dyslexia [18]. This means that many of the students who cannot read properly most probably lack the education or at least motivation for education that is needed in order to learn this as it should only be 6-10% (and not 25%) of the students who are legitimately suffering from dyslexia. This is not only a problem in elementary schools, but throughout the whole educational system lacking motivation and engagement is a problem and if nothing else it will always be beneficial to optimise the process of learning. Sites such as www.gamificationu.com present many cases, examples and knowledge about how one can use gamification for education, which would imply that the potential has been recognised.

By focusing on education this project will contain an implementation of a gamified product which will be tested through a user study. This concludes the first part of the report. In the second part of the report, the concept for the product will be created and described as well as the implementation and the test thereof. The problem that will be sought to answer throughout the rest of report will, based on previous research and decisions regarding the delimitation, be the following:

> "*Can an existing educational exercise such as flashcards benefit from gamification?*"

It has been decided to use flashcards as a case example of how gamification can be used for educational purposes. Flashcards are simple cards on which, for example, a word is written in

one language on one side and another language on the other. The user will then see a lot of cards in rapid succesion which will help the user remember the words. In the following chapter it will be important to develop a concept for later implementation which will serve as a method for improving the already existing product of flashcards.

GAME
SCORE
35,000

Level Two

Chapter 7

Concept Development

In this chapter, the different tools for creating the gamification product will be assessed and considered. In the previous chapter the problem was limited down to the core which was how to implement gamification for educational use — specifically to implement gamification in flashcard exercises.

If you are about to create an educational experience, it is interesting to look at some of the reasons why video games are so attractive and motivating to its users. The following list of reasons why video games are so interesting in regards to teaching and learning is based on a paper by Debra A. Lieberman [23]:

- Players like to experience challenging goals, stimulation of curiosity, control over the action and are attracted to fantasy themes. They also like problem solving, compelling graphics, competition, collaboration, skill development, exploration and construction.
- Players like the challenge of reaching a goal. This makes them more immersed hence making them pay more attention to the game itself. Learning that occurs in this kind of situation can increase the players' interest and motivation to learn, thus making them want to seek out more relevant knowledge.
- Players enjoy appealing characters, making choices and seeing them have an actual impact, roleplaying, extreme emotions (once again, they prefer a more interesting scenario than the usual classroom math solving problems offer) and the pleasure of having feedback/response via interacting. This might heighten the player's emotional response and lead to more motivation to learn.
- Players are motivated by interesting stories which will make them want to advance in the game in order to achieve the satisfaction of experiencing the next small part of the story. Furthermore, players like to experience flow.

Of course, not all of these elements will fit into gamification, but some of the aspects are interesting to keep in mind when designing the product.

7.1 Flashcards

Before designing the product, flashcards have to be analysed and discussed in order to gain an understanding of how they work. This is important in relation to the definition of gamification

that was reached during the analysis in part one of this work.

As the name might imply one of the features of flashcards is that they are shown to the user in a rapid succession. Flashcards make use of active recall which is a principle of actively stimulating the memory during a learning process. This is in contrast to passive review such as watching a film or reading a text — it becomes active recall when the user has to think about the answer such as being asked questions. Studies have shown that this method is effective but a subsequent test will have to be very similar to the study exercise itself in order to be fully effective — this shows a deficiancy using flashcards as it works very specifically [22] and [21]. For more advanced flashcard exercises spaced repetition is sometimes used — a learning technique where the intervals of time to study the flashcards are increased in subsequent reviews of previously learned material. The spaced repetition is very different to how many users normally fare with flashcards as they will spend less time on material they are sure they know or have already learned.

When designing the gamified version of flashcards it is imperative to keep the use and the function of flashcards in mind — how and why they work. The game elements used and how they are used will reflect this in order to avoid obstructing the inheritive functioning of flashcards.

7.2 General Design Elements

The chosen subject of flashcards leaves a large target group as anyone can use these cards and for many different purposes. During this project the focus will be on learning words in a foreign language, which is also one of the primary uses of flashcards. When designing the experience there will, therefore, not be any certain aspects, concerning the target group, to take into consideration — this exercise will be focused on building up a vocabulary. Designing for gamification is not very different from designing normal games. There is, of course, no emphasis on story in gamification nor much focus on characters, but otherwise the two are really similar. It is important to make sure that the users are having fun while playing. There are many different ways to ensure that this happens, but basically it comes down to creating an experience that makes sense, is meaningful and in one way or another puts the user in the flow zone. There are many different well known game mechanics and guidelines to follow and successful games to look at, but in the end it is all about creating something that fits and to design for the users — therefore keeping them in mind throughout the process. That being said, however, one can save some time by following some of the basic trends that have been proven to work in the past — then, if necessary, build upon that.

In their book Zichermann and Cunningham identify seven mechanisms which, according to them, are present in all gamification [49]. Therefore, this should ensure a complete gamification experience and should suffice when creating gamification for testing the effects of its use. The seven different mechanisms are, in the following, briefly presented and discussed — if gamification is to be made for this project, then it should contain all these elements and therefore it will be discussed how each of these mechanisms can be included in the project.

- **Points:** This will provide a virtual economy which can help create user retention via increased motivation (incentive). There are five different kind of points. The first is **experience points** (known from many MMORPG games) where players earn points the more they play — which makes it easier to track progression and set yourself goals along the way. **Redeemable points** (known from Farmville and flyer miles) are essentially the backbone of virtual economies — but these points are convertable to, for example, in-game stuff or real stuff such as money or gifts. **Skill points** (also known from most MMORPG games where a player has skill points, for example, for magic, using two-handed weapons, etc.) are used like experience points, but assigned to certain activities in order to guide the user towards certain subgoals thus making it easier to master the game if you choose to specialise in something specific — it also gives the game a more strategic angle as most MMORPG's have missions that require an assembly of different skillsets and thus the game will make the users collaborate. **Karma points** (known from such websites as www.reddit.com) are points that users give to each other thus rewarding each other for certain behaviour and creating a community — at www.reddit.com users are rewarded with karma points by other users when they contribute something deemed worthy to the community. Lastly **reputation points** (known from for example www.trustpilot.com) are used every time a system requires trust between two or more parties — if a system gives many reputation points to something it means that it is trustworthy and you can click on or interact with it without fearing the worst. All these different point systems should be used to guide the user towards a specific behaviour — for example by rewarding what is perceived as good behavious with more points. Using the different points systems correctly can give a large user retention and loyalty because they will want to use this system. For the purpose of this project the experience points are paramount and skill points will also be used in order to guaranteee a feeling of success for the users. Skill points will ensure that if the user is not very good overall he/she can at least find a niche and master this. For a more advanced system it could be interesting to look at for example reddemable points and karma points, but for the time being, the two first points systems are the ones that are most basic and deemed most valuable to include in the gamification for this project.

- **Levels:** As well as the experience points signal to the player that he/she is becoming better and more experienced, levels do the same. Levels tell the player that progress has been made and the player is now further in the game. The progression of levels signals that it is becoming increasingly difficult and will give the player a sense of achievement — this, however, also makes it important only to use levels when the game is actually becoming more difficult. If the game does not become more difficult, the player will feel that he is becoming too good and will fall out of the flow zone and instead become bored. In many games the level difficulty increases curvylinear, which means that they become more difficult, then flatten out and then become more difficult again thus allowing the player to catch up with the difficulty and granting a feeling of mastering the game before challenging him/her again. It is important to use believable symbols when signaling level change, the same goes for rewards, so the user is aware of the value or the difficulty — in an educational game it might be that elementary level is the easiest and professor level is the most difficult level. The last example will be relevant

as this will be used within the gamification that is implemented for this project. A ranking of different levels will be made and this will be implemented such that the higher scores the players achieve, the higher level they will be in. There is no level design in the gamification made for this project as the game will be more simple in order to test the implementations properly. An increase in levels can also reward the user, such that it does not only become more difficult but also, for example, have the player reach a level with better graphics or more skills/powers available. This is a very pedagogical approach that ensures that the player is only gradually introduced to the full content. Progress bars are often used and could also be used for this project in order to show the user what progress has been made and how far they are towards the next achievement/level/opponent. However, this will not be the case with this implementation of the game as a timer will function as an indicator of progression.

- **Leaderboards:** This allows the player to see where he/she is placed both overall and compared to friends. There are many different approaches to leaderboards — both locally or globally or looking at rankings in different specific areas of the game. There are different ways of displaying one's ranking where the most often used is one where the player is placed in the middle and opponents are placed above and below — this gives a better sense of achievement unless of course you are the one at the very bottom. When introducing a leaderboard it is very important to try not to demotivate the users. Therefore the leaderboard used should take into account that there might be some sensitive information that people would rather not share (so maybe an option to not put one's information on the leaderboard). Also, it can be disheartening for a new user to be compared to an experienced user who has much better scores — therefore they could also be divided into groups of experience level. A leaderboard will be used in this project and this is a tool that can really entice the achievers who would like to be in the top — also it can be used for explorers by, for example, having many small leaderboards for different niches that will result in rewards if one is in the top or has moved a certain amount of places up during a certain period.

- **Badges:** Well known from social games such as Foursquare and Farmville. These are the visible symbols of achievement and in many gamifications they form a very important part of their success. Badges function well when used to inject a certain behaviour to users of a system. There are many different reasons why users will want badges — it can be the collecting of the badges, the surprise of winning a badge, the feeling of exclusivity when winning special and unique badges or it can be the sheer aestethics of a nicely designed badge. Badges can be used for this project in order to give the users a sense of success — a sense of achievement. The badges should be handed out fairly easily at the beginning in order to entice the users and then become progressively more difficult to achieve which will ensure that the users are hooked and motivated to keep on doing an activity (learning) that might not seem too appealing by itself. Given the genre of the gamification activity it would be obvious to use badges in the form of, for example, diplomas, graduations (this one might be more level oriented) or fellowships.

- **Onboarding:** This is all about first impressions and is very important. Within the first minute a

player will have made up his/her mind and therefore onboarding is important. This is basically the same as keeping the user in the flow zone, but at the same time one has to introduce a user to much more in the beginning. Therefore onboarding is about how you lead the users through the first hard steps and at the same time give them a peek at what is to come — what kind of game they will be playing. One should not overwhelm the user with information nor should one have the user do things that are not interesting within the first minute — an example of this is how some websites will ask their users to register as the first thing which is a really bad decision. Instead of demanding something from the user it is better to give and to let them experience the site, game, etc. before demanding from them. This is useful for this project as they will, at some point, have to write in their name or user id in order to rank them in the leaderboards — this should not be done until they have finished playing.

- **Challenges and Quests:** These can provide meaning to the gamification. They can also be used to guide the user within the system. Using this in combination with badges (like Farmville does) will supply the user with a list of possible badges and the requirements of how to achieve these — this can motivate the user to try and fill out all the empty boxes and it gives a sense of purpose and direction to the user who might not have known what to do otherwise. As in many other cases it is important that the challenges and quests fit the rewards — otherwise the player may become disheartened or stressed. The method mentioned earlier (from Farmville) where players can see all the possible (at least those visible) badges and the requirements of achieving them seems relevant to implement in this project. This is due to the nature of flash cards which requires speed and if there is to be a proper leaderboard, then in-game challenges might be difficult otherwise. The option of cooperative quests is another possibility, but will probably prove too difficult to implement for this project, but for further research this would be interesting to look into as social factors such as these can have an affect. An example of this is the weight watchers program where they will meet up and fight their overweight together — maybe even team up to lose a certain combined amount of weight within a period thus motivating each other for their mutual benefit. Should it be implemented within this gamification one could imagine the possibility of forming study groups within the gamification and have these compete against each other and test this against the normal single player gamification and see if the users perform better when in cooperation.

- **Social Engagement Loops:** This is focused on not only engaging and motivating the user, but to do so over and over again. The main idea is to motivate the user to not only be engaged while playing, but to motivate them to return playing again and again. This is often used in MMORPG games where they will have world events, patches or updates that give the user an incentive to return — it may also be as simple as lowering the price for a period for returning customers, which is a well known marketing method. This, of course, is an important feature and definitely something that should be implemented in gamification — especially concerning user retention. However, for this project it will not have much effect as the period of testing does not stretch over many days or even weeks which could be necessary to test the full effects of proper social engagement loops. However, a small implementation is possible and the result would then have to rely on a questionnaire filled out by the users. One cannot really pin this

feature down to one specific game mechanic, but rather a series of game mechanics that can be used in many different ways to create user retention.

Many of these mechanisms fit well with the lists of player wants presented by Lieberman. A flash card game is a rather simple exercise compared to more complex educational exercises such as solving complex problems or abstract thinking. This makes it possible to control and test the effects of gamification and it is the opinion of this author that gamification would probably not work very well when the educational exercises become too complex.

7.3 Final Gamified Product

The creation and design of the gamified flashcard exercise is approached the same way that would be the case for a video game. This is due to the fact that gamifying something (as previously mentioned) should result in either designing something from scratch or re-designing something existing. In this case it is not an existing product that is gamified, but rather a gamification product that is based on the concept of flashcards.

For the purpose of testing the effects of gamification in an educational context a case study approach has been chosen. The method that is used is to create a normal, simple flashcard exercise inspired by websites like www.quizlet.com and www.ankisrs.net. Another flashcard exercise will be created, but this one will be gamified. The two different versions will then be tested in an offline user study combined with a questionnaire. The focus will be on whether the users score higher in a subsequent performance test after the gamified version than the non-gamified version, if they feel more motivated to try again and how much time they are willing to spend on the exercise. The implementation of the two different versions is described in Chapter 8 whereas the test and results are described in Chapters 9 and 10.

The normal version will feature nothing else than 25 analogue flashcards featuring a word in English on one side and the same word in Dutch on the other side. Dutch has been preferred as it is a language that most likely no participants will have any relations too and it will give no advantages or disadvantages throughout the test — also the motivation to learn 25 words in Dutch should be fairly low as the users will have nothing worthwile to gain from knowing these.

The gamified version will involve the same 25 flashcards and it will be digital due to the nature of the project in relation to the education of the author. Otherwise a gamification can be created without the aid of digital media, but digitalising a product does make it immensely more easy to for example keep track of scores and reach a wider target group. The gamified version will, furthermore, contain the following game mechanics:

- **Points:** These are at the backbone of gamification and therefore also an essential part of this implementation. The users will be rewarded with points throughout the exercise. Experience points will be used in the form of a timer and a score. This is done in order to let the users keep track of their overall progression this session. It will only work for a single session due to the

nature of this project which will require test participants to spend a small amount of time with the programs. It will, however, be possible to keep track of others who have completed the exercise and hence they will be able to compare themselves with others, which gives a social aspect to the game. A bar will show how they rank currently among their friends — only showing the closest competitors in order to motivate the users to beat the one above (which will always be a small goal) and avoid demotivating by not showing the highest scores during the exercise as this may only dishearten them.

- **Levels and badges:** The program made for the test will be fairly small and thus there are certain limitations to the exercise. There will not be any levels in the typical form, but rather acknowledgements of the progress of the user. This serves as both levels and badges. When a user performs at a certain level of skills, thus earning more points, he/she will earn a new title — lend from the world of academics. This is inspired by games such as Geo Challenge. However, the primary motivational force in this particular design will not be badges and levels as much as it will be to beat one's fellow players/users.

- **Leaderboards:** As mentioned ealier leaderboards will be interlaced with experience points in some regards. While playing one does not only follow one's own score, but also the others as they are overtaken one by one. The score system is not only based on how many correct answers, but also on how many wrong answers one has. In the original flashcard exercise the user will see the 25 flashcards and tick them off one by one as the user remembers the words. In the gamified version there will have to be a way to keep track of the players progression hence there must be options and decision making instead of relying on the honesty of the user (that he/she does not tick off a word when it was not remembered correctly). Therefore for each English word there will be four Dutch words and the user will have to choose the right one. This does supply some help in the form of narrowing down the options drastically from an infinite number of possibilities to only four and will be limited by introducing a random order of occurence to the 25 different flashcards and by having the four options be very similar. This is a part of what was mentioned in an earlier chapter — that the gamification has to be integrated from the initial design phase and is not to just be put over something without thought. In order to really make leaderboards possible there must be a fair way of tracking the users' progress and therefore points are needed. Another option could have been to have the users write the English word in Dutch (or vice versa) and put an overall time on the exercise, thus rewarding those who do it in the shortest amount of time by ranking them the highest. In order to add a sense of urgency, tension and suspense to the game, the goal will be to have as many points (gathered through correct answers where there will be bonuses for e.g. streaks) within a set time frame. The precise amount of time will be decided through small user studies throughout the design and implementation process in order to balance the exercise. This set timeframe within the gamification does not equal to the amount of time the users will be tested as they will be tested until they answer every word correctly.

- **Onboarding:** Due to the nature of the project, where the effects of gamification are tested, there will not be an emphasis on onboarding. This does not mean that it is not present as

the users will not have to go through any tutorial or sign-up pages, but will commence "play" immediately. The gamification is very similar to a video game in regards to the content and therefore the word "play" is used as the term for how the users interact with the gamification. One might argue that, in fact, the gamification is a video game, which arguably is not incorrect. The users will not have to sign in until at the end of playing — optimally users would be able to use for example a facebook profile as a login, but this is not within the scope of this project.

- **Challenges, Quests and Social Engagement Loops:** Challenges and quests can be closely related to social engagement loops as it would be in this case. The project is concerned with a small user study and will therefore not have any users coming back for more as this is simply not within the scope of this project. However, there is one important social engagement loop present in this gamification and that is the possibility that one's friends perform better than one self — this should lead to the users wanting to play again and, in turn, set themselves goals of beating the opposition. Initially, they will be faced with an overall challenge which is to answer all 25 flashcards correctly as quickly a possible. Time bonus for quick completion and bonus for correct answers and streaks will let them set their own goals and be strategic about it.

The design will be rather simple and the background of this quiz-like program will be a simple colour. There will be four distinct buttons, each containing an answer. At the buttom of the screen there is a leaderboard which shows the current score and shows the next two in front and (if any) the closest two behind the player. At the top of the screen a countdown timer will show how far the user is in regards to how much time is left until the game session finishes. In Figure 7.1 the design of the GUI can be seen.

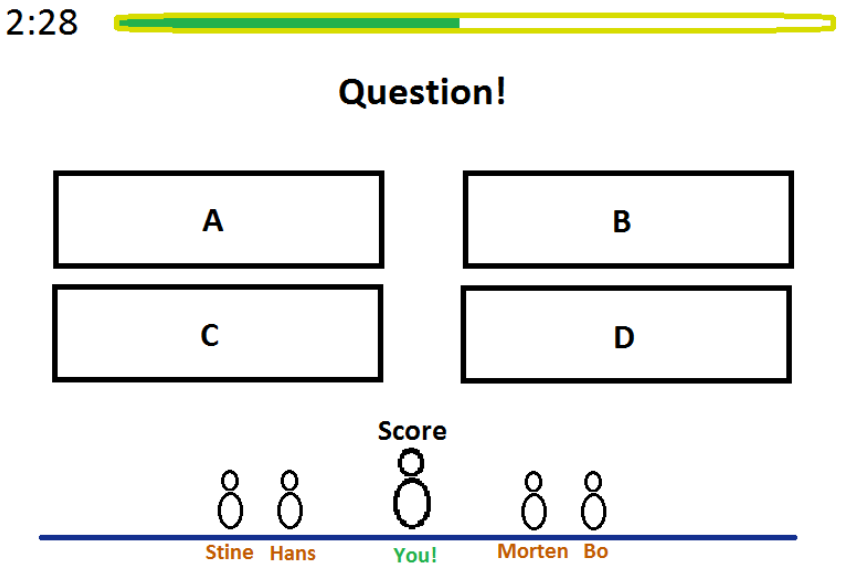


Figure 7.1: The GUI as it is designed to look.

Points will be given for different accomplishments and the overall point system is based on answering correctly and quickly. For each correct answer the user will be awarded 100 points,

but additionally 20 points will be added for correct succesive answers, such that the first correct answer gives 100 points, the next give 120 point, then the next correct answer gives 140 — if the user then answers incorrectly 0 points are given and does he/she then answer correctly once again the streak starts over and the user is rewarded with 100 points. The game takes 2 minutes and after each correct answer the correct and incorrect answers are displayed for one second. This means that, hypothetically, the users are able to answer almost 120 questions in the two minutes — thus answering each question several times. This design will allow the users to keep optimising their performance and provide an incentive to try again.

At the end of each playthrough the player will receive a badge in the form of an educational degree ranging from pupil to professor — this is presented in more depth in the table below. The progression from one badge/level to the next is non-linear (in accordance with what was previously mentioned in this chapter) and therefore becomes more and more difficult.

Badge	Points
Toddler	500
Pupil	1,000
Highschool freshman	2,000
Highschool senior	3,000
College freshman	4,000
College senior	5,000
Bachelor of Arts	7,500
Master of Arts	10,000
Language Expert	12,500
Professor	15,000

Apart from these badges, the users will also be able to earn other accomplishments such as having streaks like three in a row. These will not be badges in the same way, but graphics presented to the user in order to motivate them and drive them forwards. Due to the nature of the gamification (demanding, among other things, speed) the graphics will have to be visible, but not disruptive of the interface and the flow. The streaks will be shown to the users during the game while the badges will be shown as the end screen.

The badges can be seen in Figure 7.2 and the streak notifications can be seen in Figure 7.3

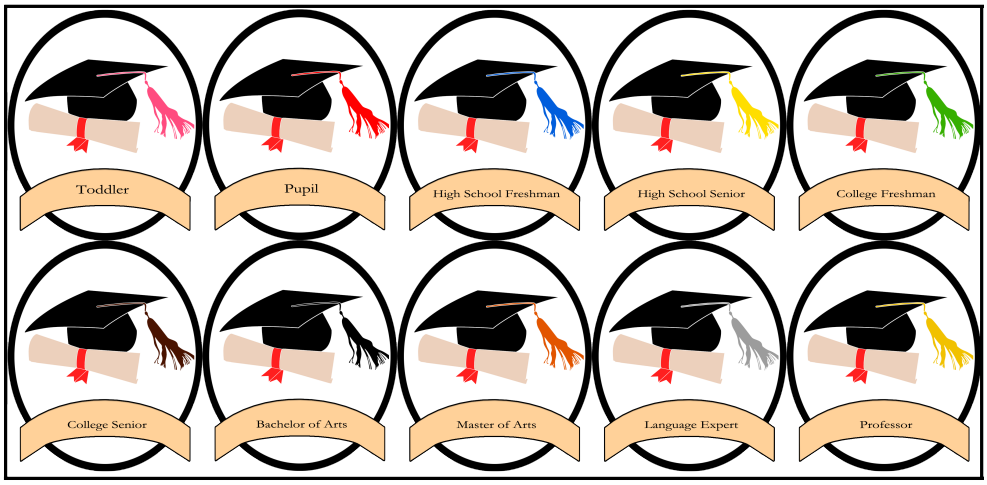


Figure 7.2: The ten different badges ranging from Toddler to Expert.

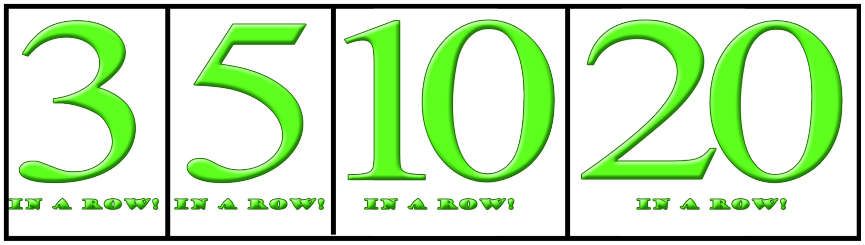


Figure 7.3: The different notifications that the player receives during play are meant to motivate the user.

When a user answers a flashcard the button of the correct answer will turn green and the rest will turn red. If a flashcrad is answered incorrectly the same will happen (the correct answer turns green and the incorrect answers turn red) and the next card is presented. When all 25 flashcards have been presented in a random order they will start over — this will occur until the time is over. It should be possible for the user to complete all 25 flashcards within the time span of the game. This is due to the circumstances of having to test the effects of gamification in a controlled environment and the time contraints that performing such a test may offer. Another option for the game design would be to create enough questions that the user is not able to play through each time thus giving more incentive in the form of not knowing which words will have to be answered each time and giving a sense of relief or joy when one's "good words" come up. This way the users would only be able to achieve the highest ranking badge if they are able to complete all questions within the game's timeframe and possibly earn time bonus points given for finishing before the time is up. However, this design would not, with high certainty, make sure that the test subjects play through each word at least once. The chosen gameplay will still allow for the users to continously improve their performance and therefore the gamification will have much more replayability — although this is not a particular issue for this simple exercise it may be beneficial for larger implementations where it is important that the users optimise their skills to perfection such as gamified surgical exercises or training amputees to use a robotic prosthetics.

The only audio that is in the game is at the very end of the 2 minute play through. Throughout the last ten seconds a clock will be ticking in order to let the user know that time is up. Otherwise audio has not been a focus point of this work and, as previously mentioned, audio is not of particular concern when creating gamification.

7.4 Final Non-Gamified product

This "game" is simple. It contains a one-coloured background and in the middle of the screen a word will be present. A tooltip is used to guide the user through the game, although it is very simple. The user will have to click on the word and a new one will appear. The first word is in English, the next in Dutch. The game will continue like this throughout all 50 words (25 in English and 25 in Dutch). When all words have been shown it will start over again until the user exits the game. This is very similar to the way usual physical flashcards work.

This chapter has described how the gamification is designed and discussed how the different game elements can contribute to the end product. The gamification exercise has been designed from the same perspective as a video game would be. Small qualitative user tests have been used throughout the design process in order to understand what the users were able to understand and to verify whether the users navigated the product as intended.

Chapter 8

Implementation

Both flashcard exercises (the gamified and the non-gamified versions) have been implemented with the Unity 3 engine. The programming language used for the gamified version is C Sharp (C#) and the programming language used for the non-gamified version is Javascript. In both versions the scene was setup using a skybox to provide a simple one-coloured background. The behaviour scripts used are all attached to the main camera in order for them to be present on the screen as there are no objects present in the screen apart from the main camera — except for four GUI Textures used for the gamified version. All textures have been created using Adobe Photoshop exported to .png and imported into the Unity scene.

8.1 Gamified Version

The structure of this version is based on randomness and repetition. The order of the 25 flash-cards/questions are randomised and once all 25 have been shown, they start over and are once again randomised (in order to avoid the users answering on routine or muscle memory). This is repeated until the game time (of two minutes) is over — this is illustrated in Figure 8.1.

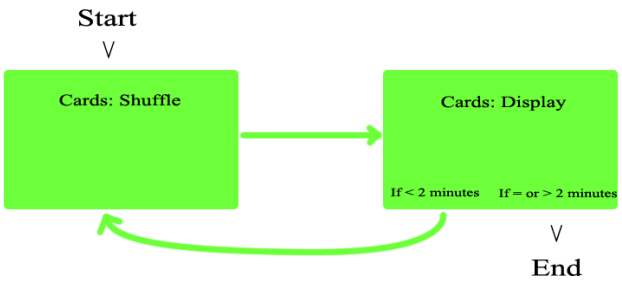


Figure 8.1: The cards are randomised (shuffeled) and starts over each time they have all been shown.

The game screen is constructed much like a quiz game. The question is presented in the top-middle of the screen and there are four different possible answers placed below the question. A

leaderboard in the bottom shows the progress and immediate ranking. The in-game screen, as well as the end-game screen can be seen in Figure 8.2.

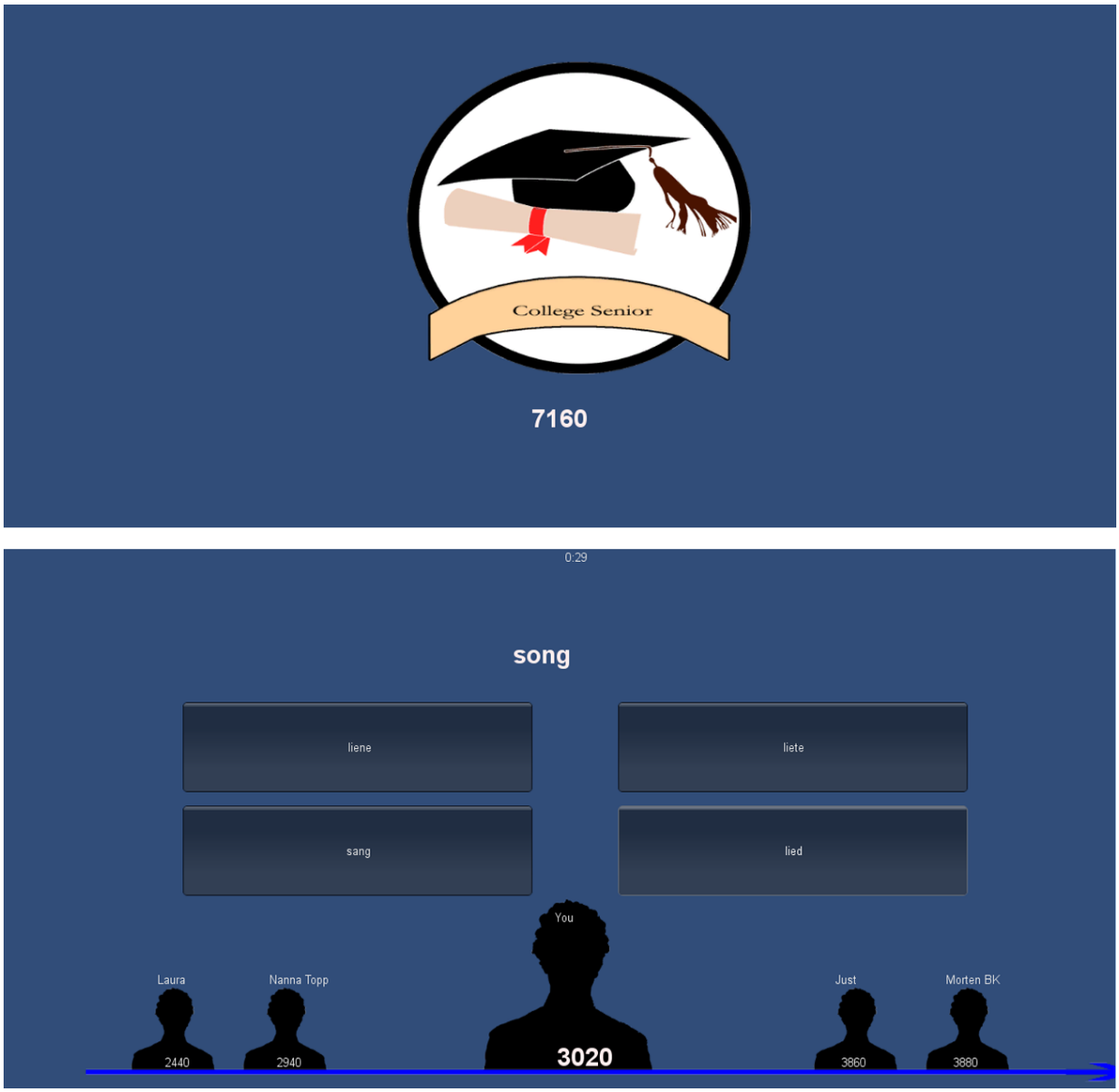


Figure 8.2: The end-game screen is shown on top and the in-game screen is shown on the bottom.

The Graphical User Interface (GUI) is implemented using various GUI calls integrated in Unity. An example of this can be seen below in Figure 8.3.

```
597     GUI.Label(new Rect(Screen.width * 0.143f, Screen.height / 1.28f, 300, 70), adjacentUsers[0].name);
598     GUI.Label(new Rect(Screen.width * 0.15f, Screen.height / 1.07f, 300, 70), "" + adjacentUsers[0].highscore);
```

Figure 8.3: An example showing two GUI.Label pieces of code.

The GUI calls are all placed in the OnGUI function. At first the type is specified (label) and secondly a rectangle is positioned (the rectangle is the area which the element covers) — within

the "new Rect" the two-dimensional coordinates of the position of the object is specified first and the dimensions secondly (also 2D). If the rectangles' dimensions are increased, but not the content (maybe a string) then the content will only be centered. A way to increase the size of a string is to add GUIStyle and set it to e.g. style and then just add style at the end of the GUI.Label code — this allows to adjust the font size in the inspector. After the dimensions, the content of the label should be declared — in this case it calls adjacentUsers[0].name and adjacentUsers[0].highscore which are funcion calls and work dynamically. An array has been specified (see Figure 8.4 and it contains the various users (the players) and their highscores (a multi dimensional array). The adjacentUsers is then found using a function (GetAdjacentUsers — line 354 in the Grafik script on the attached DVD). The reason why the function call in Figure 8.3 specifically calls for adjacentUser[0] is due to the structure of the User array and the GetAdjacentUsers function. In the array each user is assigned an id — the current user is always assigned id number 2. The GetAdjacentUsers function will then, based on the current score of the player, find two adjacent users on each side (behind and in front of the current player). The SortArray(User[] users) function keeps sorting the array via bubble sorting — this will always keep the User array updated thus allowing the GetAdjacentUsers function to find the adjacent users.

```
56      private User[] users = new User[16];
57      private User[] adjacentUsers;
```

Figure 8.4: The User array is set to private and to feature 16 users

An overview diagram of the leaderboard can be seen in Figure 8.5. This shows how the implementation works when a player earns points during the game.

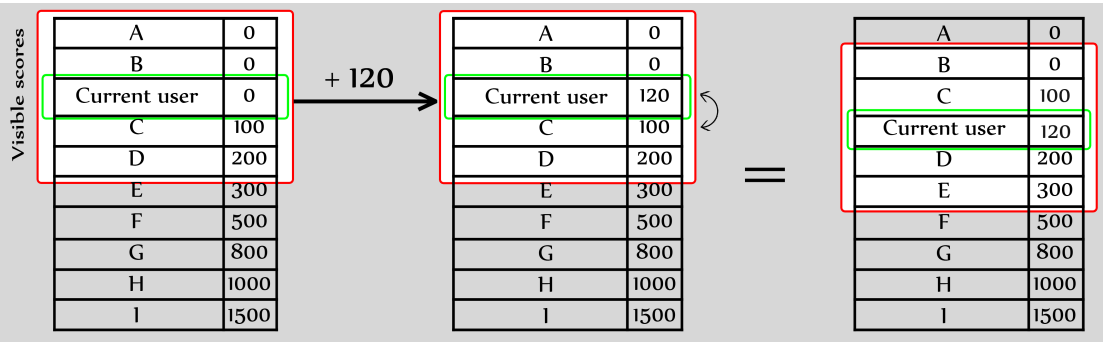


Figure 8.5: When the user gains points he/she surpasses those in front and the two+- new adjacent users are displayed.

When the game time is over a new GUI is shown (using an if/else to switch between the in-game and the end-game GUI) and the user will receive a badge depending on the score which is compared to an if/else if that assigns a badge depending on the interval the current score falls under.

8.2 Non-Gamified Version

The GUI presented to the user in this version is very simple, as can be seen in Figure 8.6.

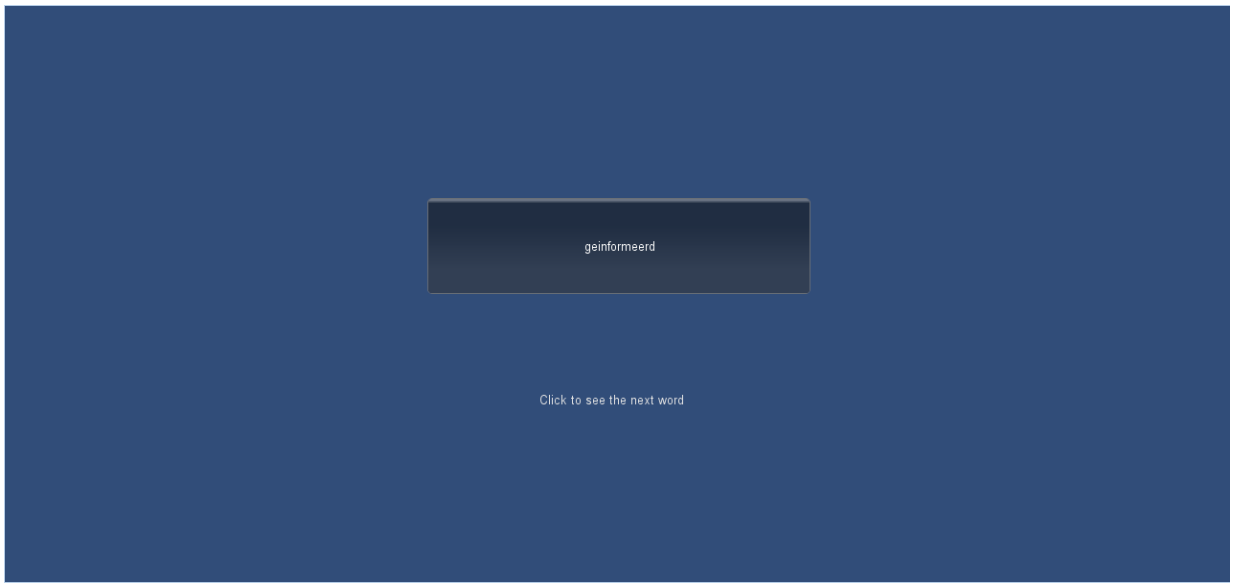


Figure 8.6: The user simply clicks the button to see the next word.

The non-gamified version has no end condition ergo it has to be quit manually at any given time — this offers the freedom of changing the test easily as the users can play for two minutes as well as five minutes, although the test facilitator must keep track of time. It consists of a simple button that, when pressed, shows a new word and loops when all words/flashcards have been shown as shown in Figure 8.7.

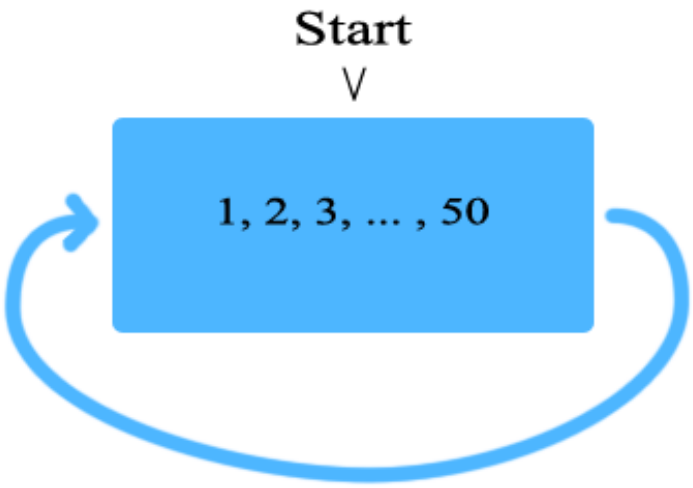


Figure 8.7: A never-ending loop keeps playing until the user quits the game.

8.3 Final Words

The full code and the executable files can be found on the attached DVD in the folder called Unity which is placed in the root. The only differences between gamify1 and gamify2 and nongamify1 and nongamify2 are the words used — otherwise the scripts are the same.

Chapter 9

Test

To verify whether there is a difference between the two implemented versions they are both tested. Each test subject will play through each version. Varying in between subjects, the sets of flashcards will be changed such that half of the test participants test a normal version of flashcard set A and then a gamified version of flashcard set B while the other half tests a gamified version of flashcard set A and a normal version of flashcard set B. Thus, one of the two test groups start with the gamified version whereas the other group starts with the non-gamified version. This should help prevent the possible error of one set of flashcards being more difficult than the other set. The test will be performed as an offline user study — the test subjects are asked to play through both of the two versions. They will be playing each version for six minutes (the equivalent of three play throughs of the gamified version). It is important that there is time enough for the test participants to play through the versions several times such that they are presented to each word and have a chance of remembering them. On the other hand they should not be afforded too much time as it will become too easy to remember the words and the difference between the two versions will be less visible — however, this method would afford more information about the long term motivational benefits of the gamified version.

During the test the following two hypotheses are tested.

Hypothesis one:

The gamified version of the flashcard exercise will yield a higher score from its users during a subsequent test.

The first hypothesis will be answered by subjecting the test participants to a spelling test after each play through.

Hypothesis two:

The test participants will prefer the gamified version of the flashcard exercises.

The second hypothesis will be answered by using an Intrinsic Motivation Inventory [32] (used to measure intrinsic motivation) for the design of the final questionnaire. Using the method will help ensure that the users are answering truthfully when asked questions about their experiences during the test. In short this method provides several questions that are related to the same answer (some more obvious than others) and if the test participants answer these questions incoherently they are likely not answering truthfully.

The test is designed such that one participant will attend the test at a time. Firstly, they are presented with an informed consent form in the form of the one presented by Sharp et al. [13].

During the test a fascilitator is present and the test participants are asked to play the game. Minimum interference from the fascilitator is required and the test subjects will only be told about the purpose and general content of the program that they are testing (explained what flashcards are and that their goal should be to remember as many words as possible for the subsequent test). A way to evaluate if the test subjects are engaged and immersed in the exercise is to not let them know for how long they have played and afterwards ask them how long they have been playing. This question will be part of the questionnaire which can be found on the DVD. The test participants will be asked to fill out the questionnaire after finishing the playthrough of both implementations. In between the two versions and after the second version they will be subjected to a spelling test where they are asked to spell all the words featured in the version they have just finished — they are presented to the word in English and asked to write it in Dutch. The spelling tests and the answers can be found on the DVD. In between the test participants, the games leaderboard is updated with the highscore of the previous test participant. During the tests the behaviour of the test participants is observed and any note worthy behaviour is recorded.

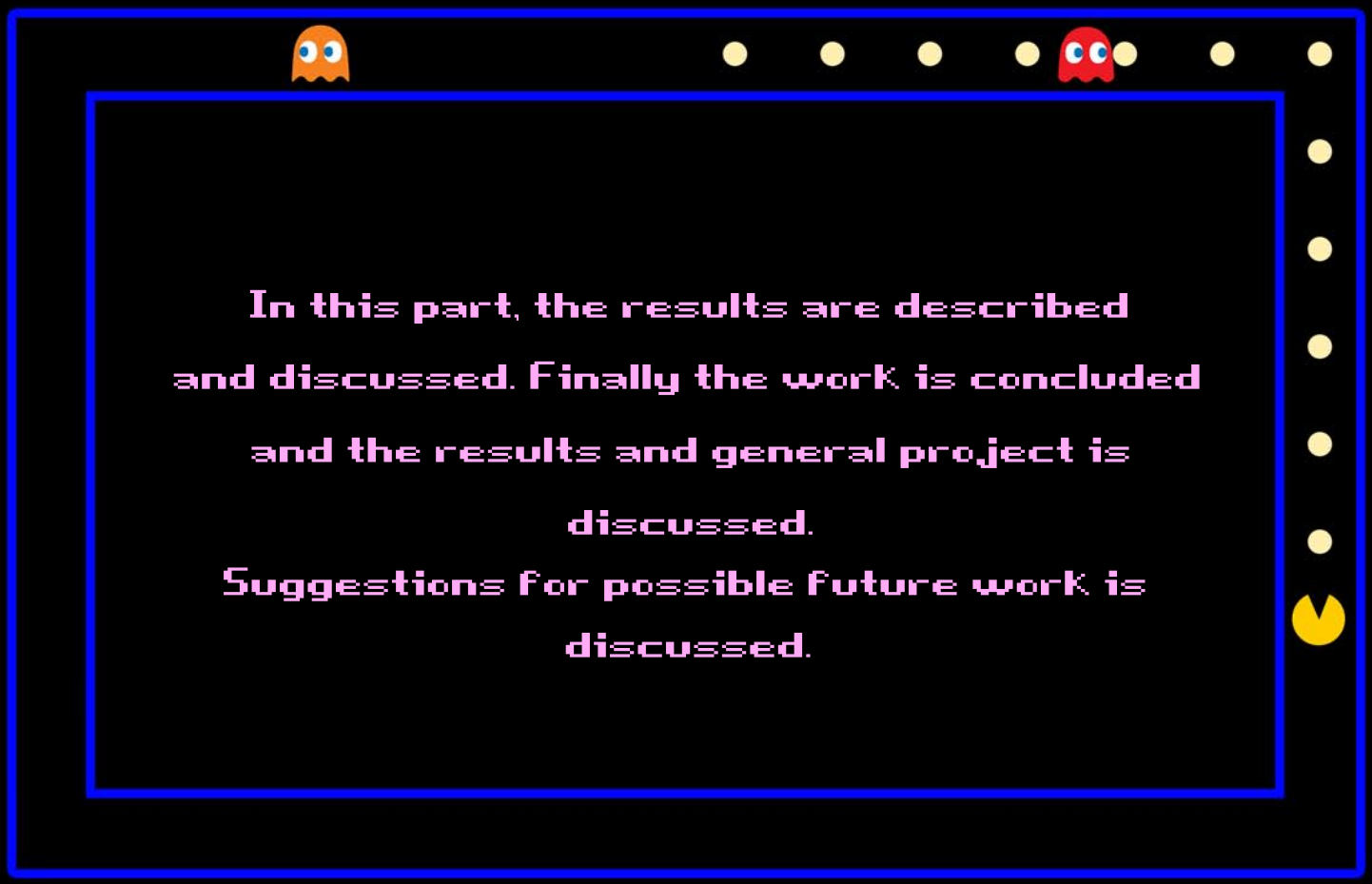
Averages of the user evaluations (answering on a scale from 1 to 7) of the question categories presented in the questionnaire are compared between the two versions of the flashcard exercise. For normally distributed data the answers are compared using a student's t-test and if any data is not normally distributed the Mann-Whitney U test is used. The use of these methods and the results are further explained in Chapter 10. To answer the first hypothesis, the number of correctly spelled words for each version will be compared — these are compared the same way as previously mentioned (student's t-test).

To succesfully complete the test a total of minimum 8 test subjects must participate. In general more test subjects will allow to conclude with more certainty, but to use a student's t-test a minimum of 8 participants is required.

Due to the implementation the facilitator will have to switch versions between tests and during tests when going from the non-gamified version to the gamified version or vice versa. It is during this time that the users will be given a test to answer thus freeing the time for the facilitator to make ready for the test of the next version. This test (pop quiz) is designed to tell if the test participants learned from the exercise they have partaken in — this is the data that is used for the student's t-test performed in order to verify the first hypothesis.

GAME
SCORE
100,000

Level Three



Chapter 10

Results

The test subjects were given two tests and two questionnaires. The hypotheses mentioned in Chapter 9 where that:

The gamified version of the flashcard exercise will yield a higher score from its users during a subsequent test.

and

The test participants will prefer the gamified version of the flashcard exercises.

The two tests show how many Dutch words the test participants have learned from each implementation whereas the two questionnaires show how much the test participants liked each implementation. By "liked" it is meant how much the users enjoyed themselves and how compelled they feel to use the implementation again if necessary.

10.1 Do Users Learn More From Gamification?

To answer the first hypothesis we must look at the means of the two samples from the tests (the gamified and the non-gamified sample). The mean of the gamified version is 15.7 while the mean of the non-gamified version is 17 (the mean refers to how many questions, out of 25, the test participants were able to answer correctly in the subsequent tests) — both sample sizes are 10. We can see that the test participants actually score higher in the subsequent test after playing the non-gamified version than the gamified version. To see whether this result is statistically significant a student's t-test is used to compare the two sample means. The α-value is set to 0.05, which means the the result will have a probability of 95% of being correct. First the distribution of the data from the two samples is found. To be normally distributed it would be expected that the data distribution is bell curved or close to being it (as there are more freedom with a smaller sample size). Using the normal distribution plotter of Wolframalpha.com [24] both samples from the tests appear normally distributed, hence the t-test will suffice to tell if there is a difference between the two sample means. To test this, the following hypothesis and subsequent null-hypothesis is used:

Hypothesis: There is a difference between the two samples.

Null-hypothesis: There is no difference between the two samples.

Using Excel to perform the t-test (the excel spreadsheets are found on the attached DVD) the p-

value is 0.49. This means that the null-hypothesis cannot be rejected — meaning that statistically there is no difference between the two samples. A larger sample size might have affected the outcome as well as only having the test participants test one implementation. As can be seen in the spreadsheets the test participants scored remarkably higher in the second test no matter which implementation it was, which could mean that they have gained some sort of knowledge of the language during the first test (although the words used are different). This means that it might be interesting to only look at the results of the first or the second test (this would, however, require more tests) — this will be covered more in Chapter 13.

These results tell that there is no statistically significant difference between the two implementations in terms of how much the users have learned within the frames of the experiments. This encompasses that the test participants had to take a test immediately after playing either version of the implementations. The test can be seen on the attached DVD.

10.2 Which Version The Users Prefer

To answer the second hypothesis the dataset from the questionnaires are used. This dataset is, as previously mentioned, based on an intrinsic motivation inventory task evaluation questionnaire targeted at measuring intrinsic motivation. This questionnaire features questions that are divided into four subscales: interest/enjoyment, perceived competence, perceived choice and pressure/tension. Of these four subscales, the first (interest/enjoyment) is considered the one that measures intrinsic motivation — the other are merely predictors of this. From the results of the questionnaires the only one of the four subscales where there, with 95% probability, is a statistically significant difference between the two samples (gamified and non-gamified implementation) is the interest/enjoyment subscale. The other subscales are remarkably alike. The hypothesis and non-hypothesis is the same for this question as for the other and by having a p-value below 0.05 (0.026) the null-hypothesis was rejected in the case of the interest/enjoyment subscale.

The users were also asked if they would use a game like this for a similar task in the future (on the same 1 to 7 scale) and although the results suggest that the users would use the gamified version (rated 4.9) over the non-gamified version (rated 3.5) the difference was not statistically proven thus the ratings cannot be said to belong to different samples. This means that the Null-hypothesis was accepted — meaning that with 95% probability the two samples are not different. However, the results indicate that the users will be more likely to use the gamified version over the non-gamified version for similar tasks in the future.

Lastly, the users were asked if they felt motivated to play the game again. Again, the hypothesis is that there is a difference between the two samples whereas the null-hypothesis is that there is no difference between the samples. With a p-value of 0.045 the null-hypothesis is rejected and therefore there is 95% probability that the users actually are more motivated to play the highest rated (the gamified) implementation again.

10.3 Discussing Results and Observations

From the spreadsheet (Quiz Test) on the attached DVD it can be seen that the users all score significantly higher scores in the second test — regardless of whether it is the gamified version or the non-gamified version. This might indicate that another approach to the test could be beneficial for the results. Although the circumstances are equal for both version, this method does yield a higher variance in the test scores which makes it more difficult to reject the null-hypothesis. This is due to the fact that the p-value is not only calculated based on the mean score, but also the variance of the scores (the range).

It was proven that the users were more motivated to continue playing the gamified version whereas there was an indication that the users learned slightly better from the non-gamified version, although this could not be statistically backed up. This indicates that some of the features that makes the gamified implementation more joyful and motivational decreases the short term learning potential of the exercise. Whether the increased game time that may result from more enjoyment and motivation yields a better long term result is unknown. It would be interesting to change the product in order to avoid the possible harm of the learning potential — for example by implementing spaced repetition. The questionnaire answers indicate that the gamified version is more stressful than the non-gamified version. Being more stressed could affect the learning potential of the test participants. Although the intention of the countdown clock is to provide the tempo needed for flashcards it might also stress the players.

During the tests it was observed that throughout the three times that the test participants had to play the gamified version, their in-game score increased drastically each time. During one of the tests the test participants was waiting in an adjacent room and through the door it was audibly observed that the test participants were comparing scores and regretting their mistakes in the game. Several of the test subjects showed frustration and joy during the gamified implementation.

Remarkably, the only two of the ten test participants who enjoyed and prefered the non-gamified version more than the gamified version were also the ones who had the lowest in-game score during the tests. This may have an effect on their enjoyment and for future reference this should be kept in mind. The low scores does not have to be the reason — it may be the other way around (that they performed badly because they did not find it interesting). If the low score is the reason, then measures must be made to minimise this issue.

Chapter 11

Discussion

During this work the method used was a case-specific approach due to the outcome of the theoretical analysis and discussion. Gamification was analysed and discussed and the result was implemented in a specific product in order to test the validity of it. The resulting test is difficult to infer any general knowledge from. Another approach could have been to simply use one of the existing definitions like that of Zichermann and Cunningham [48] and only look at the seven game mechanics they claim are implemented in every gamification. Systematically testing the use of these elements or rather the exclusion of these would provide useful general information about whether all of these seven game mechanics are in fact necessary. Also, the approach was from a user and especially designer's perspective, but another option could have been to work with gamification in a marketing context. However, it was chosen to focus on gamification in education given the lack of work that has been carried out in this field — which was a motivational factor for the author of this work.

Regarding the test carried out to verify if the gamified implementation is preferable to the non-gamified product, it could have proven beneficial to motivate the users to partake. The language that the users would have to learn is Dutch and this is undoubtedly not very motivating seeing as they have no use for it. Instead of entering a draw for a prize another solution could have been to award the highest scoring (during the quiz test) test participant with a prize, thus providing them with an incentive. However, this could also be counter productive as it would work as an extrinsic motivation and provide more joy to the non-gamified implementation while making the gamified implementation less enjoyful. The problem still remains, that under usual circumstances one would use either of these programs in order to achieve a goal such as learning a language — a solution could be to, for example, use a class of immigrants who are learning Danish. This would, however, make it more difficult to test as they already have an understanding of the language, thus it would have to be a fairly new class. As mentioned previously it would also have been beneficial for the results if the users had only played through one implementation instead of both as this gave them some knowledge of the language when playing through the first implementation that they could benefit from during the second implementation.

The implementation was, to a certain degree, influenced by the seven game mechanics mentioned by Zichermann and Cunningham and thus the test shows at least how these mechanics coupled with a specific approach compare to a non-gamified product. Although it is case-specific the results do show that the gamified version is preferable in terms of enjoyment and motivation, although it also highlights an issue that was not given much thought beforehand. Throughout the literature used for and cited in this work it was remarkably how little attention (if any) was

given to the fact that when gamifying a product you have to make sure not to interfere with the fundamental functions of this product. On the contrary you should use the game mechanics not only to make it more entertaining and motivating, but to support the function of the product.

Chapter 12

Conclusion

The analysis and discussion resulted in a method that requires a case-specific approach to gamification. Therefore the test was designed to tell whether the implemented product was preferable in terms or enjoyment & motivation and in terms of learning potential. The test showed that the product created for this project was, in fact, more joyful and motivational than the other implemented digitalised flashcard game (made in order to represent a non-gamified version of flashcards). This proves that, given the test participants answered truthfully (which the questionnaire was designed to make sure they were) the gamified version could possible provide higher user retention because of the more entertaining content. However, the results also indicated that the users did actually learn fewer words from playing the gamified version than the non-gamifying version. Therefore it may require more long term research to verify whether the gamified version is preferable.

Chapter 13

Future Work

There are many different possible changes and improvements that can be made concerning research within the field of gamification in education. For this work, the project created can go through another iteration in which it is redesigned in order to fix the problem of lower learning potential compared to the traditional flashcard exercise. Alternatively, the current product(s) can be tested again, using more test subjects and only letting each test subject play through one of the two implementations — this can give a statistically more valid result regarding the learning potentials of each version. However, the current test does provide an indication of lower learning potential in the gamified implementation. Spaced repetition can also be implemented in the gamified version to see if this has any effect on the results. In general, there are many different design choices that can be made in terms of which game elements should be included in the game and how they should be implemented — therefore it is difficult to pinpoint exactly what changes can be made, but the use of user feedback and several iterations can help to create a better and more efficient product that, optimally, should be as motivating and joyful or more.

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