Gamification - a study of motivational affordances

Jan Øyvind Engedal - 130584

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Department of Computer Science and Media Technology

Gjøvik University College

Avdeling for
informatikk og medieteknikk
Høgskolen i Gjøvik
Postboks 191
2802 Gjøvik

Department of Computer Science
and Media Technology
Gjøvik University College
Box 191
N-2802 Gjøvik
Norway

Abstract

Gamification is the use of game mechanics and game design elements to increase user motivation and enjoyment in non-game related context. This master thesis investigated the potential differences between the 10 most used motivational affordances, and how they are mapped to different players and learners, characterised by various player types and learning styles. The player categorisation model used in this study is Nick Yee's model, which is a categorisation of users' motivation to play games and consists of the 3 categories Achiever, Social and Immersion. The chosen learning style model is the revised Index of Learning Styles designed by Felder and Silverman. The ILS consists of 4 pairs of independent dimensions of learning styles: Active/Reflective, Visual/Verbal, Sensing/Intuiting, and Sequential/Global. The results show that the player categorisation Achiever has a significant correlation to the motivational affordances Leaderboards ($P < .00$), Levels ($P < .00$), Achievements/badges ($P < .004$) and Challenge ($P < .003$). The player categorisation Social has a significant correlation to Levels ($P < .00$), Story ($P < .001$) and Challenge ($P < .001$). Immersion has a significant correlation to Story ($P < .00$), Levels ($P < .005$), Clear goals ($P < .004$). There were no significant correlations between the motivational affordances and the learning styles, and therefore no correlation between the player categorisations and the learning styles.

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1 About the thesis

1.1 - Problem description

Gamification is the use of game design elements and game mechanics in order to increase user engagement and enjoyment in non-game context. Earlier studies (Hamari et al, 2014 & Koivisto, Hamari, 2014 & de-Marcos et al, 2013) have shown the positive effects of gamification, mainly it is ability to increase user's motivation and engagement by using game elements such as points, as a reward for completing a task. However, the studies show that some users report negative effects from the implementation of gamification. E.g. not all users get motivated by the increased competition that leaderboards introduce to an activity. This suggests there are individual differences to the effects of gamification and that users react differently to the different motivational affordances used by gamification. Player type models have been designed in an attempt to categorise players into different player types. Some models are based on the personality traits of the player, while others are based on in-game characteristics and behaviour of the player. The goal of a player type model is to account for users' individual differences when designing games to attract certain player types.

Gamification has been present in learning and educational environments since 2010 (Laster). There is a widespread belief in education environments that individually tailored teaching methods are the most effective (Howard-Jones, 2014). Similar to player type models, attempts have been made to categorise learners into different learning style models. A learning style model is a classification of how an individual best gains new knowledge and learns new information. The concept of learning styles is to design teaching methods that meets the need of an individual's learning style in order to increase the learning outcome.

Understanding the relationship between player types and their relation to game elements and game mechanics can help us make meaningful choices when designing gamified systems. Some believes that customizing game elements and game mechanics to target individuals

based on their personality, will increase their intrinsic motivation instead of extrinsic motivation (Ferro et al, 2013).

In this study we have investigated the potential differences between the individual motivational affordances, and how they interact with different players and learners, characterised by various player types and learning styles. This report is intended for game designers, game developers and interaction designers to increase the effectiveness of gamified systems and applications in educational context.

1.2 - Motivation

Earlier studies highlight the lack of research into the underlying factors of gamification in game mechanics and game elements in relation to motivation. Multiple researchers have encouraged research into this field, to clarify why there are differences in the effects of gamification in the context of education, most recently Hamari et al (2014), Konert et al (2013), and Koivisto & Hamari (2014). Hamari et al suggested research in how different player types experience the motivational affordances found in gamification. Konert et al suggested to investigate how established models can be combined and used together to keep players state of flow in context of playing and learning. Koivisto and Hamari suggested future work to better understand the psychological outcomes and what attract users, in terms of the personality traits and player types, in relation to gamification.

To better understand the underlying factors described in Section 1.1., this master thesis investigated the role of the individual motivational affordances that gamification uses and how they are mapped to different players and learners, characterised by various player types and learning styles.

1.3 - Research question

The master thesis answers the following research question:

- Which motivational affordances used in gamification do different players and learners get motivated by?

The main research question divided into smaller research questions:

- Which motivational affordances do different players get motivated by?
- Which motivational affordances do the different learners get motivated by?
- Are the motivations of players and learners correlated to each other, in terms of the motivational affordances found in gamification?

1.4 - Explanation of terms

Players - People who play games.
Player type model - A theoretical framework of different player types.
Player type - A player type is a categorisation of a player, based on characteristics of their in game behaviour or personality traits.
Learners - People who study something.
Learning style model - A theoretical framework of different learning styles.
Learning style - A learning style refers to how an individual best learns new information.
Motivational affordances - The objects (game elements) used in gamification which can stimulate one's motivational needs, leading to an increase in enjoyment and engagement.

Get motivated by - The participants of the online survey were presented to two statements of each of the selected motivational affordances. They were asked to choose from a Likert scale if they agreed to the statement or not. The scores were assumed to reflect the participants' motivation for each affordance.

2 Introduction

This chapter presents the background for this master thesis. Section 1 investigated the history and precursors of gamification, while also looking into the concept of gamification and motivation. Section 2 investigated the basics of game design. Section 3 explored similar studies found within gamification. Section 4 investigated how to categorise users into different player types, while Section 5 investigated how to categorise users into different learning styles.

2.1 - Background

Today gamification is a widely known term in the field of Human-Computer-Interaction (HCI), but it was first coined and introduced as a term in 2002 by Nick Pelling (Marczewski, 2003). The current industry uses two related concepts when explaining the concept of gamification. The first one being the ubiquitous use of games in everyday life, while the second is the use of video games' ability to motivate and engage users in non-game context to increase the engagement and motivation of users (Deterding et al, 2011). As Zheng (2010) points out, the idea of gamification has been around for centuries, but only recently has there been an academic interest in studying the underlying game mechanics of gamification. Its first documented use was in 2008 and originates from the digital media industry (Deterding et al, 2011).

Erenli (2012) shows the potential of gamification in his analysis of players. According to Erenli, people who play games are not only youngsters. He presents that the average age of players is 37 and that they have been playing for an average of 12 years. 97 percent of youth are playing video games. Among the statistics, there is a claim that games are already present at the workplace: 46 percent of German employees and 61 percent of CEOs and CFOs are playing games during their work hours. This suggests that the stakeholders are familiar with the subject of gamification. A Gartner research report (2011) claims that by 2015, 50 percent of organizations that use innovative processes will gamify those processes. Examples of modern

use of gamification can be rewards for using your credit card, levelling up your level on web pages by completing a certain set of tasks or receiving badges and achievements based on your contribution in a virtual environment.

Gamification is a relatively new term and has similarities within other terms in the Human-Computer-Interaction research, such as the use of technology to influence user behaviour and engagement. The following Sections explored the rather similar terms and explains their relations to one another, to give justification of the term gamification. It is important to understand how gamification has evolved from these precursors and made itself a stand-alone term within digital media.

With the rise of user experience as a profession, researchers focused their efforts on *hedonic attributes* or *motivational affordances* of *pleasurable products*. According to Deterding et al (2011), the field was dubbed *funology*, the science of enjoyable technology, with inspiration taken from *game design* (Schell, 2015). Researchers looked at games with a purpose, where incorporating game design elements such as game controllers and game interfaces, made seemingly boring tasks more enjoyable. This lead to the term *playfulness.* This term can be used broadly, as it is frequently used when describing any *pleasurable experience* or every interaction that goes beyond utilitarian work and task context.

Serious games are another precursor or parallel to gamification. It is often described as games used as a tool to help the users learn something and with the intention of being more than entertainment. The use of serious games dates back to the early 2000s and migrated from mainly military use, into education and business fields.

In parallel to serious games, *pervasive games* emerged and evolved as new game genres brought games into new context, situations and spaces. A pervasive game is often described as blending the virtual and real world together. Examples of such games are games that use Augmented Reality and the user's location as part of the game experience by overlaying information on the surrounding environment.

It is clear that there are already a number of potentially similar, overlapping, competing concepts within HCI research, yet gamification has been established as a common household term. By defining the core concept of gamification, we eliminate any confusion between gamification and the terms introduced in this Section. There are different definitions in use, among others the one proposed by Deterding et al: “Gamification is the use of game design elements in non-game contexts.” (Deterding et al, 2011, p.10). Examples of gamification used in non-game context can be found everywhere. Drawing from my own experiences, an attempt was made to gamify the process of selling by-products to customers calling to a call centre I worked at, in order to increase the sales. The head of sales introduced a leading board where all employees would add their sales during the day. The employee who managed to sell the most products won the competition, and were given a bottle of wine at the end of the week. Another example of non-game context, is how parents gamify chores for their children by designing a task and reward system. The points can be used for rewards such as increased candy on Saturdays or other fitting rewards.

The definition presented by Deterding et al lacks details and can therefore be interpreted and used broadly. Erenli (2012) investigated the term gamification and the use of non-game context in an attempt to improve the definition. In his work, Erenli uses research from Caillois and Crawford to understand what a game is. Crawford’s definition is described as: “an interactive, goal-oriented activity, with active agents to play against, in which players (including active agents) can interfere with each other” (Erenli, 2012, p. 2). Erenli suggest that non-game context can be expanded to mean games used for purposes other than their expected use for entertainment, such as motivation for use in educational context. Other purposes of gamified applications can be to increase the use of a service or change the behaviour of users (Zichermann, Cunningham, 2011).

To effectively conduct a study on the motivational affordances used in gamification, increasing the understanding of gamification is necessary.

2.1.2 - Game elements

Game elements are used as a part of the design strategy of gameful experiences. In contrast to serious games, which fulfil all conditions of being a game, gamification uses only selected elements from games. The intention of gamification is to use the selected elements to influence a change in the behaviour of a user, such as increased engagement, enjoyment and motivation.

Various game elements can be found outside games and can be argued to not be game-specific. Deterding et al (2011) refer to the *Ten ingredients to a great game*:

1. self-representation with avatars,
2. three-dimensional environments,
3. narrative context,
4. feedback,
5. reputations, ranks and levels,
6. marketplaces and economics,
7. competition under rules that are explicit and enforced,
8. teams,
9. parallel communication systems that can be easily configured,
10. time pressure.

Erenli argues that deciding if something is already a gamified application or a game is a question of personal point of view and usage of the element. The game elements play an important role in the design of games and in the concept of gamification. The ten ingredients presented in this Section are short and a simplified version of the game elements. A thorough review of game elements will be presented in Section 2.3.

2.1.3 - Motivational aspects: two contrasting categories

Gamification is said to increase its user's motivation and engagement. This Section is devoted to explain the two main categories the academic field uses when discussing motivation.

Modern research categorises the way people get motivated into two main categories called *intrinsic* and *extrinsic* motivation. Intrinsic motivation refers to the motivation of doing something because it is inherently interesting or enjoyable, known as internal factors. Extrinsic motivation refers to doing something because it leads to a separable outcome, meaning external factors. Extrinsic motivation thus contrasts to intrinsic motivation (Ryan, Deci, 2000).

A common model of a gamified activity, is to equate an activity with points and have external rewards for completing certain tasks. This model has received critique of focusing too much on the extrinsic motivation. Successful gamification should therefore strive to reach users through their intrinsic motivation for an activity because humans are inherently motivated by intrinsic motivation (Nicholson, 2012). Although rewards can influence people's behaviour, the primary negative effect of using external rewards is that they tend to undermine intrinsic motivation and the people's responsibility for motivating and regulating themselves (Deci et al, 1999).

2.1.4 - The two main components in playing: Paidia vs Ludus

Deterding et al (2011) believes that gamification represent a new, distinct phenomenon, the complex of gameful interaction, gamefulness, and gameful design, which are different from the playfulness' concepts. A summary is presented to explain the different terminology used (Deterding, 2011, p. 11):

- *gamefulness* (the experience and behavioural quality),
- *gameful interaction* (artifacts affording that quality), and
- *gameful design* (designing for gamefulness, typically by using game design elements)

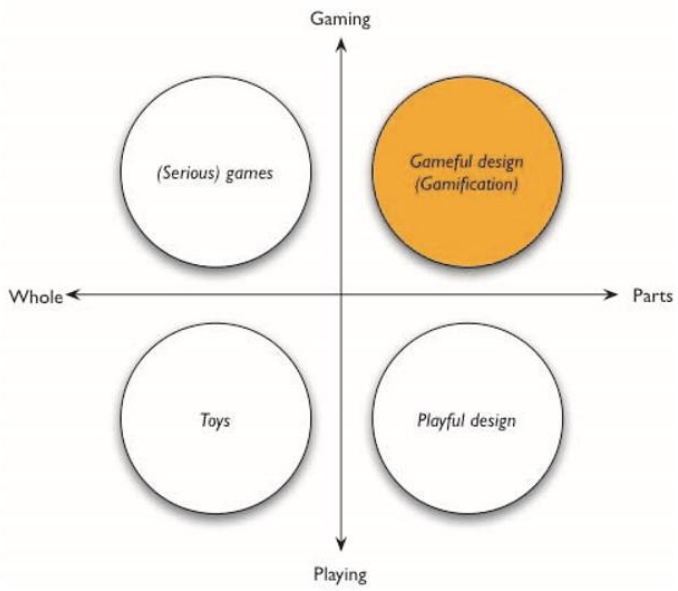

Figure 1 - "Gamification" between game and play, whole and part (Deterding, 2011, p. 13).

Roger Caillois discusses the two concepts of *play* and *game* in his book "Man, Play and Games" (Caillois, 1961). Whereas a game is a competitive, structured game with a clear goal or purpose, play is an unstructured, free form improvisation with no particular goal in mind. The two terms represent two different kinds of play styles. The paidia play style is described as games which are entertaining and made for the purpose of having fun, with no main objective or outcome. Ludus represents the contrasting play style, games which have objectives and missions to achieve. Games are often made with both play styles in mind. Some argue that gamification is mostly related to ludus, not paidia, because gamification follows a basic set of rules (Deterding, 2011). Yet, gamification often can and will give its users playful behaviours and mindset by mixing the concepts of paidia and ludus.

2.1.6 - The novelty effect

Some argue there are some underlying factors that influences the effects of gamification (Hamari et al, 2014, Koivisto, Hamari, 2014). One these factors may be the novelty effect.

The *novelty effect* refers to the tendency for human performance and engagement to initially improve when something new is introduced in a process. The human performance increases

due to an increase of interest from the introduction of new technology, not increase in actual performance or skill. The novelty effect gradually fades as users get more familiar with the technology and elements introduced. Introducing gamification to a seemingly boring task will usually result in a highly perceived enjoyment as the tasks is *played* with the use of new technology. After a while, the users become bored as most gamified applications lack the necessary game elements and mechanics to keep them satisfied. Poor understanding and use of game elements results in poor user experience, because the novelty effect will fade if new elements are not added.

The novelty effect is often deliberately used as a game mechanic to keep users from becoming bored when playing games. Introducing new elements such as unlockable characters, a new dungeon to explore, levelling up and learning new skills, each contribute to the novelty effect within a game. Even new content can be introduced as a means to provide players increased enjoyment from games. The novelty effect may in fact be one other factor influencing the sudden increase in engagement and enjoyment of users testing out new features or techniques when using gamification, especially those studies that are over a short time period.

The study conducted in this project focuses on the motivational affordances, but it is still important to be aware and know of the novelty effect and how it can bias users.

2.1.7 - Conclusion

The concept of gamification is to increase the users' engagement and motivation by using game design elements to trigger players' motivations to play games, in non-game related context. Game design elements can be referred to as *motivational affordances*, because it is these elements that when implemented impacts the users of a gamified application. The term motivational affordance can be explained as objects with properties which can stimulate one's motivational needs, leading to an increase in enjoyment. The ultimate goal for using motivational affordances in the design of a product for human use, is "that the users will feel attracted to it, really want to use it and cannot live without it" (Zhang, 2008, p.1).

Different approaches have been made to define gamification. Deterding's definition has its limitations, but is still widely used because of the simple and broad interpretation of gamification. Erenli suggest the following definition of gamification: "Gamification is the use of game elements in contexts that had originally no link to game related elements" (Erenli, 2012, p. 7).

Being aware of how gamification is defined by researchers within the HCI field, increases the understanding and the main goal of gamification; to use motivational affordances to influence a user's behaviour in non-game context.

2.2 - The basic elements of Game Design

Effort was made to increase the understanding of terms used to explain gamification, game elements, game mechanics and game design elements. Therefore, this Section investigated the field of game design to better understand what it is and how it works, in relation to gamification.

One model that is used as a framework for designers and researchers is the MDA model. It stands for Mechanics, Dynamics, and Aesthetics. This model is a formal approach to understanding games, which attempts to bridge the gap between game design and development, technical game research and game criticism. The model formalizes the consumption of games by breaking games down to their core components: Rules, System, Fun. The designers counterparts are Mechanics, Dynamics, and Aesthetics. Hunicke et al (2004, p. 2) gives the following description of the three components:

- **Mechanics** describes the particular components of the game, at the level of data representation and algorithms.
- **Dynamics** describes the run-time behaviour of the mechanics acting on player inputs and each other's outputs over time.

- **Aesthetics** describes the desirable emotional responses evoked in the player, when she interacts with the game system.

In his book *The Art of Game Design - A Book of Lenses* (Schell, 2015), game designer Jesse Schell writes about the basic elements that makes up a game, based among others, the MDA model. Schell refers to the categories as the *element tetrad* and they consist of *Aesthetics*, *Mechanics*, *Story* and *Technology*. A brief explanation of the four elements will follow. One of the fundamental elements that transcends various game design models, is mechanics.

Aesthetics

Decides how your game looks, sounds, smells, tastes and feels. This strongly correlates to how the player experiences your game. This is the most visible of the elements.

Mechanics

This element consists of rules and procedures, defining the goal of your game. It also affects what actions players can and cannot do. This game element is the most used in gamification, and will be explained in more detail in Section 2.2.1.

Story

This element gives your game context, describing events unfolding within the game.

Technology

This includes the technology required to play your game; pen and paper, plastic figures, cards, dices or other materials and interactions to make your game possible to play.

All of these elements combines and relates together and as Schell points out: "*None of the elements are more important than the others.*" (Schell, 2015, p. 52). Although all elements are considered equally important in making a game entertaining and fun, the game element that

is most frequently used in gamification, is the mechanics. Therefore, the focus in the following Section will explore the different kinds of game mechanics.

2.2.1 - Game mechanics

Schell talks about 7 different kinds of mechanics in his book; Space, time, “objects, attributes and states”, actions, rules, skill, chance.

Space

Every game needs to take place somewhere, in some kind of space. The space is only a mathematical construct and provides the abstract places which a game operates in. Most games use 2D or 3D environments, and are either discrete or continuous and “*have bounded areas that may or may not be connected,” (Schell, 2015, p. 159)*.

Time

Just as space, time can be discrete or continuous. Discrete time can be measured by taking turns, where the time between turns are non-existent to the game, e.g. strategy games such as Civilization. Continuous time is used in action games and sports. Some games use a mix of the two time systems.

Objects, Attributes and States

Something needs to occupy the space of your game. Anything that can be manipulated or seen, falls into this category and can include characters, props, tools, etc. The objects have attributes that give information about the current state of an object to the player. Schell uses a racing car as an example, where the racing car is the object. The racing car has two attributes, current speed and maximum speed. The state of current speed gives information about how fast your car is going and the maximum speed gives information about your racing cars maximums speed.

Secrets

Not all information is available to the player. It depends on which type of game you are playing. In board games all information is visible to all players. In some card games, only a deck is visible to all players, but the player's own cards are a secret to the others. Video games uses secrets to reward the player with new information by e.g. exploring a previously unknown area, completing certain tasks or quests.

Actions

This refers to what the player can do within your game. Schell explains there are two ways of explaining actions, the basic actions which are short term and strategic action which are long term. Any action is carried out by the player in his quest to achieve a goal.

Rules

Rules define the space, the objects, the timing, the actions and the consequences of actions, the constraints and the goals of the game. Schell explains that the rules are the crucial thing that makes a game a game, because they make all the above mentioned mechanics possible. Rules are enforced by using a referee in sports, but video games use the computer to make sure that rules are followed. This makes for complex rules and higher richness in video games. An enforcer (referee or computer) is needed to prevent cheating, and as Schell points out, players will try to cheat to achieve victory. If a game is easily cheatable, some players will try to cheat and others will no longer want to play.

Skill

Most games require several skills from the player, and can generally be divided into three categories: physical, mental and social skills. Players can exercise these skills to improve their gameplay.

There is a difference between real and virtual skills. Virtual skills are when your character levels up from gained experience points, while real skills can be related to quick reflexes or cognitive thinking - e.g. understanding of game mechanics. In an action game you need quick hand reflexes to react to different moving parts on the screen, while in a chess match, your reflexes are not important, but your skill to think ahead and plan your moves. Schell recognizes the fact that most games comes with a mixture of virtual and real skills.

Chance

The last mechanism is chance and is an essential part of a fun game. In board games such as Monopoly, you roll the dice to move your car, making the square you land on decided by chance. In the same game, you draw a card from the deck whenever your car lands on a chance square. The card you draw is a chance of all the cards in the deck, provided it's been shuffled. Another example is in the game Civilization, when one of your explorers find an ancient ruin, you are given 1 out of 7 possible rewards for exploring them. Giving games elements of randomization and chance makes endless variations possible, hopefully preventing the player to become bored.

Different games use its own set of game elements, and does not necessarily use the same elements. E.g. strategy games can differ from first person shooters/action games in time pressure, or the use of avatars. Therefore, Deterding et al (2011) suggest restricting gamification to incorporate *characteristics* of game elements, meaning not necessarily all elements might be present or play a significant role in gameplay. There are still debate of the heuristic definitions of the characteristics for games. Seen from a designer's point of view, gamification is different from regular entertainment and serious games because it merely incorporates elements from games, not a full game proper.

As mentioned in Section 2.2, there are four basic elements that makes up a game. People who use gamification mostly focuses on the game element mechanics and as we now can see, that is only 1 of the 4 required to make a *good* game, but how do we decide if a game is good or not?

2.2.2 - What is a *good* game?

Most players play for *fun* and their goal is to be *entertained*. Does that mean that a good game needs to be fun and entertaining? Not necessarily, because not all games have the same goals. The intention behind the use of game elements and mechanics is decided by the goal of the game. E.g. serious games designed for education, health care or military training, use game elements and game mechanics for that purpose. When only one of the four basic elements

are used the gamified application or system will most likely be considered boring after a while. The success of gamified applications and systems will increase if more than one game element are considered in the design.

One of the game elements Schell mentions in his element tetrad (see Section 2.2) is the story element. A story can increase the user experience by giving the player choices that gives the game a meaning. The story gives the game a context and communicates the required goals for the player to achieve victory. Different games have different goals, e.g. to save the princess or collect all the parts necessary to build the game winning wonder. A good game is when the player has a good experience playing the game. All of the above mentioned game mechanics and elements are essential parts in the making of a good game, to fulfil the players' goals and to provide engaging experience.

Now that we have an understanding of what gamification is and the basic, required elements good games consists of and that should be used in any gamified system or application, the following Section investigated the different effects of gamification.

2.3 - Different effects of gamification

As mentioned in Section 1, studies have shown positive effects from implementing gamification in terms of increased motivation and engagement. However, studies show individual differences between users of the studies.

de-Marcos et al (2013) measured the difference in using gamification and social networking on e-learning. Their results showed that the participation level from the gamified group were lower than those of the social networking group. They claim that this is logical as social networking promotes collaboration and participation, while gamification may lead to increased competition. According to de-Marcos et al: "the gamified approach that promotes achievements, collections and competitions does not necessarily stimulate participation" (2013, p. 9). This study contributes to the argument that users react differently to the different

elements that are said to increase motivation, and that some of them might actually decrease participation.

Another study (Koivisto and Hamari, 2014) aimed to look for demographical differences in the perceived outcomes from a gamified exercised application. The study concluded that there are gender differences and that there are some practical implications for future gamification design. They discovered that age differences only impact the perceived ease of use. The ease of use seemed to diminish with the effect of age. Another discovery was that female users appreciate the ease of use more than men. They also discovered that women are more engaged in social activity than men, suggesting that the implementation of social activity can increase the motivation for female users.

2.4 - Motivational affordances

Effort was made to find studies which studied the effects of the motivational affordances used in gamification. Juho Hamari et al (2014) did a literature review of peer-reviewed empirical studies on gamification. Their goal was to study already done research on gamification to see if there were any evidence that suggest that gamification work. They focused their review's research explicitly on studies of gamification and motivational affordances. The studies reviewed in their article could be generalised into this research question: *Does gamification work?*

The article created a framework examining the effects of gamification, and collected and combined the most used motivational affordances in the peer-reviewed studies:

Affordances	Included in the study
Points	[4][13][15][16][23][27][34][37][41]
Leaderboards	[4][10] [13] [15] [16][21][23][27][37][41]
Achievements/Badges	[2][8][10][17][20][22][25][27][34]
Levels	[11][15][16][21][27][37]
Story/Theme	[12][18][21][23][33][36]
Clear goals	[11][27][32][33]
Feedback	[4][11][21][27][32][33]
Rewards	[12][18][33][36]
Progress	[14][18][27][33]
Challenge	[4][13][18][21][23][27][33]

Figure 2 - List of the most popular motivational affordances used in gamification (Hamari et al, 2014).

The results suggest that gamification does work in terms of increasing the motivation and engagement of the users, but the results shows both positive and negative results. Hamari et al (2014) reports that within the quantitative studies reviewed, only two studies showed all tests positive, while a number of the studies reported that only parts of the tests were positive. Some of the quantitative studies only yielded descriptive statistics, backing up the suspected underlying factors to play a role of how impactful and what the effects of gamification really are, which they argue is mainly the role of the context being gamified and the qualities of the users. Freeform feedback was used by some respondents to report negative effects from certain motivational affordances, which were mostly perceived positive from other users.

There are some limitations to the peer-reviewed studies analysed in the literature review done by Hamari et al. For one, the sample sizes in some of the studies (around N=20) were small. Some studies relied solely on user evaluation and self-reporting by lacking a control group. Another limitation is that the motivational affordances were investigated as a whole. This means that any effects from individual affordances were not measured and taken into account. The novelty effect could have an impact to a number of studies because the short

timeframe. Future work should therefore try to avoid the same pitfalls as the peer-reviewed studies found in the review of Hamari et al (Hamari et al, 2014).

According to Ping Zhang, the most relevant affordances to use in information and communication technology (ICT), are psychological, social, cognitive, and emotional sources of motivation (Zhang, 2008). Zhang constructed design principles based on intrinsic motivation.

- principle 1: support autonomy,
- principle 2: promote creation and representation of self-identity,
- principle 3: design for optimal challenge,
- principle 4: provide timely and positive feedback,
- principle 5: facilitate human-human interaction,
- principle 6: represent human-social bond,
- principle 7: facilitate one's desire to influence others,
- principle 8: facilitate one's desire to be influenced by others,
- principle 9: induce intended emotions via initial exposure to ICT,
- principle 10: induce intended emotions via intensive interaction with ICT.

Zhang claims that using these design principles can support people's motivational needs in ICT, although ICT designs are still heavily dependent on their users, tasks and contexts.
The model presented by Zhang is constructed as design principles, while the 10 affordances presented by Hamari is specific affordances found in other surveys. It was therefore decided to include Hamaris affordances in the survey.

2.5 - Learning style models

A learning style model is a classification of how an individual best gains new knowledge and learn new information. The concept of learning style models is used in this study as a categorisation tool of learners. The Learning style models are similar to Player Type Models

because they are based on individuals' personality and used as a categorisation method in an attempt to meet the needs of different personalities. Gamification is used as a motivational tool in educational environments and earlier studies have shown that categorisation into different player types can be beneficial when trying to reach different individuals (Monterrat et al, 2014). The second research question presented in Section 1.3 is investigating which motivational affordances different learners get motivated by. Identifying which motivational affordances the different learners get motivated can increase the motivational effect when using gamification in education. The results can be used by interaction designers, game developer and game designers when designing gamified applications intended for educational purposes.

There are different Learning style models in use and this Section explored some of the models. By studying people's learning style preferences, it is believed that strategies can be developed to increase learning efficiency and learning outcomes for students.

2.5.1 - VARK model

One of the learning style models is commonly referred to as the VARK sensory model, where V stands for visual, A for aural, R for read/write and K for kinesthetic. The model is referring to the communication preference and deals with how an individual take in and give out information (Sidhu, 2014). Visual learners use graphs, charts, highlighters, picture and other graphics in their learning process. Aural/Auditory learners prefers interactive activities which includes discussions, seminars, lectures and debates. Read/write learners prefer physical tools/activities such as taking notes, writing essays, reading papers or web pages. Kinesthetic learners prefer participation activities such as laboratories, field trips, hands-on approaches, guest lectures and so on. They learn through trial and error, making practice and learning from experience. Individuals who possess a mixture of the four preferences are called multimodal.

2.5.2 - Learning Style Inventory

The Learning Style Inventory (LSI) model contains the two dimensions *Concrete/Abstract* and *Active/Reflective*. It provides an elaborated and evaluated model to calculate the learning style preferences of participating learners (Konert et al, 2013). The LSI indicate how consistent the students' responses are, displaying a computerized results showing the students preferred learning style.

2.5.3 - Index of Learning Styles

The revised version of the Index of Learning Styles (ILS) of Felder and Silverman (Felder and Silverman, 1988 & Konert et al, 2013) consists of 4 pairs of strong, independent dimensions of learning styles: *Active/Reflective, Visual/Verbal, Sensing/Intuiting,* and *Sequential/Global*. It differentiates among perception, provisioning, processing and understanding of the learning content (Konert et al, 2013). Similar to the LSI, the ILS provide computerized results showing the preferred learning style for students using the questionnaire.

Each model offers a different way of categorisation of users using different styles. One of the models were chosen and used in the online survey and will be explained further in Section 3.

2.6 - Player type models

A player type model is an attempt to categories players into different player types, by identifying characteristics that players exhibit within games (Bateman et al, 2011 & Ferro et al, 2013). Understanding how players act and react within games can help designers attract or alienate certain kinds of players (Yee, 2006).

2.6.1 - Bartle's Player Type model

Bartle's Player Type model (Bartle, 1996) is an informal, qualitative model which includes 4 different player types: Achiever, Explorer, Socializer and Killer. The model is the result of Bartle asking participants of a virtual online world called MUD, "what do people want of (MUD)?" and categorizing the answers into the 4 before mentioned player types. The Achiever act on the world and play to win in games, by being motivated by achievements and progress set by clear goals within the game. Socializer is motivated by interacting with other players in an interactive world. Explorers is motivated by exploring their surroundings and interacting with the world to gain new knowledge. Killers find motivation in attacking other players in an attempt to dominate and making their life hard within the virtual environment. All four Bartle's types are broad, but still give sensible categorization of player types. Although there

are limitations to Bartle's Player Types, it is still the most prominent model and should be a part of any discussion related to player type models (Ferro et al, 2013).

Figure 3 - Bartle's player type axes (Tuunanen, Hamari, 2012)

2.6.2 - Nick Yee's motivation of play model

Nick Yee continued the work of Bartle's player type model in his Deadalus Project (Yee, 2006). The project was a long term study of players in Massively-Multiplayer Online Role-Playing Games. While Bartle assumed that motivations of play suppressed other types of play and that the four types are independent types, this had at the time, not been empirically tested (Yee, 2006). Yees motivation for the study was to explore how players are motivated and if there are demographic differences to the players' motivation in relation to the usage patterns and in-game behaviours. Therefore, Yee used Bartle's model and used a factor analytical approach to create an empirically grounded *player motivation model*. His results show that play motivations do not suppress each other: "Bartle assumed that your underlying motivations "suppressed" each other. In other words, the more of an Achiever you were, the less of a Socializer, Explorer and Killer you could be, but just because you like ice-cream doesn't mean you will hate pasta." (Yee, 2006, p. 8). It is important to note that Nick Yee's motivation of play

model is not considered a player type model, because player types are independent. Nick Yee's motivation of play model will from here be referred to as Yee's model in this report.

Yee's results suggest there are 10 types of subcomponents that can be categorized into three main ones (Yee, 2006, p. 2):

- Achievement component,
    - advancement - the desire to gain power, progress rapidly, and accumulate in-game symbols of wealth or status,
    - mechanics - having an interest in analysing the underlying rules and system in order to optimize character performance,
    - competition - the desire to challenge and compete with others,

- Social component,
    - Socializing - having an interest in helping and chatting with other players,
    - relationship - the desire to form long-term meaningful relationships with others,
    - teamwork - deriving satisfaction from being part of a group effort,

- Immersion component,
    - discovery - finding and knowing things that most other players don't know about,
    - role-playing - creating a persona with a background story and interacting with other players to create an improvised story,
    - customization - having an interest in customizing the appearance of their character
    - escapism - using the online environment to avoid thinking about real life problems.

Yee's model was the chosen categorisation method of the users participating in the online survey.

2.6 - Related studies using player type and learning style models

A study done by Monterrat et al (2014) used the participants' player type to adapt the game elements used in gamification in a learning environment. They used this research question: *"How to adapt the game elements of a learning environment to learners according to their player types?"* (Monterrat et al, 2014, p. 2). They utilized a player type model called the BrainHex gamer typology (Nacke et al, 2014), which consists of 7 types of player types, and as the authors points out "*Contrary to previous typologies, the BrainHex one is not related to a specific game genre like MMORPG*." (Monterrat et al, 2014, p. 3).

The game elements used in their study were; Points counter, Badges, and Leaderboards.
Their study consisted of a generic model which could rely on two different association matrix specific to the game features implemented in the learning environment. One relied on expert judgment and one on empirical data. Their experiment proved that the expert-based matrix made 39% of the users spend more time on the learning environment than the members using the model based on empirical data, because the empirical model relied on a large amount of users, which the study lacked.

In conclusion, Monterrat et al's study shows that using and adapting gamification features to a player profile of learners is a good idea, because the features are experienced different between individuals. However, the study only identified the player type of learners, not in combination to different learning styles, but it still shows that individual adapted gamification can increase learning effects.

Questionnaires are often used when determining a user's learning style. The drawback of handing out questionnaires in classrooms, is that it takes time to gather and analyse the

answers. This has encouraged the means to discover other form of methods defining the learning style of users. In a study done by Konert et al (2013) they used the NEO-FFI (Revised NEO Personality Inventory) to measure the personality traits found in the Big Five personality model (McCrae, John, 1992), in an attempt to predict the user's player style and learning style. Konert et al aimed with this study to reduce the effort and amount of questionnaires users have to fill out when identifying their player and learner style. 72 students in the age of 12-14 years participated in the studies. The results did not fulfil the expectations of the study because their results were inconclusive, as no predictions of learning style preferences were possible. Predicting the player style preference were only possible for the player style Socializer found in the Bartle Player Styles model. The study's results show that to identify the user's player and learning styles, one need independent models and that it is not possible to make predictions using the Big Five personality model. Konert argues that the correlation between learner styles and player types are interesting in the sense that it can provide meaningful insights in how the different styles might correlate within gamification as well.

3 Methods

A survey was designed to test how the 10 most popular motivational affordances found in gamification interact with the different players and learners, in order to figure out how they get motivated. An investigation of existing studies and models of player types and learning styles in use were conducted. The main purpose of the investigation was to gain knowledge of the term gamification and to explore different avenues for similar research that could help the thesis, by looking at the three main components of the main research question: the motivational affordances used in gamification, different player type models and different learning style models. The data gathered from the study is presented in Section 4, while the discussion of the results is presented in Section 5.

3.1 - The online survey - chosen models

An online survey was chosen as the preferred method to gather data because of its ease of use and potential to reach many participants during a short time period. The survey was designed using models found in the investigation of literature.

3.1.1 - Motivational affordances

The motivational affordances were gathered by searching for similar studies that studied the effects of the individual motivational affordances of a gamified system or application. No studies were found doing this, however, it did find the review conducted by Hamari et al, (2014) which is presented in Section 2.2. The 10 most used motivational affordances found in their study were the chosen affordances tested in the online survey. It made sense to test the most used affordances in gamification and the list is more detailed and concrete, compared to the proposed design guidelines for affordances by Zhang (2008).

3.1.2 - Nick Yee's model

Nick Yee's model consisting of the three main components Achiever, Social and Immersion, were chosen as it has been empirically tested from Bartle's player type model. The outcome of his study resulted in main clusters of motivations of play, which does not suppress each

other. It is therefore not a player type model, but rather a categorisation model of the users' motivation to play games.

Nick Yee's study were designed for his daedalus project where the target user group were players of Massively Multiplayer Online Role-Playing Games, such as World of Warcraft. This means that the questions used in the survey are based on the expectation of knowledge of such games. Of the two questionnaires that could be used to identify the players' motivations, the smaller version which consisted of 10 questions were considered to be too simple. Therefore, the larger questionnaire consisting of 39 questions were chosen to identify players' motivation.

There was a concern by using Yee's model and questionnaire, that not all of the participants of the survey would understand the rather technical questions. Therefore, a pilot test was run with 3 participants which had no particular interest in online games. The results from the pilot test revealed that all 3 participants of the pilot study were able to understand the questions and provide meaningful answers. The pilot test reduced the vulnerability of participants not understanding the survey and giving false data based on their lack of understanding.

3.1.3 - Index of Learning Styles

The chosen learning style model is the revised version of the Index of Learning Styles (ILS) of Felder and Silverman (1998), and is one of the three models presented in Section 2.5. The ILS is designed for research purposes and is free to use. It provided scoring methods after submitting a form filling out information of the intended use for research purposes. The scoring sheet enabled the questionnaire to be implemented into the survey and translated into comparable numbers.

3.2 - Design of the online survey

The online survey was designed with some basic questions at the very beginning, where the participants were asked to select gender and rate how familiar they are with video games and gaming. Participants with no or low familiarity to video games could be considered to be

removed from the data pool, if the answers reflected no understanding of the questions. The following Sections will explain how the online survey was designed.

3.2.1 - Motivational affordances

The goal of the first Section of the survey was to map which of the individual motivational affordances got the participants motivated to play games. Two questions were designed for each of the individual motivational affordances with a Likert scale from 1 to 5, meaning a total of 20 questions in the first Section. The 10 affordances by Hamari et al (2013) show that some terms overlap, e.g. a reward can be given in terms of a badge or points. The questions to each affordance were designed after defining and operationalizing the affordances. The questions were designed as statements where the participants were asked to agree with the statement or not, by using the Likert scale. The definitions together with the questions is provided in Appendix A.

3.2.2 - Identifying players

The second Section of the survey determined the participant's main component of motivation, using the established model made by Nick Yee. The model uses a questionnaire consisting of 39 questions with a Likert scale going from 1 to 5 where 1 equalled to not at all, not interested at all, not enjoyable at all and never, whereas 5 equalled a great deal, extremely interested, extremely enjoyable and always. The questionnaire is provided in Appendix B.

3.2.3 - Identifying learners

The third and final Section were used to determine the participant's learning style. The Index of Learning Styles model includes 4 pairs of contrasting styles: Reflective/ Active, Sensing/Intuitive, Visual/Verbal, and Sequential/Global. There were 11 questions to each pairs with the alternative of answering A or B. The questionnaire is provided as Appendix C.

3.3 - Conducting the study

The online survey was published three times and gathered a total of 84 answers. The study was first published on the master thesis author's personal Facebook page publically. It

gathered 45 answers. One of the answers were ruled out as the respondent had chosen to answer all questions with alternative number 1. The number of participants were deemed too low, and the survey were handed out to two of the game design classes at Gjøvik University College with the help of the supervisor. The survey gathered a total of 84 answers. 10 of the participants were female, while the rest were male.

3.4 - Gathering data

The results were gathered and translated into numeric values using the provided scoring sheets from the two established models used in the survey. The two categorisation models were used to group the participants into different players and learners. Every participant was categorised into each of the different player components and learning styles. The Z-score made is possible to categorise only the high scoring participants in every component and style and comparing this group towards the their score with the motivational affordances.

3.4.1 - Motivational affordances

The questions used for mapping the motivational affordances did not use an established model, and therefore the scores had to be summed up manually. Each question provided the participants with 5 answers with a Likert scale ranging from 1 to 5. The scores were added up to a total of 10 and a minimum of 2. This method made it possible to get an overview of the participants and the motivational affordances.

3.4.2 - Player motivation categorisation

The questionnaire worked by weighing each item by its factor loading, adding them up and then calculate the Z-score for each aggregate for each participant (Appendix D). It was decided to group the participants score into groups divided by 1 standard deviation by calculating the Z-score for all participants. Using the factor mean, participants scoring 1 standard deviation and above were grouped into one group (high), another for scoring between 0.9 to -0.9 (neutral), and the last group from -1 and lower (low). This was done with all three components in Yee's model, Achiever, Social and Immersion to make them comparable, and because the interest lies in the participants with high scores. Yee's study showed that motivations does not

suppress each other. In theory, that means that one participant can be categorised into both the Achiever and Social component. This method of grouping the scores is a common technique when looking at large data pools where the interest lies in the extreme cases. The different groups could then be compared with the scores from the motivational affordances and analysed for correlations.

3.4.3 - Learning style categorisation

The scores were added up using the scoring sheet provided with the questionnaire (Appendix E). The A's and B's were summarized and the smaller number subtracted from the larger, e.g. if you scored 7As and 4Bs you would end up with 3As. The participants scoring As were categorized into the first learning style, while Bs were categorized into the second pair. This method was changed slightly for analysing purposes. The As were translated into positive values and the Bs were translated into negative values, making it possible for a participant to score 11 to -11. The positive values represented the first of the two pairs, while the negative values represented the other, contrasting pair. The participants scores could then be divided into groups using the Z-score as described in Section 3.4.2. E.g. a participants scoring 1.3 would be in the high scoring group and be categorised in the Active learning style while a participant scoring -1.4 was categorised in the Reflective learning style. Participants scoring between 0.9 and -0.9 were deemed neutrals. The different groups could then be compared with the scores from the motivational affordances and analysed for correlations.

3.5 - Conducting the analysis

Each of the components in Yee's model were compared to the motivational affordances by running a T-test. This was also done with the different learning styles. Finally, the components of Yee's model were compared to the different learning styles, in terms of their scores in the different motivational affordances by doing a correlation analysis.

4 Results

This chapter presents the data gathered from the survey. A discussion of the results will follow in Section 5. In social statistics, the null hypothesis is used to accept or reject the probability of the results obtained can be explained by random variation. In order to reject the null hypothesis, the probability value has to be calculated and compared to the data. It was decided that the probability value had to be lower than 0.05 in order to reject the null hypothesis ($P < 0.05$).

4.1 - Which motivational affordances do different players get motivated by?

This Section looked at the participants in terms of Nick Yee's model consisting of the components Achiever, Social and Immersion. The participants determined motivation component were compared to their score on the motivational affordances to look for correlations. Grouping the participants score in the components into 3 groups using the Z-score, made it possible to look at the difference between the groups. Using the factor mean, participants scoring 1 standard deviation and above were grouped into one group (high), another for scoring between 0.9 to -0.9 (neutral), and the last group from -1 and lower (low).

4.1.1 - Achiever

The grouping of participants using the Z-score resulted in the following groups. 12 scored lower than 1 standard deviation, 56 were considered neutrals and 15 scored above 1 standard deviation. The score was analysed for correlation. 4 affordances obtained a P value below 0.05 and the null hypothesis could be rejected, meaning the results are not the result of pure chance. The following motivational affordances showed a significant correlation with the high scoring Achiever component:

- Leaderboards ($P < .000$),
- Levels ($P < .000$),

- Achievements/badges (P < .004),
- Challenge (P < .003),

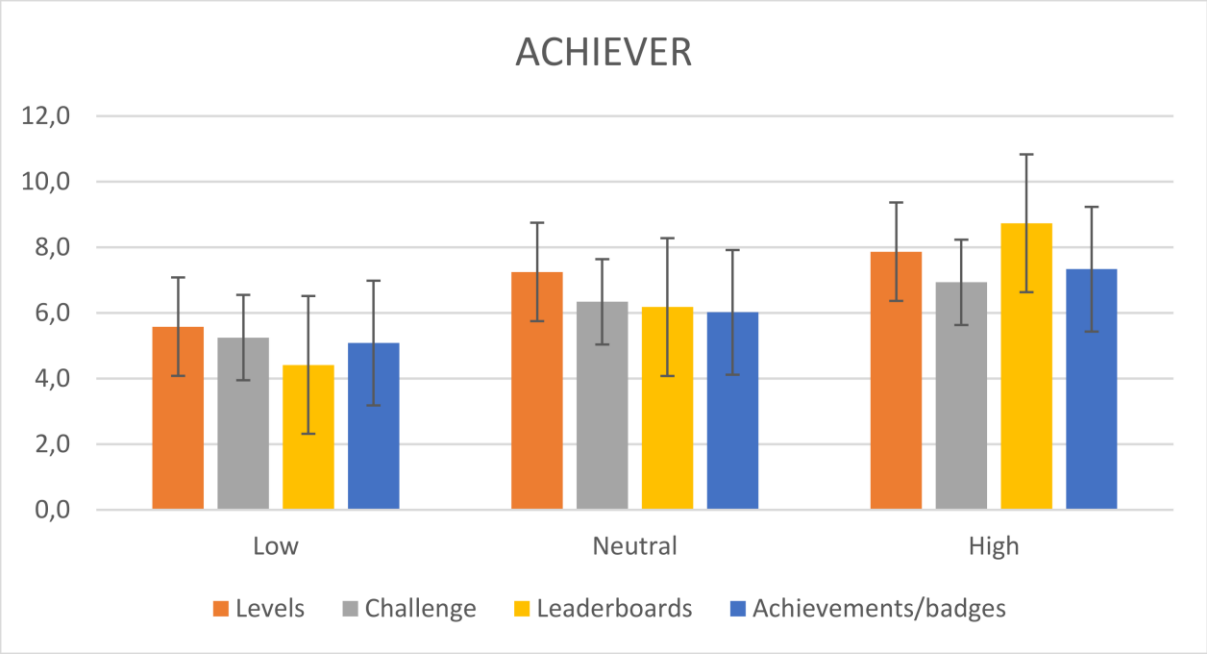

Figure 4 - The mean of the motivational affordances Leaderboards, Achievements/badges, Levels and Challenge for the component Achiever divided by the three scoring groups. Based on data table presented in Appendix H.

4.1.2 - Social

The grouping of participants using the Z-score resulted in the following groups. 12 scored lower than 1 standard deviation, 56 were considered neutrals and 15 scored above 1 standard deviation. The score was analysed for correlation. 3 affordances obtained a P value lower than 0.05 and the null hypothesis could be rejected. The following motivational affordances showed a significant correlation with the high scoring Social component:

- Levels (P < .000),
- Challenge (P < .001),
- Story (P < .001)

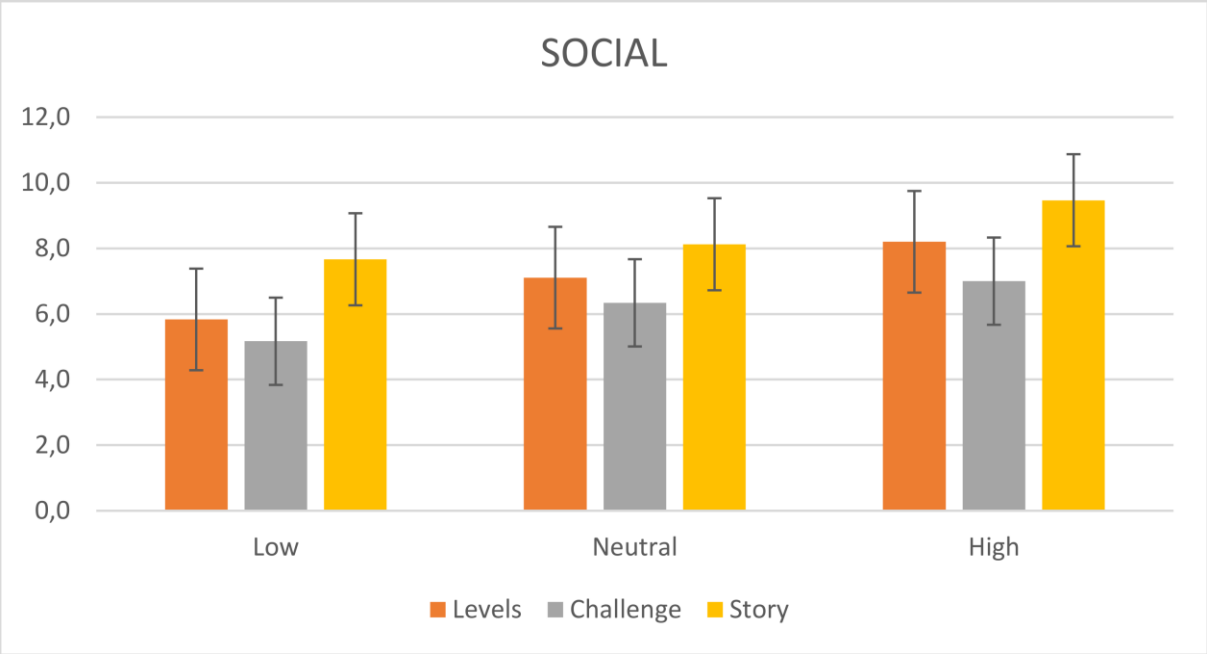

Figure 5 - The mean of the motivational affordances Levels, Challenge and Story for the component Social divided by the three scoring groups. Based on data table presented in Appendix I.

4.1.3 - Immersion

The grouping of participants using the Z-score resulted in the following groups. 12 scored lower than 1 standard deviation, 58 were considered neutrals and 13 scored above 1 standard deviation. The score was analysed for correlation. 3 affordances obtained a P value under 0.05 and the null hypothesis could be rejected. The following motivational affordances showed a significant correlation with the high scoring Immersion component:

- Story ($P < .000$),
- Levels ($P < .005$)
- Clear goals ($P < .006$)

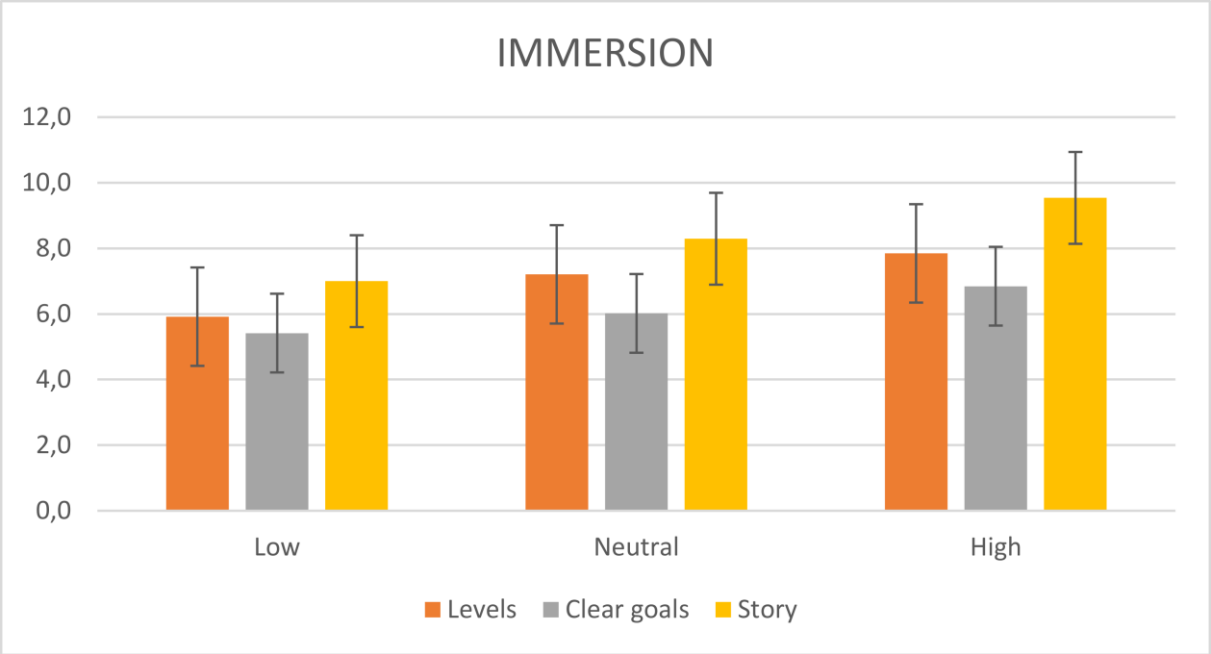

Figure 6 - The mean of the motivational affordances Levels, Clear goals and Story for the component Immersion divided by the three scoring groups. Based on data table presented in Appendix J.

4.2 - Which motivational affordances do different learners get motivated by?

This Section looked at the participant's learning style and compared it to their score with the motivational affordances. Using the categorization method described in Section 3.4.3 made it possible to categorise participants into the different styles and to remove participants with no strong preference to either of the two styles and therefore considering them neutrals. The grouping of participants using the Z-score resulted in the following groups:

- 15 Reflective - 15 Active
- 18 Intuitive - 20 Sensing
- 16 Verbal - 19 Visual
- 10 Global - 10 Sequential

No P values were below 0.05 and therefore no significant results were found between any of the learning styles when compared to the motivational affordances. The null hypothesis could therefore not be rejected.

4.3 - Yee's model vs learning types

The data showed no significant correlations between the learning styles and the motivational affordances, and therefore no correlation between the two categorisation models.

4.4 - Other results

The data suggest a slight trend towards female players scoring higher in the immersion player type than males. This trend can be explained by females being more social and want to being immersed with the game, e.g. explore the world, engage in their character. It should be noted that only 10 females participated in the survey compared to 73 males.

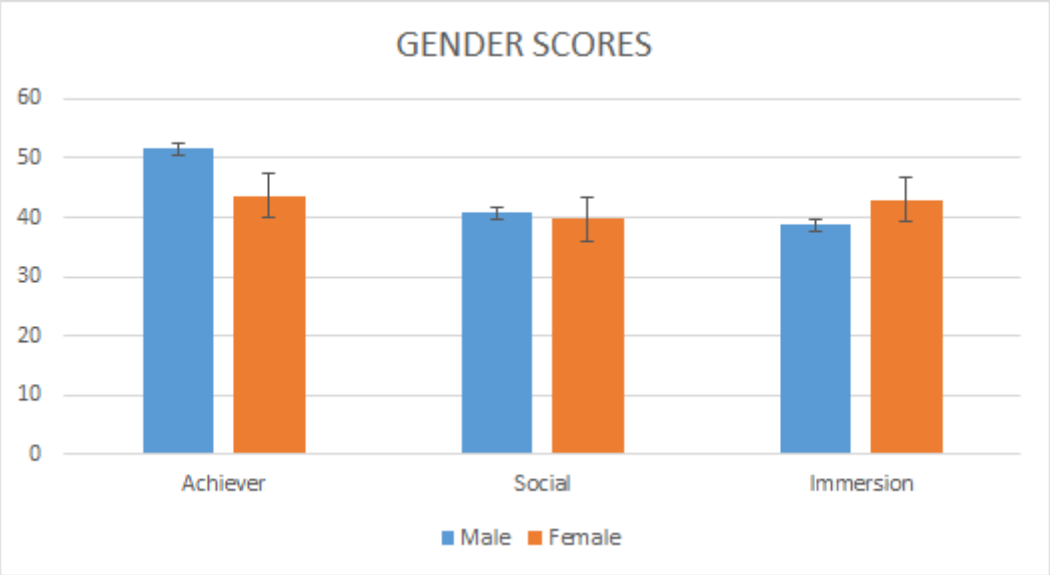

Figure 7 - Graph showing the mean scores by gender in the different player categories. Males score higher than females in the Achiever component, while females score higher than males in the Immersion component.

4.5 - Final results

The table gives an overview of which type of players have significant correlations to the 10 motivational affordances. No significant correlations were found between the learning styles and the motivational affordances, and is therefore not present in the table.

	Achiever	Social	Immersion
Leaderboards	YES	YES	NO
Levels	YES	YES	YES
Story	NO	YES	YES
Challenge	YES	YES	NO
Clear goals	NO	NO	YES
Progress	YES	NO	NO
Rewards	NO	NO	YES
Achievements	YES	NO	NO
Feedback	NO	NO	NO
Points	NO	NO	NO

Figure 8 - An overview of the significant correlations between the motivational affordances and the player motivation components.

5 Discussion

The thesis investigated how users categorised as different players and learners get motivated playing games, by looking at the 10 most popular motivational affordances used in gamification. The study shows promising results for categorising users by identifying their motivation of play, as all the 3 different motivation components in Yee's model have a significant correlation to one or more of the motivational affordances. The learning styles shows no significant correlation to the motivational affordances, thus giving no correlation when combining Yee's model with the learning styles.

5.1 - Which motivational affordances do different players get motivated by?

Participants scoring high in the Achiever (15) showed significant correlation to the motivational affordances leaderboards, levels, achievements/badges and challenges. Social (15) had a significant correlation to levels, story and challenge. Immersion (12) had a significant correlation to story, levels and rewards.

The results are similar to Nick Yee's study into player motivations for online games (Yee, 2006), that the different motivation categories do not suppress each other, as the results show that the Achiever and Social components both have a significant correlation to levels and challenges.

The results show that levels have a significant correlation to all three categories. This can be explained by the player models not being perfectly analogous. Nick Yee investigated Bartle's four archetypes Killer, Achiever, Socializer and Explorer and found that the underlying sub-factors in his model was not the same as in Bartle's model.

An unexpected result is that points had no significant correlation to any of the components of Yee's model, as this is one of the affordances mostly used, together with leaderboards and badges (Hamari et al, 2014). The reason might be because points is one of the affordances that boosts extrinsic motivation, in forms of giving a reward when completing a task. As mentioned in Section 2.1.3, extrinsic motivation undermines intrinsic motivation (Deci et al, 1999), which is believed to be the desired motivational approach for motivational applications (Nicholson, 2012). However, it is used in gamification to influence user's behaviours and it can be argued to do so somewhat effectively, depending on which definition of gamification you use.

The affordance leaderboards have by some been reported as doing more harm than good, in terms of users reporting negative effects because of the increased competition gamified applications introduces (de-Marcos et al, 2014). The study done by de-Marcos have some limitations, as the gamified plugin used in the study had emphasis on achievement, collection and competition. Naturally, participants with low attraction to competition will report negative effects. However, the results from this study shows a significant correlation between leaderboards to the player categories Achiever and Socializer, and can be argued to not back-up de-Marcos' results.

There are some that question the approach of using player type models to identify user's playing motivation. Some argue that other methods should be considered, because no one can be generalised into one player type (Tuunanen, Hamari, 2012). Tuunanen and Hamari suggest using other theories that relies on playing mentalities (Kallio et al, 2010) and/or trait theory (Bateman et al, 2011). Kallio et al believes that gamers cannot be generalised into one player type and that the motivation for playing is influenced by many, complex variables. They argue that there are both social and cultural motivation behind the motivation to play digital games. They suggest 3 main mentalities with 3 subcategories; Social mentalities - Playing with Children, Playing with Mates and Playing for Company. Casual mentalities - Killing Time, Filling Gaps and Relaxing. Committed mentalities - Gaming for Fun, Immersive Play and Gaming for Entertainment.

Tuunanen and Hamari (2012) argue that Nick Yee's model are only motivational factors combined into main components, and not exactly player types, but it can still be seen as a possible basis for *psychographic* segmentation based on motivations for play. Most of the player type models developed, are based on studies using either psychographic or behavioural categorisation. Psychographic categorisation tries to group people by studying their opinions, values, personality, interests, attitudes and lifestyle, while behavioural categorisation tries to find patterns in users' behaviour towards a product (Tuunanen, Hamari, 2012).

5.2 - Which motivational affordances do different learners get motivated by?

The results show no significant correlation between any of the learning styles compared to the motivational affordances because the null hypothesis could not be rejected. This does not mean there are no correlation between the motivational affordances and the learning styles, only that this survey failed to provide enough evidence for a significant correlation. The notion that everyone learns in different ways is widely accepted as a truth, thus theories of learning styles have emerged. One survey found that 90% of the teachers in the 5 countries of England, Turkey, China, Netherlands and Greece agreed that students learn more when the teaching methods are tailored individual needs (Howard, Jones, 2014). However, recent research shows that this general acceptance of the theory of learning styles does not have scientific empirical evidence to back-up it is effects. Daniel T. Willingham et al discusses this in the article *The scientific status of Learning Styles* (Willingham et al, 2014). Willingham claim that many confuse the important difference between ability and style. "While styles refer to how one does things, abilities concern how well one does them." (Willingham et al, 2014, p. 2). In the article they discuss the predictions of the learning styles and compare them to the data available. The first prediction is that an individual's preferred learning style is a consistent attribute and should remain constant through various situations. The second is that a visual learner should remember better with visual materials than with other materials. Whittingham points in his review to several other reviews investigating the field of learning styles. One of those reviews is the study done by Coffield et al (2004), where most of the instruments used to identify learning styles are discovered to be unreliable. If the instruments used to identify learning styles are unreliable, there's no surprise supporting evidence for the overall

effectiveness of using learning styles is lacking. Willingham argues that the challenge with learning styles is that it is impossible to prove something not to exist and that the concept of learning styles has been widely accepted, although without supporting evidence.

5.3 - Correlations between players and learners

The results show no significant correlation between the learning styles and the player components, when comparing the two categories with their scores on the motivational affordances. There could be several reasons to explain this result.

According to Coffield et al (2004), most of the instruments used to identify learning styles are unreliable. Although the Index of Learning Styles designed by Felder & Silverman (Felder and Silverman, 1988) is not part of the models tested by Coffield et al, it should be carefully considered if this applies to this model as well.

The idea of categorising individuals into different learning styles and player types sound promising in theory, but in practice it might prove to be almost impossible to account for all the variables influencing an individuals' motivation and learning style. As mentioned in Section 5.1, some question the approach of using player style models to identify an individual's motivation to play games because no one can be generalised into one player type. The same criticism can be applied to the learning style models. As Willingham predicts, if the concept of learning styles is true, then an individual's preferred learning style should be a consistent attribute and remain constant through various situations. As mentioned in Section 5.2, there are not enough empirical evidence to back up this prediction.

The individual can be influenced by a number of variables, such as the mood or situational context. Drawing some examples from my own experience, my mood can heavily influence what type of game I want to play. If I feel tired I would want to relax and therefore play a strategic, turn based game where I can take my time and not need to be making quick

decisions. In that mood I would maybe be identified as an Immersion type of player. On the other hand, if I have a lot of energy, a first person shooter game suits my mood and current state of mind. That mood would help me strive for victory and make me want to achieve something, thus I would probably be identified as an Achiever type of player. A hypothesis could be that an individuals' mood and situational context can influence the decision process when answering the questions used to identify the type of motivation of play. Therefore, the suggestion of developing player models built on playing mentalities, as suggested by Kallio et al (2010) might be a more fitting methodology when identifying players' motivation of play.

5.4 - Limitations of the study

The two models with their corresponding questionnaires used to identify the different players and learners are both in English. Because most, if not all, participants are Norwegian, some may find it tricky to understand all questions correctly, as some of the questions are technical and may include words participants might find hard to understand. The technical difficulty of the questions was measured by conducting a pilot test as described in Section 3.1.2. The results revealed that all 3 participants of the pilot study understood the meaning of the questions.

Another aspect of the questions used in the questionnaires was whether or not to translate the questions into Norwegian, but it was decided not to, as the risk of translating could lead to loss in the meaning of the questions. Furthermore, the practical considerations such as time and effort invested were considered to be too high.

Despite efforts, no studies were found to test individual motivational affordances. Unlike the models and questions used to identify the players and learners, the questions created to map the preferred motivational affordances had to be created manually. This could be considered a limitation, because the questions have never been used before. This limitation is countered by defining and operationalizing the 10 affordances, as described in Section 3.2.1 and in Appendix A. More effort into researching how the different affordances have been used in other studies, may improve the design of the questions.

The survey was first posted on the author's' Facebook page with a brief explanation and with a request that as many as possible should participate in the survey and resulted in 44 answers. The participants recruited through Facebook is most likely people that are already interested in the topic of gaming. This might bias the results as typical gamers might feel attracted to take part in the survey. This can explain the big representation of the player type Achiever. At first, the participants were categorised only in the player motivation component they received the highest score in. This resulted in a big group of Achievers (32) compared to very small numbers in Social (8) and Immersion (4). To counter this limitation, the method of categorizing every participant in all categories using the Z-score was done as described in Section 3.4.2. It was also decided to hand out the survey to the two game design classes on the University College of Gjøvik to get more participants.

The data gathered from the online survey provided quantitative data. Quantitative surveys is a suitable method when analysing larger data pool and doing statistical analysis. The limitation of quantitative research is that it gives no in-depth, detailed explanation of the results. Moreover, questionnaires and online surveys uses a method called self-reporting to gather data from the participants. This method has some drawbacks, as the participants respond with no interference from the researcher and it relies on the participant's ability to report their views as truthfully as possible. Another weakness is the emotional state of the participant and it can bias how he/she answers and is therefore a result of how a person feels at the time of participating.

The online survey used the Likert scale to map how the participants answered to the different statements that make up the survey. The strength of the Likert scale is that it gives more detail compared to a simple yes / no question. The weakness of using Likert scale is that participants often chose the neutral alternatives and avoids the strongest alternatives.

5.5 - Validity and reliability

Validity refers to the ability for a test to measure what it claims to measure. Validity is important to ensure that the results reported can be examined and interpreted correctly. Generally speaking, questionnaires and surveys relying on self-reporting are said to lack validity because as mentioned in Section 5.2, participants can be biased by their mood and also chose to not answer truthfully.

The survey conducted in this thesis used established models to identify player types and learning styles. Although the instruments used to identify learning styles is claimed to lack validity (Coffield et al, 2004), Nick Yee's model has been empirically tested and should report valid data (Yee, 2006). As discussed in Section 5.3, the questions designed for measuring the motivational affordances has never been used before and might be lacking validity.

Reliability refers to the ability for a measuring device to provide consistent results. One way to increase the reliability of questionnaires and surveys is to have easy to understand questions that is interpreted the same way by all participants. To test the reliability of the designed questions for the motivational affordances, the survey should be tested further. The learning style methods lack validity and might therefore also lack reliability.

6 Conclusion

This master thesis shows that categorisation of users into player types should be included in methodologies for designing gamified applications and systems when targeting specific player types. Participants who scored high in the player component Achiever (15) showed significant correlation to the motivational affordances leaderboards, levels, achievements/badges and challenges. The player component Social (15) had a significant correlation to levels, story and challenges. The player component Immersion (12) had a significant correlation to the motivational affordances story, levels and rewards. The results show that there are individual differences between users in terms of how they are motivated. The results should be used by game designers, interaction designers and game developers when designing gamified applications as a framework when targeting certain player types.

The different learning styles had no significant correlation to the motivational affordances, providing no correlation to the different player components.

The results seem to indicate a minor gender difference in the player component Immersion, where females score higher than males. This suggest that females are motivated by the social aspects of the game in a greater extent than males. Gamified applications and systems should therefore focus on giving context, e.g. by including a compelling story with a playable character or other characteristics to the Immersion component when targeting females.

The results from this report can be used in other context other than gamification. User centred design processes used in interaction design can use a similar approach to identify and categorise users into groups, and use tailored design methods to attract certain groups of users. Detailed information of users can help designers to increase the user experience by facilitate their needs. The results show that identifying users' motivation to play games can be one of these methods.

7 Future work

The research conducted in this study is not of a gamified service or application, but rather a quantitative survey to measure which of the motivational affordances used in gamification can be used to attract different players and learners. The result of the study provides a detailed table over which of the individual motivational affordances the different player types get motivated by. The result shows no significant correlation between the motivational affordances and the learning styles, and is therefore one of the areas that is suggested for future work. Primarily, future work should investigate the relationship between the motivational affordances and learning style models. Eliminating the player type models and focusing solely on the learning style models might be one approach.

Future work to increase the understanding of the relationship between the player components and the motivational affordances is suggested. One approach could be to use the specific motivational affordances provided in this study and including them in a gamified application or system. A qualitative survey could be conducted to measure the effects of the individual motivational affordances. This way the actual user experience of a gamified application can be measured and tested. Another approach to increase the understanding between player type models and the motivational affordances is to execute the survey used in this report, but with different categorisation methods or models, E.g. the BrainHex model which has 7 different player types for a more detailed outcome. Similarly, a different set of motivational affordances can be used together with Nick Yee's model.

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Appendix A: Definitions of the motivational affordances

Points

Any form of accumulated value that is given as a reward by performing tasks within a game.

Example: Loyalty programs used by companies to reward a customer's loyalty to their product or services, where the points can be used on various rewards within that company.

Leaderboards

A visual representation of the points gathered by all the participants. The leaderboard is used give an overview of the score.

Example: Leaderboards can be enabled so organizations can reward employees, managers, and teams for following proper time and attendance policies and different work procedures.

Achievements/badges

A visual token given by completing specific tasks, challenges or goals. Often displayed to other players as a symbol of the user's skill.

Example: A diploma is given to the most successful sales worker of the month.

Levels

The user increase in levels by gathering points from completing different activities, reflecting the commitment and contribution of the user or the playing character.

Example: Online communities such as Yahoo! answers, where members can increase in level based on their commitment and contribution by answering questions.

Story/theme

Any form of narrative or scenario to give the actions and goals performed meaning.
Example: Introducing a character or a story to a task or objective, giving the task a context.

Clear goals

How a system guides/helps a player to complete objectives. Can be categorized into two types: wizard vs exploration.
Example: The annoying clip in Word that tries to help the user with advice. Games that visually marks the objective with a marker on a map.

Feedback

Rapid and frequent feedback is given to the user based on its actions. Can be given in form of text, audio, visual and tactile forms.
Example: Games use feedback to motivate people, giving them signals and signs that they are on the right track.

Rewards

Random generated or fixed rewards that boost intrinsic motivation when completing tasks.
Example: A fixed reward for completing a specific objective, e.g. experience points.

Progress

Any kind of showing progression. Divided into two types: personal skill level and system progress.
Example: A visual marker showing the current score, while another visual marker shows the current high score.

Challenge

Any task that challenges the skills of the participant, often with increased difficulty.

Example: A chess game challenges the user on a mental, cognitive level, while first person shooter games challenge the mechanical skills such as swiftness and reflexes.

Appendix B: Questions part 1 - motivational affordances

1) I like games where the goal is to gather as many points as possible

2) I like games where I can compete with other players and improve my score on a leaderboard

3) I like games where I receive badges as a token of my hard work.

4) I like games where I can level up my character by completing different objectives.

5) I like games with a fun, compelling story

6) I like games with easy to follow guides, pointing me towards my next target objective.

7) I like games where I easily know where to go next to complete an objective through visual clues.

8) I like games where I receive fixed rewards for completing specific objectives.

9) I like games which shows my current progress and personal high score.

10) I like easy, fun games which require no effort of skill to play.

11) I like to gather resources more than to complete the main objective of a game.

12) I like games that focus on competition between players or teams, where scores are made public.

13) I like games where I can brag of my achievements.

14) I like games where I can receive recognition of my contribution to the community.

15) I like games where I control my own playable character.

16) I like games where I need to explore and investigate for clues to solve a puzzle.

17) I like games that gives me immediate feedback on my performance.

18) I like games which gives me random generated rewards from certain actions.

19) I like games which shows how far I've come in completing an objective.

20) I like to challenge myself with difficult games.

Likert scale used to questions 1 - 20::

1. Not At All
2. A Little
3. Some
4. A Lot
5. A Great Deal

Appendix C: Questions part 2 - Nick Yee's model

1) How interested are you in the precise numbers and percentages underlying the game mechanics?

2) How important is it to you that your character is as optimized as possible for their profession / role?

3) How often do you use a character builder or a template to plan out your character's advancement at an early level?

4) Would you rather be grouped or soloing?

5) How important is it to you that your character can solo well?

6) How much do you enjoy working with others in a group?

7) How important is it to you to be wellknown in the game?

8) How much time do you spend customizing your character during character creation?

9) How important is it to you that your character's armor / outfit matches in color and style?

10) How important is it to you that your character looks different from other characters?

11) How much do you enjoy exploring the world just for the sake of exploring it?

12) How much do you enjoy finding quests, NPCs or locations that most people do not know about?

13) How much do you enjoy collecting distinctive objects or clothing that have no functional value in
the game?

14) Leveling up your character as fast as possible.

15) Acquiring rare items that most players will never have.

16) Becoming powerful.

17) Accumulating resources, items or money.

18) Knowing as much about the game mechanics and rules as possible.

19) Having a self-sufficient character.

20) Being immersed in a fantasy world.

21) Escaping from the real world.

22) Helping other players.

23) Getting to know other players.

24) Chatting with other players.

25) Competing with other players.

26) Dominating/killing other players.

27) Exploring every map or zone in the world.

28) Being part of a friendly, casual guild.

29) Being part of a serious, raid/lootoriented guild.

30) Trying out new roles and personalities with your characters.

31) Doing things that annoy other players.

32) How often do you find yourself having meaningful conversations with other players?

33) How often do you talk to your online friends about your personal issues?

34) How often have your online friends offered you support when you had a real life problem?

35) How often do you make up stories and histories for your characters?

36) How often do you role-play your character?

37) How often do you play so you can avoid thinking about some of your real-life problems or worries?

38) How often do you play to relax from the day's work?

39) How often do you purposefully try to provoke or irritate other players?

Different Likert scales were used to answer the questions

Likert scale used to question 1:

1. Not Interested At All
2. Slightly Interested
3. Somewhat Interested
4. Very Interested
5. Extremely Interested

Likert scale used to questions 2, 3, 5, 7, 9, 10, 14 - 21:

1. Not Important At All
2. Seldom
3. Sometimes
4. Often
5. Always

Likert scale used to question 4:

1. Much Rather Solo
2. Rather Solo
3. In-Between
4. Rather Group

5. Much Rather Group

Likert scale used to questions 22 - 31

1. Not Enjoyable At All
2. Slightly Enjoyable
3. Moderately Enjoyable
4. Very Enjoyable
5. Tremendously Enjoyable

Likert scale used to questions 32 - 39

1. Never
2. Seldom
3. Sometimes
4. Often
5. Always

Appendix D: Questions part 3 - Learning styles

1. I understand something better after I

    (a) try it out.

    (b) think it through.

2. I would rather be considered

    (a) realistic.

    (b) innovative.

3. When I think about what I did yesterday, I am most likely to get

    (a) a picture.

    (b) words.

4. I tend to

    (a) understand details of a subject but may be fuzzy about its overall structure.

    (b) understand the overall structure but may be fuzzy about details.

5. When I am learning something new, it helps me to

    (a) talk about it.

    (b) think about it.

6. If I were a teacher, I would rather teach a course

    (a) that deals with facts and real life situations.

    (b) that deals with ideas and theories.

7. I prefer to get new information in

(a) pictures, diagrams, graphs, or maps.

(b) written directions or verbal information.

8. Once I understand

(a) all the parts, I understand the whole thing.

(b) the whole thing, I see how the parts fit.

9. In a study group working on difficult material, I am more likely to

(a) jump in and contribute ideas.

(b) sit back and listen.

10. I find it easier

(a) to learn facts.

(b) to learn concepts.

11. In a book with lots of pictures and charts, I am likely to

(a) look over the pictures and charts carefully.

(b) focus on the written text.

12. When I solve math problems

(a) I usually work my way to the solutions one step at a time.

(b) I often just see the solutions but then have to struggle to figure out the steps to get to them.

13. In classes I have taken

(a) I have usually gotten to know many of the students.

(b) I have rarely gotten to know many of the students.

14. In reading nonfiction, I prefer

(a) something that teaches me new facts or tells me how to do something.

(b) something that gives me new ideas to think about.

15. I like teachers

(a) who put a lot of diagrams on the board.

(b) who spend a lot of time explaining.

16. When I'm analyzing a story or a novel

(a) I think of the incidents and try to put them together to figure out the themes.

(b) I just know what the themes are when I finish reading and then I have to go back and find the incidents that demonstrate them.

17. When I start a homework problem, I am more likely to

(a) start working on the solution immediately.

(b) try to fully understand the problem first.

18. I prefer the idea of

(a) certainty.

(b) theory.

19. I remember best

(a) what I see.

(b) what I hear.

20. It is more important to me that an instructor

(a) lay out the material in clear sequential steps.

(b) give me an overall picture and relate the material to other subjects.

21. I prefer to study

(a) in a study group.

(b) alone.

22. I am more likely to be considered

(a) careful about the details of my work.

(b) creative about how to do my work.

23. When I get directions to a new place, I prefer

(a) a map.

(b) written instructions.

24. I learn

(a) at a fairly regular pace. If I study hard, I'll "get it."

(b) in fits and starts. I'll be totally confused and then suddenly it all "clicks."

25. I would rather first

(a) try things out.

(b) think about how I'm going to do it.

26. When I am reading for enjoyment, I like writers to

(a) clearly say what they mean.

(b) say things in creative, interesting ways.

27. When I see a diagram or sketch in class, I am most likely to remember

(a) the picture.

(b) what the instructor said about it.

28. When considering a body of information, I am more likely to

(a) focus on details and miss the big picture.

(b) try to understand the big picture before getting into the details.

29. I more easily remember

(a) something I have done.

(b) something I have thought a lot about.

30. When I have to perform a task, I prefer to

(a) master one way of doing it.

(b) come up with new ways of doing it.

31. When someone is showing me data, I prefer

(a) charts or graphs.

(b) text summarizing the results.

32. When writing a paper, I am more likely to

(a) work on (think about or write) the beginning of the paper and progress forward.

(b) work on (think about or write) different parts of the paper and then order them.

33. When I have to work on a group project, I first want to

(a) have "group brainstorming" where everyone contributes ideas.

(b) brainstorm individually and then come together as a group to compare ideas.

34. I consider it higher praise to call someone

(a) sensible.

(b) imaginative.

35. When I meet people at a party, I am more likely to remember

(a) what they looked like.

(b) what they said about themselves.

36. When I am learning a new subject, I prefer to

(a) stay focused on that subject, learning as much about it as I can.

(b) try to make connections between that subject and related subjects.

37. I am more likely to be considered

(a) outgoing.

(b) reserved.

38. I prefer courses that emphasize

(a) concrete material (facts, data).

(b) abstract material (concepts, theories).

39. For entertainment, I would rather

(a) watch television.

(b) read a book.

40. Some teachers start their lectures with an outline of what they will cover. Such outlines are

(a) somewhat helpful to me.

(b) very helpful to me.

41. The idea of doing homework in groups, with one grade for the entire group,

(a) appeals to me.

(b) does not appeal to me.

42. When I am doing long calculations,

(a) I tend to repeat all my steps and check my work carefully.

(b) I find checking my work tiresome and have to force myself to do it.

43. I tend to picture places I have been

(a) easily and fairly accurately.

(b) with difficulty and without much detail.

44. When solving problems in a group, I would be more likely to

(a) think of the steps in the solution process.

(b) think of possible consequences or applications of the solution in a wide range of areas.

Appendix F: Scoring instructions - Nick Yee's model

More Precise Method: Weigh each item by its factor loading, add them up, and then calculate the z-score (i.e., [score - mean]/standard deviation) for each aggregate for each participant.

- Achievement: Q14*0.68 + Q15*0.77 + Q16*0.81 + Q17*0.69 + Q7*0.53 + Q29*0.60
- Mechanics: Q1*0.78 + Q2*0.65 + Q3*0.67 + Q18*0.69
- Competition: Q25*0.64 + Q39*0.81 + Q26*0.72 + Q31*0.82
- Socializing: Q23*0.82 + Q22*0.65 + Q24*0.77 + Q28*0.63
- Relationship: Q32*0.71 + Q33*0.88 + Q34*0.86
- Teamwork: Q4*0.79 + Q5*0.77 + Q6*0.60 + Q19*0.63
- Discovery: Q11*0.82 + Q12*0.77 + Q13*0.55 +Q27*0.80
- Role-Playing: Q30*0.66 + Q20*0.62 + Q35*0.83 + Q36*0.85
- Customization: Q8*0.73 + Q9*0.81 + Q10*0.80
- Escapism: Q37*0.81 + Q38*0.62 + Q21*0.83

Appendix G: Scoring instructions - Index of Learning Styles

SCORING SHEET

1. Put "1"s in the appropriate spaces in the table below (e.g. if you answered "a" to Question 3, put a "1" in Column "a" by Question 3).
2. Total the columns and write the totals in the indicated spaces.
3. For each of the four scales, subtract the smaller total from the larger one. Write the difference (1 to 11) and the letter (a or b) with the larger total.

   For example, if under "ACT/REF" you had 4 "a" and 7 "b" responses, you would write "3b" on the bottom line under that heading (3 = 7- 4, and the "b" total was the larger of the two.)

ACT/REF			SEN/INT			VIS/VRB			SEQ/GLO		
Q	a	b	Q	a	b	Q	a	b	Q	a	b
1	__	__	2	__	__	3	__	__	4	__	__
5	__	__	6	__	__	7	__	__	8	__	__
9	__	__	10	__	__	11	__	__	12	__	__
13	__	__	14	__	__	15	__	__	16	__	__
17	__	__	18	__	__	19	__	__	20	__	__
21	__	__	22	__	__	23	__	__	24	__	__
25	__	__	26	__	__	27	__	__	28	__	__
29	__	__	30	__	__	31	__	__	32	__	__
33	__	__	34	__	__	35	__	__	36	__	__
37	__	__	38	__	__	39	__	__	40	__	__
41	__	__	42	__	__	43	__	__	44	__	__
Total (sum X's in each column)											
ACT/REF			**SEN/INT**			**VIS/VRB**			**SEQ/GLO**		
	a	b		a	b		a	b		a	b
	__	__		__	__		__	__		__	__
(Larger - Smaller) + Letter of Larger (see below*)											
	___			___			___			___	

*Example: If you totaled 3 for a and 8 for b, you would enter 5b.

Appendix H: Data table Achiever

Report

ACHIEVERS		Leaderboards	Achievements/Badges	Levels	Challenge
Low	Mean	4,41	5,08	5,58	5,25
	N	12	12	12	12
	Std. Deviation	1,50	1,62	1,44	0,86
Neutral	Mean	6,17	6,01	7,25	6,33
	N	56	56	56	56
	Std. Deviation	1,65	1,68	1,23	1,28
High	Mean	8,73	7,30	7,86	6,93
	N	15	15	15	15
	Std. Deviation	1,83	2,05	1,92	1,38
Total	Mean	6,38	6,12	7,12	6,28
	N	83	83	83	83
	Std. Deviation	2,07	1,85	1,54	1,33

ANOVA Table

	Total		Sum of Squares	df	Mean Square	F	Sig.
Leaderboards * ACHIEVER_LOWHIGH	Between Groups	(Combined)	131,59	2	65,79	23,7	0,000
		Linearity	128,75	1	128,75	46,38	0,000
		Deviation from Linearity	2,83	1	2,83	1,02	0,315
	Within Groups		222,06	80	2,77		
	Total		353,66	82			
Achievements/Badges * ACHIEVER_LOWHIGH	Between Groups	(Combined)	35,56	2	17,78	5,8	0,004
		Linearity	34,9	1	34,9	11,38	0,001
		Deviation from Linearity	0,65	1	0,65	0,21	0,645
	Within Groups		245,23	80	3,06		
	Total		280,79	82			
Levels * ACHIEVER_LOWHIGH	Between Groups	(Combined)	37,64	2	18,82	9,46	0,000
		Linearity	32,66	1	32,66	16,42	0,000

		Deviation from Linearity	4,97	1	4,97	2,5	0,118
	Within Groups		159,15	80	1,98		
	Total		196,79	82			
Challenge * ACHIEVER_LOWHIGH	Between Groups	(Combined)	19,32	2	9,66	6,14	0,003
		Linearity	18,21	1	18,21	11,59	0,001
		Deviation from Linearity	1,1	1	1,1	0,7	0,404
	Within Groups		125,73	80	1,57		
	Total		145,06	82			

Appendix I: Data tables Social

Report

SOCIAL		Story	Levels	Challenge
Low	Mean	7,66	5,83	5,16
	N	12	12	12
	Std. Deviation	0,98	1,40	1,11
Neutral	Mean	8,12	7,10	6,33
	N	56	56	56
	Std. Deviation	1,42	1,35	1,22
High	Mean	9,46	8,20	7,00
	N	15	15	15
	Std. Deviation	0,91	1,61	1,36
Total	Mean	8,30	7,12	6,28
	N	83	83	83
	Std. Deviation	1,40	1,54	1,30

ANOVA Table

	Total		Sum of Squares	df	Mean Square	F	Sig.
Story * SOCIAL_LOWHIGH	Between Groups	(Combined)	26,94	2	13,47	8,01	0,001
		Linearity	23,42	1	23,42	13,92	0,000
		Deviation from Linearity	0,14	1	3,52	2,09	0,152
	Within Groups		134,52	80	1,68		
	Total		158,47	82			
Levels * SOCIAL_LOWHIGH	Between Groups	(Combined)	37,37	2	18,68	9,37	0,000
		Linearity	37,22	1	37,23	18,67	0,000
		Deviation from Linearity	0,14	1	0,14	0,07	0,786
	Within Groups		159,42	80	1,99		
	Total		196,79	82			
Challenge * SOCIAL_LOWHIGH	Between Groups	(Combined)	22,84	2	11,42	8,47	0,001
		Linearity	21,65	1	21,65	14,17	0,000
		Deviation from Linearity	1,18	1	1,18	0,77	0,381

	Within Groups		122,22	80	1,52		
	Total		145,06	82			

Appendix J: Data tables Immersion

Report

IMMERSION		Story	Levels	Clear goals
Low	Mean	7,00	5,91	5,41
	N	12	12	12
	Std. Deviation	1,65	1,88	1,08
Neutral	Mean	8,29	7,20	6,01
	N	58	58	58
	Std. Deviation	1,24	1,36	1,14
High	Mean	9,53	7,84	6,84
	N	13	13	13
	Std. Deviation	0,51	1,51	0,80
Total	Mean	8,30	7,12	6,06
	N	83	83	83
	Std. Deviation	1,40	1,54	1,15

ANOVA Table

	Total		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
Story * IMMERSION_LOWHIGH	Between Groups	(Combined)	40,22	2	20,11	13,26	0,000
		Linearity	40,21	1	40,21	26,53	0,000
		Deviation from Linearity	0,01	1	0,01	0	0,93
	Within Groups		121,24	80	1,51		
	Total		161,46	82			
Levels * IMMERSION_LOWHIGH	Between Groups	(Combined)	24,66	2	12,33	5,73	0,005
		Linearity	22,82	1	22,82	10,6	0,002
		Deviation from Linearity	1,84	1	1,84	0,85	0,357
	Within Groups		172,12	80	2,15		
	Total		196,79	82			
Clear goals * IMMERSION_LOWHIGH	Between Groups	(Combined)	13,1	2	6,55	5,48	0,006
		Linearity	12,88	1	12,88	10,77	0,002
		Deviation from Linearity	0,22	1	0,227	0,19	0,664

	Within Groups		95,59	80	1,19		
	Total		108,69	82			