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COPING TO PLAY: THE EFFECT OF USER-DRIVEN INNOVATIONS ON USER EXPERIENCE IN GAMES

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ABSTRACT

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This master's thesis studies how user-driven innovations help players to cope with usability problems in video games. Additionally, the effect of user-driven innovations on the user experience is covered. The topic is important for the game industry, as several game companies have given the opportunity for the players to modify their games with *modifications*, that can alter the games visual appearance, mechanics and logic, as well as content. Continuing the game development further in the gaming community has become a major part of the gaming culture. Therefore, it is important for the gaming companies to understand the opportunities and threats that lie beneath this phenomenon.

The thesis consists of a literature review from the existing literature on coping, usability, user experience and user-driven innovations, and an empirical study. In the empirical study, the methodology for interviewing players is presented, along with the explanation of thematic analysis used for interpreting the interview data. Themes chosen based on the interview data were performance and usability, content, and aesthetics. Each theme is a fundamental part of the gaming experience and their effect on user experience can be further amplified with user-driven innovations. The results of the research indicate that user-driven innovations are often used by the players to cope with usability issues, but also they tend to improve the overall user experience as well. Finally, the thesis concludes with a discussion on the results and their meaning and possible topics for future research are presented.

Keywords: Coping, gaming, usability, usability issue, user-driven innovation (UDI), user experience (UX), video game

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Tässä Pro Gradu -tutkielmassa tutkitaan miten käyttäjälähtöisiä innovaatioita voi hyödyntää videopeleissä esiintyvien käytettävyysongelmien selvittämisessä coping-keinona. Lisäksi käsitellään käyttäjälähtöisten innovaatioiden vaikutusta pelien käyttökokemukseen. Aihe on tärkeä erityisesti peliteollisuudelle, sillä useat peliyhtiöt ovat antaneet pelaajille mahdollisuuden muokata pelejä tietyiltä osin luomalla modifikaatioita, (engl. modification, *mod*) joilla voidaan vaikuttaa pelin ulkoasuun, mekaniikkaan ja sisältöön. Pelikehityksen jatkaminen lisäsisällön luomisella peliyhteisössä on nykyään merkittävä osa pelikulttuuria, joten peliyritysten on tärkeää ymmärtää sen sisältämät mahdollisuudet ja uhat.

Tutkielman rakenne sisältää katsauksen aiheeseen liittyvään olemassa olevaan kirjallisuuteen sekä empiirisen osuuden. Kirjallisuuskatsauksessa perehdytään coping-keinoihin, käytettävyyteen ja käyttökokemukseen sekä käyttäjälähtöisiin innovaatioihin. Tämän jälkeen empiirisessä osuudessa käydään läpi tutkimusdatan kerääminen haastattelukysymyksillä, datan analysointi temaattisella analyysillä ja tulosten esittäminen teemoittain. Teemoiksi määritettiin pelikokemuksen osa-alueita, joilla todettiin olevan merkittävä vaikutus käyttökokemukseen, eli suorituskyky ja käytettävyys, sisältö ja estetiikka. Lisäksi jokaiseen teemaan voidaan vaikuttaa modifikaatioilla, jolloin niiden vaikutusta käyttökokemukseen voidaan voimistaa. Tulosten perusteella käyttäjälähtöisiä innovaatioita käytetään usein käytettävyysongelmista selviämiseen, mutta ne myös parantavat pelien käyttökokemusta yleisellä tasolla. Lopuksi käydään läpi pohdintaa tutkimustulosten merkityksestä ja esitetään mahdollisia jatkotutkimusaiheita.

Asiasanat: Coping, käytettävyys, käytettävyysongelma, käyttäjälähtöinen innovaatio (UDI), käyttökokemus (UX), pelaaminen, videopeli

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1 INTRODUCTION

This thesis addresses the topics of what kind of user-driven innovations video game players use to cope with usability problems occurring in games, and how these user-driven innovations allow players to continue enjoying the user experience of the games, despite these glitches. These coping situations can be related to usability problems, glitches or altering logic within the game. Furthermore, the effect of user-driven coping strategies and innovations to the user experience is examined. Specifically, the research questions are *"What kinds of strategies do players adopt and develop to cope with technical usability problems?"* and, to elaborate it further, *"What is the relationship between user experience, and strategy adoption/development?*

First, this thesis concentrates on giving a research background to the essential topics, coping, usability and user-driven innovations, along with subchapters on relevant areas. Then, the methodology used in the empirical research is presented, including the methods for collecting data and analyzing the data. After this, the results are presented. The results include reflecting the relationship that exists between user-driven innovations and user experience as well as discussing the use of user-driven innovations as a coping strategy. Furthermore, based on the literature, two hypotheses are made. These hypotheses are then examined in the discussion chapter.

User innovations are innovations that have been developed by an institution (Shift, 2013) or any end user, including firms and individual consumers (von Hippel, 2005) for usage purposes only, instead of trying to sell it. Additionally, user innovations aim to make things easier, more practical or safer (Shift, 2013). Therefore, they have a rather direct benefit for the innovator. According to Nieborg and Van der Graaf (2008), modern digital technologies have created a possibility for consumers to take part in production and distribution of media content since the mid-1990s. The consumers are not merely the receiving end of the delivery. Companies can even enforce this behavior by deliberately giving tools for the consumers to use (Nieborg & Van der Graaf, 2008). Furthermore, as von Hippel (2005) states, this way users can develop whatever

they might want but also can get help if needed and gain benefit from the innovations others have developed and shared.

Essential concepts covered in this thesis in addition to user-driven innovation are user experience (UX), usability, playability and flow. Hassenzahl (2008) explained UX as a temporary and mainly evaluative feeling that is experienced when a user is interacting with a product or a service. The ISO standard 9241-210 (2008) defines user experience as the perceptions and responses which follow using or anticipating the use of a product, system or service. Gerling, Klauser and Niesenhaus (2011) applied this in a gaming context, explaining it as player experience. According to them player experience describes this interaction process with a game. This approach highlights the subjective as well as the psychological nature of the phenomenon while having a focus on the interaction process (Gerling et al., 2011). According to the view of Law, Roto, Hassenzahl, Vermeeren and Kort (2009), UX is about technology fulfilling more than only an instrumental need, that is the functionality it is used for. Additionally, this fulfillment acknowledges that the use of the technology is subjective, situated, complex and a dynamic interaction. Furthermore, UX is affected by the many aspects that user's internal state' the characteristics of the system and the use context have. For example, user's expectations and needs, the system's purpose and usability, and the social setting and the voluntariness of use are such aspects (Law et al., 2009). As McCarthy and Wright (2004) mention, users are more and more aware of how the interaction with technology involves them emotionally, intellectually and sensually. They argue that for this reason it is important for the designers to understand and analyze the experience users have with a technology.

Usability is defined by Nielsen (1993) as an outcome of learnability, efficiency, memorability, error rate and satisfaction. Especially, as Holzinger (2005) mention, usability is about how easy to use and acceptable a system is for a particular user group performing specific tasks in a specific environment. Playability on the other hand is a concept which includes usability, but reaches beyond it, assessing also the properties of the game experience such as game play, story and mechanics (Desurvire, Caplan & Toth, 2004). According to Sánchez, Zea, and Gutiérrez (2009), playability can be seen as a set of properties describing the player experience which results from the use of a specific game system, where enjoyment and entertainment are the main objectives. Moreover, the game system needs to be credible and satisfying whether the player plays alone or with another people.

Csikszentmihalyi (1991) defines flow as a state of mind, which can be achieved through conducting a task that requires a lot of skills when a person has those skills. In the flow-state the action is meaningful for the person doing it (Csikszentmihalyi, 1991). Flow is also related to mastery, as defined by Pink (2011). Pink (2011) explains that people who aim to improve their skills or performance on a certain task, that they consider important, want to achieve mastery. However, Pink (2011) further mentions that in order to achieve mastery, the individuals have to become genuinely engaged with the action. This is im-

portant in the context of video games, because as Korhonen and Koivisto (2006) mention, video games are enjoyed the most when the players are engaged with a sufficient challenge.

According to Ye (2004), video games have become an influential entertainment form in the past decades. For example, it has been forecast that the video game industry will keep growing faster than TV, music and cinema, nearly 5% annually while reaching a total revenue of $90.1 billion in 2020 in the global market (Takahashi, 2016). Furthermore, as we are examining the effect of user-driven innovations, it should be noted that the game Arma 2 had a modification, (DayZ), that had 20 times the size of the daily peak in player amount comparing to the original game (Chapple, 2012). This specific mod helped the game to increase its sales by 300.000 units. As Postigo (2007) mention, businesses and other organizations are also now recognizing the value of this consumer-created content.

Furthermore, it is expected that games will further give input for human-computer-interaction (HCI) research, even though the combination of HCI and games has not been yet much studied (Ye, 2004). However, according to Komulainen et al. (2008), in order to gain a full understanding of HCI in video games, the UX of games can be explained with psychological concepts. This supports the idea of studying both extremes, positive and negative experiences (Komulainen et al., 2008).

This thesis will help game designers to improve the user experience of future games. Nacke, Drachen and Göbel (2011) noted that the gaming industry has started to apply formal techniques to evaluate the user experience. These techniques have been adopted from previous human-computer interaction research and especially user experience (Nacke et al., 2011). Therefore, this thesis will provide game developers with further insight to this specific area. Video game industry is also recognized as an important field, as they are considered as the most popular form of entertainment thanks to the immersive user experience they offer (Takatalo & Häkkinen, 2014). Additionally, Komulainen, Takatalo, Lehtonen and Nyman (2008) pointed out that it is important for the gaming industry to have games with a wide range of positive user experiences, which is where this thesis is aiming to help. Furthermore, as Calvillo Gámez, Cairns and Cox (2009) mention, games are all about delivering a positive experience to the players and this is what this thesis is looking into. However, according to Chen (2007), the skills and expectations for challenge vary among players, which should be considered in this thesis.

2 COPING

In this chapter coping is explained on a general level and its relation to creativity is discussed. Furthermore, coping is examined in the context of IT and what kind of confrontational strategies are used when coping with IT.

2.1 Coping and creativity

Lazarus and Folkman (1984) describe coping as being a psychological process where a person tries to manage psychological stress. Furthermore, Lazarus and Folkman (1984) explain that coping is about realistic and flexible thoughts and acts that are supposed to reduce stress by solving problems. Therefore, the strategies that people use to reduce tension following from stressful situations are known as coping devices (Lazarus & Folkman, 1984). Coping can also be described as adaptational acts that the user performs when trying to respond to a disruptive event in the user's environment (Järvelä, Lehtinen and Salonen (2000); Beaudry, A. & Pinsonneault, A., 2005). Järvelä et al. (2000) also mention that users perform adaptational acts in order to cope with the perceived consequences of a technological event. According to Stein, Newell, Wagner and Galliers (2015), users of information technology tend to combine different adaptation behaviors of various strategies when choosing a strategy for coping with a situation.

Table 1 describes the four levels of creativity by their type, source of motivation and purpose, as defined by Sanders and Stappers (2008). The type of first level creativity is 'doing'. Doing-type of creativity is motivated by the individual's effort to be productive while getting some work done. The type of second level creativity is 'adapting'. Creativity of the second level is motivated by appropriation, where the individual aims to make things their own by adding their own touch to the product. Third level creativity is 'making'-type of creativity. In the third level creativity the individual uses their abilities and skills in order to create something on their own. Finally, level four creativity is of 'inspi-

ration'-type. The individual aims to express their creativity while creating something new, while being motivated by the inspiration to create something (Sanders & Stappers, 2008).

Table 1 Four levels of creativity (Sanders & Stappers, 2008)

Level	**Type**	**Motivated by**	**Purpose**	**Example**
4	Creating	Inspiration	'Express my creativity'	Dreaming up a new dish
3	Making	Asserting my ability of skill	'Make with my own hands	Cooking with a recipe
2	Adapting	Appropriation	'Make things my own'	Embellishing a ready-made meal
1	Doing	Productivity	'Getting something done'	Organizing my herbs and spices

2.2 Coping with technology

Jones and Issroff (2007) explain that users who are learning to use information technology are able to control their goals and to choose the tasks and activities they want to engage in informal learning situations. Furthermore, Jones and Issroff (2007) emphasize that ownership is often regarded as a central concept concerning learning motivation. However, this motivation can mean the ownership of the learning or of the products (Jones & Issroff, 2007).

When studying user acceptance of new IT, Beaudry and Pinsonneault (2010) noticed that users who were willing to search for social support for the use, were using the new IT more than those who did not. This was the case even when the users had distanced themselves from the new IT prior to finding support. Beaudry and Pinsonneault (2010) explain that excitement leads users to seek instrumental support, meaning looking for help from people around the user, online or from manuals. This was done in order to enhance the use of IT in order to maximize its benefits. Therefore, excitement tends to lead to explorative behavior where users "play" with the system and learn its use. However, this might not add anything to the functional use of the new system (Beaudry and Pinsonneault, 2010).

It is common for users to feel delighted and empowered, and have a sense of belonging through their social and professional relations when the used technology is working as expected or even beyond. However, when problems occur with the technology these feelings tend to change towards anger, frustration, fear, stress, loneliness and even depression (Järvenpää & Lang, 2005).

A special instance of coping with technology is user adaptation. Beaudry and Pinsonneault (2005) defined user adaptation as the cognitive and behavioral efforts that user goes through when trying to cope with a major IT related

event occurring in their work environment. First, when an IT event is evaluated by the user with primary appraisal. Primary appraisal is about determining the consequences following the IT event and what kind of personal and professional effect they might have on the user. After the primary appraisal, the user starts the secondary appraisal phase (Beaudry and Pinsonneault, 2005). Lazarus and Folkman (1984) explain that in the secondary appraisal phase users start to evaluate the amount of control they have over the IT event. Furthermore, users assess the adaptation options they have based on the available resources. In the IT context however, secondary appraisal is approached through three main components, which are work, self and technology (Beaudry and Pinsonneault, 2005). After the appraisal users start adapting, which can be either emotion- and/or problem-focused. In emotion-focused adaption the user orients toward themselves, while trying to change their perception of the IT event's consequences or to reduce emotional distress (Beaudry and Pinsonneault, 2005).

Lazarus and Folkman (1984) also explain that users are able to adjust aspects of their self in order to better match with the IT, a strategy called adjusting the self. This is the case when a technology has a specific requirement the user resists, but is willing to change their behavior to fit other requirements, or even learn a new skill in order to be able to use the technology experiences (Lazarus & Folkman, 1984).

Beaudry and Pinsonneault (2005) emphasize that it does not necessarily matter for the user, which coping strategy is used in the face of an IT event. All coping strategies can provide the user with help in order to deal with the issues following an IT event. Some users feel that the reduced stress and restored emotional stability after the IT event is sufficient allowing them to continue normally. Some might also consider exceeding their limits in the use of new IT as a significant achievement (Beaudry and Pinsonneault, 2005).

As Carver and Scheier (1994) mention, coping strategies can be divided to problem-focused and emotion-focused coping. In problem-focused coping the individual aims to remove the event causing problems or reduces the effects of that event. In emotion-focused coping the individual tries to reduce the negative feelings related to the threat response. According to Nach and Lejeune (2010), when an individual confronts a situation where they cannot cope by acting on it or adjusting the self, they tend to approach the situation with emotion focused responses such as cathartic practices and detaching. With these strategies the individual aims to handle the negative emotional effect caused by the stressful event, and therefore reduce discomfort. Cathartic practices do this with expressing the frustration outward. Detaching strategy on the other hand relies on the individual's effort to decrease the amount of thought or attention from the issue. This can be done for example with humor (Nach & Lejeune, 2010). Cui, Bao and Chan (2009) mention that avoidance coping strategies, including refusal and delaying, can be also considered as active management of the problems with new technology.

2.3 Confrontational coping strategies

Järvenpää and Lang (2005) explain how some users are not afraid to confront technical issues or unexpected behavior that is encountered. These users are ready to apply confrontational coping strategies. According to Järvenpää and Lang (2005), these strategies are used to understand and accommodate technology. Love and Irani (2007) noticed that when users were actively trying to adapt and coping in a problem-focused manner, they would adjust more easily compared to users who used emotion-focused coping strategies. These emotion-focused coping strategies include cognitive-avoidance coping, social coping, accepting responsibility and self-controlling coping. Love and Irani (2007) also explain how self-controlling coping strategies can be used when the individual aims to regulate and control their feelings and behaviors in stressful situations.

Järvenpää and Lang (2005) studied confrontational strategies in a mobile technology context and they explain how users applying these strategies are willing to learn to use the technology. Furthermore, as users gain more understanding about the possibilities of a technology, they are also ready to change their expectations to better match the circumstances (Järvenpää & Lang, 2005). This was also studied by Mick and Fournier (1998), who brought up consumption confrontational strategies, explaining the behavior when the user has decided to use a product and has to deal with problems arising from the use. According to Mick and Fournier (1998) these strategies are accommodation, partnering and mastering.

When accommodating, users change their use habits of the product based on the information they have from the requirements, abilities and inabilities of the specific technology. In partnering, the user decides to establish a committed relationship with the technology and may trust it as a teammate or a companion. Mastering strategy is used when the user wants to eliminate the possibility of disorder, dependency, obsolescence or incompetence felt during the use. It is done by gaining a full dominance over a technological possession and learning the operations, strengths and weaknesses of the technology. Furthermore, users tend to change coping strategies to better match with other crucial paradoxes they might face with multiple technologies (Mick & Fournier, 1998).

Nach and Lejeune (2010) mentioned acting on situation and adjusting the self as strategies where users actively try to find a solution for the problem. When acting on the situation, the individual believes that something can be done when IT is threatening their identity. Furthermore, the individual will take action in order to protect their identity as well as pursue returning their work environment under their control. Users are also able to adjust aspects of their self in order to better match with the IT, a strategy called adjusting the self. This is the case when a technology has a specific requirement the user resists, but is willing to change their behavior to fit other requirements, or even learn a new skill in order to be able to use the technology (Nach and Lejeune, 2010).

According to Love and Irani (2007) active coping is engaged in order to manage stress via cognitive as well as behavioral attempts. One of these active coping strategies is a meaning-based coping process, where a stressful event is used to actively seek and find a positive meaning. Furthermore, the individual aims at engaging in activities that would ease the stress. Additionally, Love and Irani (2007) mention that this coping strategy can be assimilated to problem-focused coping. Problem-focused coping is about gathering information, making decisions, planning and resolving conflicts, while aiming to manage or solve that particular issue that is preventing the individual from achieving goals and causing distress. Cognitive-avoidance on the other hand is about completely involving or denying thoughts or feelings that deal with the cause of the stress. Furthermore, avoidance coping can be considered as a defense mechanism, that means a way of protecting oneself from any unpleasant feelings arising from the stressor. Social coping on the other hand is about confronting the issue with social support. However, this coping strategy has been associated with high stress and high anxiety. Finally, in responsibility acceptance the individual is aware of their role in the problem but also tries to fix it at the same time (Love & Irani, 2007).

Based on the literature described in this chapter, hypothesis 1 is concluded as follows:

> Hypothesis 1: Players facing usability issues will (depending on the type of usability issue):
>
> - adapt to situation
> - try to fix usability issues
> - abandon the game
> - start over

Hypothesis 1 explains the first possibility to be user adapting to the situation causing usability issues. This can be for example learning how to user the product without causing crashes or prepare for these crashes e.g. by saving the state of the software more often. The second option is fixing these usability issues. This can be achieved by making modifications to the game, installing modifications created by someone else or finding information on how to fix it. The third option is to abandon the game. In this scenario, the user might be frustrated or considers the effort exceeding the value gained from fixing the product. The last option is starting over. For example, if a game crashed in the middle of gameplay, the user might start over, if they are not too frustrated by the event and are willing to go through sections that had already been solved.

3 USABILITY

This chapter discusses usability, along with concepts related to it, including usability problems and user experience. Furthermore, these topics are viewed also from the perspective of video gaming. Factors affecting user experience, and flow and immersion are also explained.

According to Nielsen (1994), usability is a multidimensional concept, which is about learnability, efficiency, memorability, occurring errors and user satisfaction. It is often defined as the ease of use and acceptability of a system (Holzinger, 2005). Especially, this ease of use and acceptability should be considered from the aspect of a certain user group that is executing specific tasks in a specific environment (Holzinger, 2005). As IJsselsteijn, De Kort, Poels, Jurgelionis and Bellotti (2007) mention, in-game experiences should not be measured merely with usability related metrics, since they usually highlight the productivity of the user and the output of the performed action. Therefore, IJsselsteijn et al. (2007) explain that this kind of measurement does not suit well in applications, where productivity is not aimed to, such as games, since they have different goals than productivity applications. According to Jørgensen (2004), computer games are played mostly voluntarily. Therefore, the usability of games does not necessarily have great effects on the market (Jørgensen, 2004). As Federoff (2002) explains, games are played in order to achieve goals and if there is no challenge to obtain these goals, the game is perceived as boring. Therefore, certain level of challenge is needed in order to keep the game fun (Federoff, 2002). This is further examined in chapter 3.2.3.

A special instance of usability in video game context is playability (Sánchez et al., 2009). Sánchez et al. (2009) explain that playability describes how well video game players are able to achieve the goals set within the game, while being effective, efficient, satisfied and still having fun. As Federoff (2002) mention, playability is tightly integrated with the usability of the game. Furthermore, as Desurvire et al. (2004) mention, playability goes further than merely assessing the usability of the game's user interface. The emphasis of this approach lies on the interaction style and the quality of the game's plot or the quality of gameplay itself. Furthermore, there are several factors affecting play-

ability, such as the storyline quality, responsiveness of the game to user input, usability, customizability and the realism of the game, as well as the graphics and sound quality (Sánchez et al., 2009).

Sánchez et al. (2009) suggested a set of seven attributes to define playability; satisfaction, learnability, effectiveness, immersion, motivation, emotion and socialization. If we compare this to Nielsen's (1994) definition of usability, we notice that there are several aspects overlapping, including learnability, effectiveness/efficiency, and user satisfaction. This underlines the fact that usability and playability are very closely related. Furthermore, Sánchez et al. (2009) emphasize the satisfaction and credibility aspects of this definition. Satisfaction in video games tends to be challenging to measure comparing to desktop systems, because games are more exposed to subjectivity of non-functional objectives. Furthermore, Sánchez et al. (2009) explain that credibility is dependent on the level of immersion during gameplay, which is difficult to measure objectively as well.

3.1 Usability problems

The first chapter discussed the psychological process of coping, it's relationship to creativity and coping strategies used with technology and confrontational coping strategies in specific. This chapter gives an overview on usability problems, since they are usually obstacles preventing the normal use of IT. The user has to use some coping strategies in order to overcome these problems.

According to IJsselsteijn et al. (2007) usability problems are a serious threat for the interaction with the game, since they can single-handedly prevent users from enjoying the game. Usability issues occur especially when a player is interacting with a new game environment, while they might feel more challenged (Gerling et al, 2011). However, Gerling et al. (2011) noticed that the overall experience from a game can still be positive, if the game is well designed.

There has been discussion in media that it might be possible that when there are problems accessing a digital service, such as Facebook, users attempt to find alternative methods for accessing it (Hern, 2016). This should be studied further, especially in game context in order to see, whether the technical problems actually cause abandoning a certain game.

Jones and Issroff (2007) noticed in their study in the context of mobile phones, that if there is a strong incentive to use a technology, the usability problems do not matter as much. However, the motivation behind this behavior should be examined. In the case of mobile phones, a following reason was mentioned for the use despite of usability problems (Jones and Issroff, 2007):

> "Mobile devices are widely used for entertainment, especially by young people, so it is possible that the emotion and the excitement generated by this use may be associated with the device – mobiles become identified as 'fun' devices".

Mentis and Gay (2003) noticed that users would mostly remember problems that had occurred while the system was making a response to user's actions, a phase that Mentis and Gay (2003) call the outcome phase. Therefore, they claim that if the usability design's goal is to improve the perception of experience from the use of technology, the focus of the design should be on the areas affecting the outcome phase.

According to Sweetser & Wyeth (2005), Adams (2004) explains that errors occurring during gameplay can cause a sense of losing control over the game. This is the case especially with errors or consequences beyond the player's control. Therefore, the game design should not allow players to make mistakes that would crash the game. Furthermore, the game should guide the player to recognize, diagnose and eventually recover from any errors that might have occurred (Sweetser & Wyeth, 2005; Adams, 2004; Federoff, 2002).

3.2 User experience

In general, a meaningful and satisfying experience is created when the acts included are related to the total action and perceived by the individual to have a fulfilling unity or wholeness (Wright, Blythe and McCarthy, 2005). Hassenzahl, Diefenbach and Göritz (2010) suggest that users' perceptions and evaluation of a product are related to their experiences of affect with the product. According to Hassenzahl et al. (2010), this emphasizes the role of emotions in using and experiencing a product. Furthermore, the hedonic quality of a product has a bigger influence on positive affect comparing to pragmatic quality. Therefore, Hassenzahl et al. (2010) explain that hedonic quality explains how a product is able to create positive experiences. On the other hand, pragmatic quality of a product enables fulfilling needs via barrier removal. This helps to reduce the negative affect, but is not able to produce positive experience on its own.

As mentioned earlier, Hassenzahl (2008) defines UX as a transient and mostly evaluative feeling that a person has when they are interacting with a product or a service. Additionally, Hassenzahl (2008) mentioned that this has affected UX research attention to shift towards the users and their feelings instead of product and materials that used to be the target of interest. Hassenzahl (2008) further states that a good UX comes along fulfilling the basic human needs called be-goals, including autonomy, competency, stimulation, relatedness and popularity while interacting with the product or service. According to Hassenzahl (2008), hedonic quality is therefore also a direct contributor for positive experience. Furthermore, McCarthy and Wright (2004) mention that UX has an important role as we try to understand the usability of technology. McCarthy and Wright (2004) explained the four threads of experience giving an insight of technology as an experience. These threads are sensual, emotional, compositional.

Hassenzahl and Tractinsky (2006) stated that UX is multi-faceted and that it is about a technology fulfilling various needs, while acknowledging that the

use is subjective, situated, complex and dynamic. Additionally, Hassenzahl and Tractinsky (2006) explain that UX results from the user's internal state, the characteristics of a system and the context of the interaction. Roto, Law, Vermeeren and Hoonhout (2011) also pointed out that there are various factors affecting the UX, but those can be classified into these same categories mentioned by Hassenzahl and Tractinsky (2006). These categories are further inspected in chapter 3.2.1.

Nacke et al. (2010) noticed that the research interest with an emotional and affective focus on digital games' user experience has grown in the recent years. According to Hassenzahl (2008), this approach emphasizes the subjective aspect of product use, but also recognizes the dynamic nature that UX has. UX is after all a temporal phenomenon that is ever-changing and studied in the presence (Hassenzahl, 2008). Nacke and Lindley (2008) mention that a major part of gaming experience is the emotions arising from the interaction. It is these emotions that motivate the cognitive decisions players make in the games (Nacke & Lindley, 2008). Chen (2007) suggests a four-step methodology to be used in game design in order to provide an enjoyable interactive experience for the largest audience:

- "Mix and match the components of Flow;
- Keep the user's experience within the user's Flow Zone;
- Offer adaptive choices, allowing different users to enjoy the Flow in their own way; and
- Embed choices inside the core activities to ensure the Flow is never interrupted."

An important thing concerning in gaming UX that Takatalo et al. (2010) noticed that in players can be more attentive and aroused rather than engaged in the game when studied in a laboratory. Alternatively, those who were studied while playing at home were still feeling engaged with a game, as it was a real place and socially interactive. This implies that any game research should take place in a natural space where the players act and react like usually.

3.2.1 User experience factor categories

Hassenzahl and Tractinsky (2006), and Roto et al. (2011) mentioned categorizing factors affecting UX to three different types: context of use, user's internal state and the system's characteristics. The context of use consists of social context, physical context, task context, and technical and information context. The social context is affected when the user is working or interacting with other people. The physical context describes the use of a product in different physical locations, e.g. using a system with a desktop in an office or with a mobile device on the move. Task context is about the simultaneous tasks that the user has to deal with in addition to the product. Finally, technical and information context

defines how the product might be connected to network services or other products (Roto et al., 2011).

The user's internal state affects the UX as well. According to Roto et al. (2011), the dynamic nature of the person experiencing the system causes the UX to be dynamic as well. The dynamics of a user's experience result from the motivation to use, user's mood, mental and physical resources, and the user's expectations (Roto et al., 2011).

The last category is the system's properties. Roto et al. (2011) mention that the properties of the system that affect UX can be designed into the system, added or changed by the user, resulting from the use or having a certain image about the brand of manufacturer. Examples of properties designed into the system are the functionality, aesthetics, designed interactive behavior and responsiveness of the system. The properties that can be changed or affected by use are any customization possibilities in the product or a worn look in physical products. These properties can be further changed with user-driven innovations and modifications in games, which we will examine later. The brand or manufacturer image can be for example about its sustainability or perceived coolness among the users (Roto et al., 2011).

3.2.2 User experience in gaming

User experience in games is very individual. Players have differences in their skills and they also expect different kinds of challenges (Chen, 2007). However, understanding and studying the psychological aspect of UX in games can be challenging (Takatalo, Häkkinen, Kaistinen & Nyman, 2010). Prior knowledge is often used when learning new games (Ye, 2004). When a player has identified the genre of a game based on its visual conventions, this prior knowledge is used to help the playing of the game (Ye, 2004). According to Prensky (2001), tasks of playful intention can foster creativity. Dealing with new kind of playful tasks requires much more investment in learning and exploring.

Games are all about providing a positive experience to the players (Calvillo Gámez et al., 2009) and games developed with a technology-driven mentality neglecting the gameplay tend to vanish from the market quickly (Kiili, 2005). However, as Calvillo Gámez et al. (2009) mention, also non-game applications pursue to improve the individual's experience despite being a different domain of study. Calvillo Gámez et al. (2009) also explain that there is usually a general goal in a game provided for the player. This goal is used to gain control over the game, even if the player is not aware of the goal, since there is often a clear starting point (Calvillo Gámez et al., 2009). According to Calvillo Gámez et al. (2009), this is something that productive applications could learn from games, since a clear goal specification allows improved experience. After all, in games the goal is provided by the application, but in the case of productive application the user has to provide the goal (Calvillo Gámez et al., 2009). As Federoff (2002) mentioned, games can entertain with their ability to provide an environment where players can "escape" the real world.

According to Costkyan (2002), games are really about a struggle and overcoming the challenges causing this struggle. It is the core objective of the game to solve different kind of puzzles, where items are searched and used in a specific manner in order to cause certain kind of changes in the game-state. Gameplay requires the player to interactively struggle in order to approach the goal. Furthermore, the game should not be too easy, nor too difficult in order to maintain the player's interest. This is further explained in chapter 3.2.3, where flow and game experience are discussed. Good gameplay helps to maintain the motivation and engagement with the game throughout the experience. (Costkyan, 2002). According to Kiili (2005), game designers Rollings and Adams (2003) defined gameplay as a series of challenges that are causally linked and take place in a simulated environment. Additionally, Kiili (2005) mentions that the actions players take in order to deal with these challenges are part of the gameplay as well.

De Lima, de Lima Salgado and Freire (2015) explain that game developers use their prior knowledge about the gaming community in order to meet their requirements about the games. Therefore, it is important to know the thoughts of the community in order to find the subtler insights concerning the gaming experience (de Lima et al., 2015).

Calvillo-Gámez et al. (2010) explain that the players' actions are determined by meaningful goals within the game. Within the boundaries offered by the game, these goals are pursued by the players, as they earn rewards, make decisions and deal with the game's challenges. During the gameplay the players tend to evaluate their performance in the game constantly. This behavior may be conscious or unconscious. Players want to know whether they are reaching the desired goals and assess if they are able to meet the challenges. When players reach goals after overcoming obstacles, they feel positive and competent. The narrative of the game become more of a storytelling while the player gets an active role (Calvillo-Gámez et al., 2010).

Nacke, Drachen and Göbel (2011) talk about gameplay experience (GX) and how it is created when the player is interacting with the game. Furthermore, this interaction between the player and the game aims to provide a motivating experience while still being entertaining (Nacke et al., 2011). In their study of evaluating UX in games, Calvillo-Gámez, Cairns and Cox (2010) explain that the enjoyment from a game is achieved when the player has gained enough control over the game. Specifically, the enjoyment is also linked to the sense of ownership that the player has over the game (Calvillo-Gámez et al., 2010). When assessing the game experience, Nacke et al. (2009) mention that it should be performed only when a game offers good playability. Furthermore, there should not be any problems in the game design that might disturb an individual game experience.

Mandryk, Inkpen and Calvert (2006) suggest that if the interaction technique between the player and the game is successful and delivers a seamless access to the game environment, the interaction itself should be a source of fun. Even there are traditional usability issues with games that should be considered,

the most important things affecting a gaming experience are the challenge, engagement and fun (Mandryk et al., 2006). Another problem that Calvillo-Gámez et al. (2010) mention concerning the design of a game's UX is that even if the designer has a clear idea of what kind of UX should be provided, it still might not be the same experience from the player's perspective.

As Sánchez et al. (2009) mention, it is the goal of video games to entertain above all. Therefore, satisfaction cannot be reached if a game is not fun to play. Additionally, the games should not make players feel disappointed or uneasy while playing, so that they would stop playing it completely (Sánchez et al., 2009). As Sweetser and Wyeth (2005) mention, the players will eventually stop playing if they do not enjoy the game. According to Federoff (2002), having metrics on satisfaction is a key part in the evaluation of game usability. This is due to the fact that games aim to provide players with entertainment instead of productivity. Furthermore, Federoff (2002) explains that game related satisfaction is a multidimensional concept consisting of fun, immersive environments and compelling experiences. Furthermore, according to Federoff (2002), user satisfaction in games does not usually rely much on the user interface. However, Federoss (2002) points out that Shelley (2001) mentions the possibility of poor user interface design reducing the enjoyment of game play.

According to Gilleade and Dix (2004), video games are capable of producing feelings of frustration for the player. This occurs for example in situations where a certain enemy cannot be defeated or if the player is unable to get away from a certain location in the game world, such as a dungeon. Frustration occurs when these situations are not resolved by the player in a reasonable period of time. Additionally, Costkyan (2002) explains that feelings of frustration typically when progression is hindered regardless of the player's efforts. Gilleade and Dix (2004) define frustration in the context of video games as a feeling arising when something is preventing a user making progress towards a set goal. Specifically, frustration is a negative emotion that can reveal when the user would need assistance in order to make progress in the game. Monitoring can be used in order to help recognize frustration during gameplay. Using this information can help to figure out what kind of situations are the user able to handle themselves and where do they need assistance, helping to avoid these frustrating situations and avoid the possibility of discontinuing play (Gilleade & Dix, 2004). Gilleade and Dix distinguished at-game frustration as a situation where the user is not able to use the input device, such as mouse or a gamepad, so it would help the player to progress with the game. Similarly, at-game frustration occurs, when user-interface is causing preventing the user from efficiently interacting with the game (Gilleade & Dix, 2004). In-game frustration on the other hand refers to situations, where the user is not able to complete the challenges set by the game.

3.2.3 Flow and immersion in gaming

The concept of flow was developed by Csikszentmihalyi (1991), meaning a state of mind that can be achieved while conducting a task that requires a lot of skill that a person possesses. When the skills exceed the challenge, the person becomes bored and anxious when the challenge is too great (Csikszentmihalyi, 1991). As Pink (2011) mentions, this also relates to mastery. In mastery, the individual aims to become better at tasks they consider important and therefore invest significant amounts of effort to the task. Specifically, these tasks are intrinsically fulfilling, and have to be difficult enough to keep the person challenged but matching their skill-set in order to avoid causing anxiousness (Pink, 2011). Hassenzahl et al. (2010) explain that when people have positive experiences with technology, they can feel close to other users and communicate with them more, while gaining stimulating insights on the technology which helps to reach mastery. Agarwal and Karahanna (2000) talk about cognitive absorption, which occurs for the technology users when the technology provides a visually rich and appealing experience, while the user can feel control over the interaction. Additionally, cognitive absorption is strongly related to the perceived usefulness of the technology as well as its ease of use. Agarwal and Karahanna (2000) propose that the user's individual playfulness and personal innovativeness are strong factors on the occurrence of cognitive absorption.

It is vital from the perspective of game experience to provide feedback for the player. However, it is not so clear cut how much feedback should be provided, since frustration can occur when too little or too much feedback is provided. This is also related to the adaptive nature of video games, meaning the automatic adjustment of difficulty based on player actions. This is done in order to maintain the players' flow state (Prensky, 2001). According to IJsselsteijn et al. (2007) it is common for games to allow the player to choose the difficulty level in the beginning of the game or adjust it automatically based on the player's performance. Furthermore, the difficulty level can also be progressive, increasing every level throughout the game. This way the game tries to match the increasing skill level of the player with more advanced challenges. This enables the gradual increase in the experienced flow throughout the game, a phenomenon described as a homeostatic positive feedback loop, where the flow keeps increasing until the player is faced with too big of a challenge, leading to frustration, or the player keeps learning faster than the game can provide bigger challenges, leading to boredom.

According to IJsselsteijn et al. (2007) the flow model offers a good description of how the balance between challenges offered by the game and the player's skills should be defined. Good game design includes challenges adjusted for as broad audience as possible. The challenge should motivate the players to play but also enable them to use their prior experience and gained skills. This is currently an important topic in the games research (IJsselsteijn et al., 2007). The applicability of flow to gaming context was also recognized by Takatalo and Häkkinen (2014). They noticed that also in the gaming context, high motivation,

concentration and positive emotions were related to high and balanced challenge-skill evaluation. Immersion on the other hand is defined by Sánchez et al. (2009) as the degree to which the content in a video game is believable in order to make the player directly involved in the world of the game. Federoff (2002) explained that interactive environments can only create an experience of immersion when the user forgets that the participation is done through a medium. IJsselsteijn et al. (2007) further mention that the provided challenge is amongst the most important things in game design. Additionally, one of the major challenges in game design is to enable the flow state for the player as long as possible (IJsselsteijn et al., 2007).

As Prensky (2001) explains, there are reports of players describing a mental state of intense concentration, where a task earlier considered too difficult becomes manageable and extremely pleasurable. This has been identified of players' description of the flow state. According to Prensky (2001), flow is critical in the consideration of successful games, since they manage to find the balance of difficulty, without being too hard or too easy. Furthermore, this needs to be repeated among a mass of different players. Negative feedback is a strategy designed to help the player back to the flow: it smooths the challenges when player hit a hard time and gets more difficult as the player progresses.

Most games allow the player to choose a difficulty level before starting the gameplay. The difficulty can also be adjusted automatically based on player's performance on certain challenges. Furthermore, some games become more difficult as the game progresses. Usually this happens while the player's skills improve as well (IJsselsteijn et al, 2007). This was also suggested by Kiili (2005), who explained that increasing challenge along with the growing skill level of the player helps to keep the player in the flow state. Additionally, flow can keep increasing, until too difficult or easy challenges occur. Therefore, one of the major problems in game design is creating suitable difficulty levels and advancement models that would enable flow for a maximum time (IJsselsteijn et al, 2007). Especially, the challenge level should not spike unexpectedly during the game, instead increase incrementally (Kiili, 2005). Furthermore, if the challenge level is decreased before the end of the game, the player's interest to finish it might drop. In addition to the balanced relationship between skill and challenge, Kiili (2005) mentions that players should be provided with immeadiate feedback, as well as the goals and challenges matching the player's skill. However, it should be remembered that there is no way to guarantee the flow experience for the player (Kiili, 2005).

Regardless of the typical flow theory considering the need for suitable level of challenge in video games, Klarkowski, Johnson, Wyeth, Smith and Phillips (2015) noticed in their study involving the game *Left 4 Dead 2* that participants would achieve flow even when they were offered very easy challenges by the in-game enemies. In their study, the flow would be more related to exploring the world and enjoying the aesthetics of the game, since *Left 4 Dead 2* features a very detailed environment (Klarkowski et al., 2015). Therefore, Klarkowski et al. (2015) suggest that having an imbalance between challenge and skill does not

necessarily affect negatively in the possibility of experiencing flow in video games. Furthermore, Klarkowski et al. (2015) mention that the flow construct may not be completely applicable for video games, as is. They point out to the fact that multiple commercial games feature detailed environments, increasing the possibility to experience flow. However, in their *Left 4 Dead 2* study Klarkowski et al. (2015) noticed that when immersion was not possible to experience due to the imbalance between challenge and skill, when the player did not have the possibility to immerse themselves with the game world. Nevertheless, Klarkowski et al. (2015) explain that it is difficult to measure flow in games, while recommending further research on the challenge-skill balance in order to understand better the role of flow in games.

Jennett, et al. (2008) mention, that one shared element between successful computer games is their ability to attract people and keep them occupied. As Sweetser and Wyeth (2005) explain, in order for a game to be enjoyable, it has to be challenging enough to make the player concentrate. Furthermore, the player has to be able to concentrate on it as well. The game will be more absorbing when higher level of concentration is required by a task in terms of attention and workload (Sweetser & Wyeth, 2005). Furthermore, Jennett et al. (2008) emphasize the fact that games provide people a possibility to focus on something else than everyday worries and concerns and therefore people tend to "lose" themselves to the game. This is what Jennett et al. (2008) describe as immersion. It is vital for an enjoyable gaming experience, since it is a sign of good gameplay (Jennett et al., 2008). Nevertheless, Jennett et al. (2008) also remind that there are still different views about what immersion truly means and how it is born, although one key factor seems to be emotional involvement according to them.

Kiili (2005) mentioned bad usability, inappropriate challenges and objects breaking the in-game harmony as possible factors reducing the possibility to experience flow. Mentis and Gay (2003) noticed that when the cognitive flow of a user would be broken due to interruptions, the users had to compensate for that. Furthermore, this would be the case even if the users knew what they were required to do next in order to complete a specific task. Mentis and Gay (2003) mentioned bugs to be one type of these interruptions, that were considered intrusive. Additionally, in order to maintain the user's state of flow when interacting with a system, the system's responses should not take the control from the user. In case of an intrusive system response, the user should be able to regain the control as easily as possible (Mentis & Gay, 2003).

4 USER-DRIVEN INNOVATIONS

This chapter talks about co-creation and co-design, then user-driven innovations in the context of technology, while focusing especially on gaming context. Furthermore, this chapter explains the role of lead users with user-driven innovations, the toolkit approach to user-driven innovations.

4.1 Co-creation and co-design

Sanders and Stappers (2008) talk about co-creation and co-design, where multiple people are collaborating in order to design and perform collective creativity acts. Co-design is specifically an instance of co-creation, referring to the creativity of those designers and individuals who do not have training in collaborative design.

Sanders and Stappers (2008) mention that collective creativity has been known as a practice for decades, while it has been known as participatory design. As Sanders and Stappers (2008) mention, users are able to act in a co-creating role in different stages of the design process while acting as a co-designer. However, according to Sanders and Stappers (2008) this is not necessarily the case, since it depends of the user's expertise, passion and creativity. After all, anyone can be creative, but not everyone can become a designer (Sanders & Stappers, 2008). As Füller, Hutter and Faullant (2011) explain, co-creation activities are seen as providing interaction with people with similar interests and a possible medium to establishing social relationships with others. This strengthens the appeal of co-creation in addition to the actual content of the co-creation process (Füller et al., 2011). Furthermore, according to Füller et al. (2011), taking part in co-creation activities is usually considered as rewarding instead of requiring only effort from the co-creator.

As Sanders and Stappers (2008), explain, co-design can be perceived as a threat for existing power structures lingering in companies, since it enables customers, consumers and end-users to gain more control. It may be challenging

for the companies to see how this kind of new business would be able to be successful as well. However, acknowledging co-design's possibilities allows easier distribution and sharing of the control and ownership, which is possible due to networked online communities, where more people can have their opinions expressed. Nevertheless, as Sanders and Stappers (2008) mention, it will require time until this kind of egalitarian sharing will be accepted in a general level, although examples of companies acknowledging its possibilities will be presented later in this chapter. Furthermore, individuals have to be convinced that they can be creative and act as co-designers. After all, co-designing cannot be performed without creative initiative coming from all participants, including researchers, designers, clients and the individuals for whom the co-designing experience is aimed, in order to produce them some benefit (Sanders & Stappers, 2008). Holmqvist (2004) recognized the connection between user-driven innovations and participatory design, since both acknowledge the potential of users already in the design process.

As Humphreys et al. (2005) explain, an important aspect for the companies to consider is the difficulty to depend on unpaid this kind of unpaid workforce, as it is unruly, hard to contain and they do not face any milestones or demands from the publishers. Instead, user innovators choose the pace they work at, as they are creating innovations merely with passion, enthusiasm and self-motivation.

Humphreys, Fitzgerald, Banks and Suzor (2005) mention that in the context of video games, there are some views, that the game's code should be protected as much as possible and all interference to it is damage or theft. Furthermore, according to this view, the developer or publisher is holding all game rights. However, alternative perspectives exist, where toolsets have been given to be used by innovative users freely in order to create content, and also a web platform to upload these creations. This kind of behavior has encouraged the mod communities to build versatile content. These kinds of companies have not tightened their control on intellectual property, instead they have chosen to allow strategic aspects of the game to be modified in the community (Humphreys et al., 2005).

4.2 User-driven innovations and modern technology

Modern digital technologies have created a possibility for consumers to take part in production and distribution of media content since the mid-1990s. The consumers are not merely the receiving end of the delivery. Companies can even enforce this behavior by giving tools for the consumers to use in product development (Nieborg & Van der Graaf, 2008). Jeppesen and Molin (2003) mention examples from recent history of how consumer innovations have been implemented in the video game industry, such as *Half-Life: Counter-Strike* that was made by users based on the game Half-Life and afterwards made into a complete game. Furthermore, it has been shown in research that innovations popu-

lar only among lead users may become general demand in the near future (von Hippel, 2001). As von Hippel (2005) mentions, there have been instances where user-driven innovations have been found to be commercially attractive and even been eventually adopted to commercial production.

Piller, Ihl, Füller and Stotko (2004) define user innovation as a concept where consumers are involved with the value chain early in the process of product innovation and development. As Jeppesen and Molin (2003) explain, the innovative activities of consumers should concern companies also in a commercial sense, since they enable longer product lives and are a source of new product ideas. This was also realized by Sotamaa (2005), who further explains that the video game industry is interested in being in an active relationship with the community and allowing them to make their own modifications (mods) to the games. According to Rosted (2005), user-driven innovations spring from the understanding of customer needs and being able to create unique products and experiences based on this knowledge. Aoyama and Izushi (2008) explain that there is a shift going on from product provision to sharing. Instead of passively receiving new products consumers are now active participants in the development, sharing and distribution of digital products, as co-developers (Ayoama & Izushi, 2008).

Furthermore, consumer innovations lead to cost savings, since they are making research and development for free (Jeppesen & Molin, 2003; Sotamaa, 2005). Also, Rosted (2005) explains that accessing knowledge about the customer and user-driven innovations lead to higher profits. Sotamaa (2005) refers to these innovations creating consumers as 'modders'. Additionally, user-driven meeting of requirements in organizational context is known as Shadow IT (György, Cleven, Uebernickel & Brenner, 2012). György et al. (2012) explain that SIT can be the main driver for innovations in an organization, but can also cause problems. According to György et al. (2012), SIT aims to make IT usage more effective, since it enables the users to use solutions they prefer. However, a strong set of skills are required from the user in order to participate in shadow IT (György et al., 2012).

In order to maximize their benefits from innovating, user-innovators should aim for combining and leveraging their effort invested on innovations. Users tend to achieve this through versatile co-operation, such as forming communities (von Hippel, 2005). Utilizing online consumer communities has already become common practice in the computer game industry, because companies acknowledge the communities' abilities to contribute to the product development through learning and innovation (Jeppesen & Molin, 2003). Furthermore, according to Humphreys et al. (2005), there is a long history of active fan communities creating more content to video games. The content varies from user-created levels, to object and character 'skins' and new artificial intelligence to play against (Humphreys et al., 2005).

Riggs and von Hippel (1994) explained that free sharing of innovations plays a major role in the user driven innovation communities, as individual users do not need to make everything by themselves. Instead, they can access the

knowledge and innovations already created by their peers (Riggs & von Hippel, 1994). The user-driven innovations can lead to new content or ideas for new products as well as ideas for improvements (Jeppesen & Molin, 2003). Piller et al. (2004) use the term "open innovation", meaning an innovation built with open source principles. According to Piller et al. (2004), the goal of open innovations is to use the ideas and approaches of open source software development in other product categories and services by enabling consumers to develop new products and services. Therefore, also game modifications can be considered as open innovations.

According to Jeppesen and Molin (2003), playfulness should be remembered both in the development as well as in the use of the product. Furthermore, Jeppesen and Molin (2003) think that there should be a solution space offered by the product, which would support intrinsic motivation. However, the environment should also support extrinsic motivation, for example peer recognition tends to lead to free sharing of knowledge for the public (Jeppesen & Molin, 2003).

Jeppesen and Molin (2003) mention that the degree of openness to innovation can be adjusted by the developers. However, excessive openness can be harmful for the product innovation, since the solution space can become too complicated even for the more advanced users. Furthermore, the arisen problems may be too difficult for the whole community to solve if core issues cannot be identified due to the diversity of problems. Whatever the decision for the degree of openness will be, it should be increased over time, since consumers develop better design capabilities and are able to deal with more complex solution spaces and therefore create improved consumer innovations (Jeppesen & Molin, 2003).

For the developers it is important that customers help and teach each other with the development tools, since it reduces the effort needed from the developers (Jeppesen & Molin, 2003). Users who give input to development also perform problem-solving activities and therefore save expensive iterations for the company, which enables even further savings for the company (Jeppesen & Molin, 2003).

According to Sotamaa (2005), it is common that game development is regarded as an iterative process that uses the observations, suggestions and designs of consumers as important resources. It is not necessary to analyze the needs and requirements of the user since development tools can be given to users, who can experiment with them.

Buur and Matthews (2008) introduce three approaches to user-driven innovations. These are lead-user approach, participatory design, and design anthropology. The lead-user approach emphasizes the importance of innovations made by lead-users as well as the preceding condition. These lead-users come up with market needs months or years before they are acknowledged within the majority that is other users. Therefore, lead-users can be in a situation, where they would benefit from products meeting their needs. Lead-users often have the skills and tools required for creating artifacts that would fulfill their

needs. Lead-users tend to predict future market conditions rather precisely and guide companies for needed innovations. In participatory design, the developers invite end-users to participate and contribute to the development process. This participation includes usually design, rather than giving feedback and evaluations of the product (Buur & Matthews, 2008). The last approach mentioned by Buur and Matthews (2008) is design anthropology, which aims to understand the users and their need comprehensively by researching consumers and their behavior.

According to Györy, Cleven, Uebernickel and Brenner (2012), innovations and the efficiency of IT use can be improved with user-driven approach. However, from the perspective of the company making the original products, user-driven approach also includes increased IT security risk and integration costs, while reducing the amount of provided services and limiting the advantage of economies of scope. Additionally, user-driven meeting of requirements in organizational context is known as Shadow IT (SIT) (Györy et al., 2012). Györy et al. (2012) explain that SIT can be the main driver for innovations in an organization, but also cause problems. According to Györy et al. (2012), SIT aims to make IT usage more effective, since it enables the users to use solutions they prefer. However, a strong set of skills are required from the user in order to participate in shadow IT (Györy et al., 2012).

According to von Hippel (2001), the success of innovative user communities is often subject to three conditions. First, there has to be an incentive for some users to innovate. Usually this is met when the expected benefit exceeds the associated costs. Second, there has to be an incentive for some users to share their innovations with others along with the distribution medium. However, the costs related to revealing innovations are usually low. This is also acknowledged by the innovating users, if there is no rivalry on the innovation among their potential adopters. Third, these user-driven innovations have to be able to compete with commercially produced and distributed innovation. When users have needs that they wish to be addressed, the commercial manufacturers might lack the incentive to solve the issues with every detail. This is often explained with cost reasons, as it might not be financially viable to create a product for the niche market (von Hippel, 2001). As von Hippel (2001) mentions, this kind of decisions are understandable but also hinder further innovations. Therefore, there might not even be competition between the user driven innovations and the commercial production in the first place. As was the case with open source software, the innovations could be created and distributed for free on the web, due to the nature of software being information, not a physical product.

Riggs and von Hippel (1994) explain the difference between user innovation and manufacturer innovations to be essentially the area of importance; user-driven innovations tend to have scientific importance whereas manufacturer innovations have commercial importance. Different definitions for user-driven innovation have been used as well. Rosted (2005) applied a definition, where the user did not necessarily take part in the design. Rather, the design was a

user-centric process, where the consumer was not an active participant but the company making the product would map the customer needs in a scientific and systematic manner, while generating innovations from user needs that had not been previously recognized (Rosted, 2005). This thesis however considers user-driven innovations only from the perspective of users participating in the design and creation of the innovations.

Aoyama and Izushi (2008) explain that traditionally the costs related to sharing user-driven innovations are the cost of distribution and losing the intellectual property. However, as Aoyama and Izushi (2008) mention, distributing digital products is ultimately free. Furthermore, the loss of intellectual property can be seen low as well if no rivalry exists between different market segments in using the innovation. Humphreys et al. (2005) mention that the possibilities that have emerged from the adoption of digital networks in terms of innovation can also collide with legislation on copyright and intellectual property.

4.3 Users and their approach to innovation

Jeppesen and Molin (2003) mention that regardless of the end-users' tendency to innovate from time to time, they have varying readiness, interest and capabilities to perform that. However, consumer innovation processes driving consumer learning and innovation require certain types for consumers in order to happen. Therefore, Jeppesen and Molin (2003) defined three types of consumers. Type 1 consumers are not only using the product but also tend to develop innovative applications. According to Jeppesen and Molin (2003), type 1 consumers have more in-depth and specific knowledge on some level of the product and they also try to have the updated information through peer interaction. In this thesis, type 1 consumers are paralleled with lead users. As Jeppesen and Molin (2003), they can be recognized as lead users, being the minority of a user segment, developing solutions for needs that do not yet exist in the general market.

In their study, Jeppesen and Molin (2003) described type 2 consumers as a product user actively interacting with other users in discussions related to their problems in the use of a product. However, type 2 consumers do not show innovative efforts towards further product development, like type 1 consumers. In the study of Jeppesen and Molin (2003), type 2 consumers were seen as players who would mostly play against the same type consumers. Finally, type 3 consumers are considered as a passive consumers using the product alone and not discussing the product with other users, typically playing against the computer (Jeppesen & Molin, 2003). Being a type 3 consumer is considered from the perspective of Jeppesen and Molin (2003) as a mandatory but transitionary phase, before the user can move to another group. Additionally, Jeppesen and Molin (2003) mention that users are able to move from one consumer group to another.

After a video game is released, the development continues in online communities by the players, who create more content for the game (Jeppesen & Molin, 2003). According to Hyysalo (2009), these lead-users are responsible for creating a major share of user inventions and modifications in the communities. They are often also referred to as "modders" (Postigo, 2007). Furthermore, Hyysalo (2009) mentions that bug and defect reporting, and suggesting improvements is one of the most common mode of user involvement in innovation. Jeppesen and Molin (2003) also point out that it is necessary for the developers to have consumers with a deep knowledge of the product they are hoping to extend.

Lead users are motivated to create innovations by their passion towards games, interesting theme of a game, out of the satisfaction to craft something new, their social status within their user community or in order to aim for employment through their own innovations. It is after all a productive activity, produced for free. Even though there might be some financial profit coming related to user-driven innovations, it is not usually the driving motive to work with user-created content (Humphreys et al., 2005). Similarly, according to von Hippel (2005), a motivation for lead users to innovate, is the innovation process itself, as it might increase the lead users' enjoyment or learning. Additionally, the possibility to solve problems can be seen as attractive and enjoyable from the view of innovating users (von Hippel, 2005).

Innovating users do not want to hide their innovations from the public, as it often is not beneficial for them in any way. In such a case, the only practical possibility is to reveal their innovations, as it is unlikely that the hiding would continue to be successful (von Hippel, 2005). Many others probably have the same knowledge, while it does not cause any costs to share this knowledge freely (von Hippel, 2005). According to von Hippel (2005), Raymond (1999) suggests that there is a mutual benefit for the lead users and the users adopting their innovations in revealing the innovations. When lead users have revealed their innovations, others can improve them even further, also to the benefit of the lead users. Furthermore, lead users can gain enhancement of their reputation among the community thanks to free sharing. Additionally, the benefits gained from sharing innovations can be amplified by being the first to do so. Therefore, it is possible that lead users compete on who manages to reveal their innovation first (von Hippel, 2005).

Riggs and von Hippel (1994) mention that if a user expects benefiting from an innovation while the traditional manufacturer would not, it is likely that the user gets involved with the innovation process instead of the manufacturer. Piller, et al. (2004) explain 'lead users' as customers who realize upcoming user needs months before the majority of users and who are able to benefit from creating a solution for these need. Hyysalo (2009) talks about lead users as the early majority of adopters and crucial users, who are making micro-innovations and adapting faster than other users and contribute to the development by expanding and changing the shape of the design space. Holmqvist (2004) explained them *(lead users)* as "extreme users", as they send to have specialized in

the product and therefore helped to push the original technology and concepts further than what would have been possible without them.

When users are involved in the design process, their innovative designs can give significant contributions to the development of a new product. However, this requires that these individuals are talented and willing to distribute their ideas and also to submit any innovative designs they might have come up with (Füller et al., 2011). Füller et al. (2011) suggested that individuals might not have interest for this process since they are not motivated to take part in companies' virtual co-creation projects where they could contribute with their ideas. This might be due to the companies failed attempts to create a motivating experience from the co-creation (Füller et al., 2011). It should be noted however, that Bar and Riis (2000) suggest that including a variety of users, including both lead users and lay users, will ultimately be beneficial for the innovation process.

4.4 Toolkit approach

Ayoama and Izushi (2008) mention that traditionally consumers were considered as consultants telling their preferences and requirements, which would eventually lead to new, innovative products. However, recently companies have started to experiment with the toolkit-approach. According to Piller et al. (2004), developers offer toolkits to be used in the solution space by for creating solutions and detecting problems. The adoption of toolkits eventually leads to the spreading of people involved with the innovation process. This helps users to access just the right kind of products and services, as they are designing them for their own needs (Von Hippel & Katz, 2002).

Toolkits can be used by the user to create new functions and also new products for themselves (Von Hippel & Katz, 2002; Piller et al., 2004; Aoyama & Izushi, 2008). Furthermore, these toolkits can usually be used for development without deep technical understanding (Piller et al., 2004). Additionally, Piller et al. (2004) mention that the average consumer using a toolkit for development do not probably match the performance of open source developers. However, the contributions can be very sophisticated comparing to mere text based contribution made in different online communities, thanks to toolkits (Piller et al., 2004). Nevertheless, toolkits enable very specific designs solving a particular problem with a trial-and-error –type of iterative process (von Hippel & Katz, 2002). These toolkits are usually available for commercial PC games in their websites, however some modders can also create their own tools for modifications (Sotamaa, 2005). Furthermore, even they are usually free, they require the original game's retail version, which enables the extended life time, increased sales and growing a dedicated fan community (Sotamaa, 2005). Von Hippel and Katz (2002) mention that toolkit approach enables developers to outsource need-related innovating to the users and therefore they are not required to perform as much activities trying to understand the needs of the users comprehensively. Additionally, von Hippel (2005) states that adding the possibility for

customization has been found to be related to increased user satisfaction, also outside the realm of IT.

Von Hippel and Katz (2002) mention that there are five objectives, that user innovation toolkits should pursue. Firstly, they enable user learning through trial and error. The second objective is offering a solution space which helps the user to define the upcoming designs. Thirdly, well-designed toolkits are user friendly, and they do not require much learning since they support design languages and skills the users are familiar with. The fourth objective is containing libraries of most common modules that the user is likely to need in the custom design. Lastly, well-designed toolkits enable user-made products to be produced by the manufacturer without any further revisions.

Empowering users with toolkits enables the users to improve their innovation abilities. Furthermore, users who are motivated to innovate and design product with the toolkits can fulfill their own needs accurately and at low cost (von Hippel & Katz, 2002). Additionally, the computer games industry is dependent on the innovation and product development that takes place in online communities (Jeppesen & Molin, 2003). As Aoyama and Izushi (2008) noticed, user-led innovations depend heavily on peer-to-peer interactions as well as communal input from the users. Furthermore, Jeppesen and Molin (2003) found several examples, where consumers held as sophisticated competencies related to product innovation as individuals inside the companies.

Concluding this chapter, the second hypothesis is explained:

> Hypothesis 2: User-driven innovations can affect the user experience of games positively or negatively.

Hypothesis 2 suggests, that user-driven innovations can help to improve or worsen the user experience in games. As mentioned above, users are offered toolkits to be used in mod development, in a trial-and-error manner. These customization possibilities have been found to increase user satisfaction. However, it should be possible that these modifications made by the lead users are not always that successful providing great user experiences. Furthermore, as the lead users creating these modifications have various level of skills for mod development, hypothesis 2 suggests that the modifications can cause technical issues as well.

5 METHODOLOGY

In this chapter I explain the research methodology along with the empirical research, covering the objectives, methods and problems of the research topic and how the research was conducted. Furthermore, the methods for data analysis are explained.

5.1 Research approach and objective

Bugs have an intrusive characteristic, interrupting the user's cognitive flow and therefore, having a negative effect on the user experience of software (Mentis & Gay, 2003). However, users tend to adapt and combine several strategies in order to cope with problematic situations (Stein, Newell, Wagner & Galliers, 2015). In video games the challenges that have to be overcome in order to achieve the goals of the game are deliberately created and it is part of the gameplay experience (Jørgensen, 2004). Considering these aspects, I am focusing on the external factors affecting the gameplay experience, especially technical problems and how they can be overcome with user-driven innovations. It must be noted, however, that users may not remember being frustrated earlier (Mentis & Gay, 2003), a fact that should be considered when making interpretations from the collected data.

Since developers are not necessarily aware of all usability problems that might occur in software (Høegh, 2006), toolkits offered for the users to create modifications could improve the situation. Furthermore, customization possibilities in general help to improve the gameplay experience (Bostan & Marsh, 2010), as was the case with the game World of Warcraft (Scacchi, 2010). Therefore, I am examining how these modifications (mods) can be used to cope with technical issues and to improve the user experience of a game.

The objective of the empirical research was to find out if players of *The Elder Scrolls V: Skyrim* (*Skyrim*) use user-driven innovations in order to cope with usability problems, including technical bugs, glitches, altering logic or anything

disturbing the UX within the game. Specifically, based on the research problem, the research was conducted in order to answer the following research questions:

- What kinds of strategies do players adopt and develop to cope with technical usability problems?
- What is the relationship between user experience, and strategy adoption/development?

5.2 Data collection

The game chosen for this research was *The Elder Scrolls V: Skyrim. Skyrim*, a medieval fantasy role-playing game was chosen, because it is still a popular release being among the 20 most played Steam games still in 2017, over five years after its release (Valve Corporation, 2017) and it has a vast selection of mods developed by active contributors (Ryan, 2014; Livingston, Hatfield & Papiz, 2016).

The research was performed conducting interviews with nine participants, each of them interviewed individually via Skype due to logistical reasons. The aim was to perform a qualitative research. As Hirsjärvi, Remes and Sajavaara (2004, 155) mention, qualitative research is suitable for topics that have not been thoroughly studied. A prerequisite for participating in the study was that the participant had experience playing *Skyrim* and that they had experience playing games in general with mods installed. Participants were gathered from local students, causing a bias towards IT students. However, professionals and students of different fields were included as well, such as social sciences, metalwork industry and chemistry. Only one participant was female, a factor that should be considered in the study, while the reason being out of this study's scope.

The subjective data provided in this study helps the evaluation of entertainment technology UX to advance with qualitative results (Mandryk et al., 2006). However, Mandryk et al. (2006) remind that it is not sufficient to use them alone in order to gain full understanding on the research topic. Furthermore, Calvillo- Gámez et al. (2010) explain that it is difficult to study digital games by using HCI research methods that are analyzing the functionality and productivity of a software. This is due to games providing players with rich but also personally meaningful experiences (Calvillo- Gámez et al., 2010).

The interviews (APPENDIX 1 INTERVIEW STRUCTURE) were conducted in a semi-structured manner. Smith, Harré and van Langenhov (1995) explain that using semi-structured interviews allows the researcher to interact with the interviewee more flexibly comparing to structured interviews. Furthermore, with-semi structured interviews it is possible to continue discussion on interesting topics found from the answers of the respondent. This way a more complete picture on the topic can be reached (Smith et al., 1995). The questions were the same for all participants, but further discussion occurred occasionally depending on participants' answers, if it seemed that the reason behind a certain answer would be discoverable. The interviews were held in Finnish, since all of

the participants were native Finnish speakers. Additionally, the interviewees were informed on the use of the interview data. The interviews were anonymous and they were recorded for replaying purposes and would not be shared to other parties. The participants were asked to accept an information consent about the research prior to the interviews.

In the beginning of each interview, the participants were asked for their background information, including age, sex, education, occupation and field. Then they were interviewed for their experience in video games, what they enjoy and what might cause irritation in video games, and installing mods in a general level in order to get an idea of their background and to further understand their behavior and reasoning concerning mods and gaming along with their experiences. After this, the interview would continue to discuss the participants' experiences with *Skyrim*, including questions on the general experience with the game, the game's technical performance, confronting technical issues, installing mods, and gathering information on the game from external sources on the internet. The participants were 23-27 years old, active gamers with approximately 5 to 30 playing hours per week, although this number was an estimate and naturally varying. Furthermore, all of the interviewees had a long history from gaming, as they all had started what they considered active gaming by the age of 11, first memories from gaming being from the age of five. Since *Skyrim* is a fifth game of *The Elder Scrolls* -game series, most of the interviewees were familiar with one or two preceding games, these being *The Elder Scrolls III: Morrowind* and *The Elder Scrolls IV: Oblivion*. The players had varying total time spent in *Skyrim*, from 59 to hundreds of hours. Some of these were not only estimates, but precise times that the Steam game platform had calculated.

5.3 Data analysis

A data analysis was performed as thematic analysis, as defined by Braun and Clarke (2006):

> "Thematic analysis is a method for identifying, analysing and reporting patterns (themes) within data. It minimally organizes and describes your data set in (rich) detail."

However, Braun and Clarke (2006) admit, that despite being widely used, there was not any commonly agreed definition on thematic analysis and its use. Nevertheless, according to Braun and Clarke (2006), Attride-Stirling (2001) argue that thematic analysis helps evaluating the research and analysis that has been performed upon qualitative data and comparing it with other studies.

According to Braun and Clarke (2006), thematic analysis enables an approach to analyzing qualitative data that is both accessible and theoretically flexible. They also argue that thematic analysis is a foundational qualitative

analysis method. Furthermore, Braun and Clarke (2006) mention that thematic analysis has multiple advantages, including:

- Summarizing key features from large amount of data and to propose a comprehensive description from it
- Finding and highlighting resemblance and variations between data sources
- Generating unexpected findings
- Interpretations of data can be made from a social or a psychological aspect

Additionally, thematic analysis can help reflecting reality and to unravel aspects of the reality. However, thematic analysis still springs from a theoretical standpoint, and therefore cannot offer complete answers but instead a baseline for further research. Furthermore, it should be noted that Braun and Clarke (2006) mention how the researcher plays an important role on the observations made with thematic analysis and that the themes brought up from the analysis are often deliberately "found" from the material. Table 2 shows the phases of thematic analysis and explains them in detail, as Braun and Clarke (2006) described them. The analysis in this study was performed accordingly, as explained below.

Table 2 Phases of thematic analysis (Braun & Clarke, 2006)

Phase	Description of the process
1. Familiarizing yourself with your data	Transcribing data (if necessary), reading and re-reading the data, noting down initial ideas.
2. Generating initial codes	Coding interesting features of the data in a systematic fashion across the entire data set, collating data relevant to each code.
3. Searching for themes	Collating codes into potential themes, gathering all data relevant to each potential theme.
4. Reviewing themes	Checking if the themes work in relation to the coded extracts (Level 1) and the entire data set (Level 2), generating a thematic 'map' of the analysis.
5. Defining and naming themes	Ongoing analysis to refine the specifics of each theme, and the overall story the analysis tells, generating a thematic 'map' of the analysis.
6. Producing a report	The final opportunity for analysis. Selection of vivid, compelling extract examples, final analysis of selected extracts, relating back of the analysis to the research question and literature, producing a scholarly report of the analysis.

The first step of thematic analysis is to become familiar with the data. In this phase transcriptions were made from each interviews, question by question and a table was formed in order to parallel the answers with each other. This helped to find similarities and differences between the answers. This stage also included making initial notes, based on how the answers related to previous studies and if relatively important things came up, i.e. repeating constantly.

The second phase was to generate initial codes of the data in a systematic fashion. This was performed by creating a table from topics discussed in the interviews. The topics were performance, usability and playability, game content, aesthetics, user experience, curiosity, progression and self-development, social aspect of gaming, creativity and external factors. These topics helped with the search of themes in the third phase.

The third phase was to search for the themes of the interviews and gather all the data that was related to the specific theme. The themes created based on the data were usability, aesthetics and game content.

In the fourth phase the themes were reviewed in order to find out if the themes were appropriate in terms of the coded extracts as well as the entire data set of the analysis. It is worth mentioning, that in this stage the themes were noticed to overlap with some coded topics. However, the topics chosen as themes did not overlap with each other and they were related to many of the topics as well, acting as drivers and/or enablers to some topics.

The themes were named and further defined in the fifth phase. This was done with the help of a thematic map, which helped to further understand the content of the themes as well as their relations to other coded topics.

Finally, a report was produced, as explained in chapter 6. Specifically, the relations and logic behind the topics and the themes were explained. Furthermore, the report included examples of data extracts and analysis, while explaining their relation to this research as well as the earlier literature.

6 RESULTS

This chapter discusses the results of the empirical research and the thematical analytics based on the research data. Specifically, the relationship between user experience and user-driven innovations seems to be related to three different themes: The answers revolved around the following themes:

- Performance and playability of the game
- Content of the game
- Aesthetics of the game

The themes were derived from an interpretation that the motivation for installing modifications was always related to improving one or more of these aspects of the game. There were more specific topics and areas that the participants wanted to modify with the UDIs, but they would all fit under one of these themes, as will be explained later in this chapter.

Performance of the game refers to the technical functioning of the game, i.e. whether it is running smoothly, crashing or lagging. It is also closely related to the usability and playability of the game, since it can cause the occurrence of errors, one of Nielsen's (1994) aspects of usability. The content aspect covers everything within the game world, such as the lore, story, quests, environment, characters and items. Finally, aesthetics is about the visual appearance and graphics of the game. User experience was found to be related to each of the other themes, and the other themes' effect on user experience was inspected. Furthermore, the themes were examined from two different angles:

- Was a theme affected positively with user driven innovations?
- Was a theme affected negatively with user driven innovation?

Additionally, curiosity, usability issues and the willingness to further improve user experience seemed to be the main drivers for installing modifications. Curiosity in this context means the willingness of the player to explore the available resources in order to modify the game. However, the willingness

to improve the user experience further seemed to be the most important factor for installing mods in *Skyrim*. This was mostly caused by the modifications allowing a diverse range of possibilities that could be introduced in the game. For example, a certain participant described their experience with *Skyrim* completely different, when playing with mods. According to the participant, this was due to the major changes in the game mechanics, such as a survival aspect, where the physiological and biological aspects had a major effect on the relationship between the game world and the character. In this case the participant had used a modification that introduced e.g. hunger and the possibility of frostbites, otherwise unavailable in the game. A few other participants had had similar experiences with alike modification. This also added to the game's realism according to the participants. The realism of the game was reported to be generally improved with the modifications. In addition to the previous examples, also more realistic nights, general improvement of the visual appearance had been introduced in modifications, and considered as improving the realism. However, although some participants mentioned that improved realism had also improved their general experience with the game, it was not approved by everyone.

6.1 The relationship between user-driven innovations and user experience

User-driven innovations seemed to be related to performance, usability, content and aesthetics in a similar way. UDIs had the ability to affect them all so that it would further affect the user experience, in better or worse. Specifically, performance and content could be improved or worsened by the UDIs. Usability and aesthetics were mostly mentioned to be improved, but in another context, it would be reasonable to study if UDIs can impact them also negatively, especially since it was mentioned that modifications had a varying quality. Since there is a vast selection of modifications to choose from, some modifications probably become more popular than others. The quality of the modifications could be one factor for the popularity, and therefore reinforce the idea that most modifications improve usability and aesthetics.

UDIs were also able to improve the progression within the game. For example, with modifications players could get help in difficult sections trying to find items or skip some scenes completely. Furthermore, with information shared within gaming community, players mentioned to be able to improve their skills. However, there should not be any reason why it would not be possible to have "learning mods", a way for the players to interactively rehearse their skills in competitive games.

Table 3 Themes and their relation to UX and UDIs

	Performance and usability	Content	Aesthetics
Game aspects affecting UX	Poor stability, Bugs, Illogical and inconsistent game mechanics, Controllability, UI usability, Overall usability, Feeling of incompleteness, Level of challenge	Plentiness and diversity of content, Story integrity and quality, Game world, (Un)exciting content, Level of character development, Game progression complexity, Sense of novelty	Degree of immersion, Degree of interestingness, Affect atmosphere, Quality of visual aspects and graphics, Attractiveness
UDIs enforcing the effect on UX	Improve/worsen stability, Fix/cause bugs, Improve/decrease playability, Altered game mechanics, Reduce at-game frustration	Increase amount of content, More interesting/uninteresting content, Alternative content, Access to more experiences, Create personal experiences, Increased possibilities, Consistency with original game, Prolong game life	Improve/worsen visual aspects and graphics

6.1.1 Drivers to improve user experience with UDIs

A repeating aspect came up on the reason for installing modifications in the first place. Curiosity was the main driver for installing modifications when asked. However, in later questions it was revealed that some technical issues concerning bugs, game performance, crashing and usability initiated the need for installing modifications for fixing them. When asked, the interviewees would admit that the use of modifications did indeed improve the user experience and the game overall. This was gained through e.g. improved performance, usability and controllability, additional game content and improved aesthetics.

Multiple interviewees mentioned, that they wanted to install modifications because it was possible and they were curious what kind of modifications were available and how they could change the original game. Common drivers were also fixing bugs and usability issues, improving visual appearance, adding content and changing the experience. The participants were even ready to put in extra effort to make the game work with modifications, if problems would occur.

6.1.2 Performance and usability affecting user experience

A common factor for the participants dealing with technical issues, was that especially with *Skyrim*, some technical issues had appeared, but they were not seen as having a major effect on the user experience. This was the case as long as these issues did not prevent the game play completely. At most, this kind of performance and stability issues were causing short-term irritation, but not necessarily stop the gameplay even temporarily due to frustration or irritation. However, one participant mentioned that a performance issue prevented him from playing the game with a newer computer, whereas previously it had been working properly. The interviewee was aware of the solution, but was not interested in going through the effort in getting the game working again. In general, other respondents explained that they were able to fix performance and stability issues with modifications or "unofficial 3rd party patches", modifications made by the community to fix several well-known bugs and other technical issues. However, some respondents mentioned that they did not have any performance issues with *Skyrim*. It is possible however, that since the players had not had major feelings of frustration due to the issues, they might have not remembered them, even if they had occurred, since the interviews were taking place for most of the participants up to a year after last game play.

Multiple aspects of usability were found to affect user experience, for example through causing or preventing frustration and disabling flow. For example, design deficiencies and the feeling of the game being unfinished were mentioned to cause frustration. Additionally, one respondent told specifically that they had felt that several games are released as "incomplete" and then updated a lot later after the release. This is the case when the game has several bugs and stability issues after being released.

Examples of usability issues affecting the willingness to install modifications were found out to be bugs and crashing of a game, and poor user-interface design. Bugs included problems such as stability issues causing crashes, getting stuck "physically" with the game character or facing a roadblock in completing a quest, due to broken game mechanics. Some respondents mentioned that they had not encountered any major technical issues with *Skyrim*, like crashing, game-breaking bugs or performance issues. However, this was not the case for all respondents. Some even described *Skyrim* as "broken" in the beginning. A certain respondent told that a different game, *Vampire: The Masquerade* was in his opinion "*broken and filled with bugs, but playable with mods*". However, one respondent mentioned that albeit having experience installing modifications, the fear of causing performance issues to *Skyrim* with modifications prevented from installing them.

It should be noted, that generally when discussing the user experience with games, performance and usability were not mentioned unless asked or they had been causing issues. Therefore, performance and usability seem to have a rather passive effect on the user experience of games. On the one hand, when they are taken care of properly, they enable the player to have the experi-

ences as the game developers have designed. Additionally, they are taken as granted at some level, since they are not considered unless they are causing problems, while being a foundation for a great user experience. On the other hand, when performance and usability are not in shape, the user is prevented from enjoying the experience as designed, and at the worst case they can even act as showstoppers. One interviewee mentioned that after a hardware change they experienced problems starting the game and were therefore prevented from playing. The respondent was aware of a possible solution, but was not interested to fix it anymore, since they had already played the game earlier with their previous hardware.

Related to the performance of the game and user experience, inadequate hardware can affect the user experience as well. If the system is not capable of running the game with the best possible visual settings, it might not prevent the gameplay, but needs lowering the graphical settings. One respondent explained that they were forced to run *Skyrim* with the lowest possible setting in order to make the game run properly and to be playable. Additionally, they claimed that this had not been affecting their user experience drastically. The effect of visual aspects to user experience is covered further in chapter 6.1.4.

Several respondents told that they had experience performance issues with *Skyrim*, even if this was not the case for everyone. Respondents experiencing performance issues told that it was possible to stabilize the game to reduce crashing with modifications, that were sort of "third party patches" to the game, made by the community focusing only on bugs. However, a few participants described instances, where modifications had been affecting the performance of the game negatively. In these cases, the modifications would cause crashing, prevent the game from starting, jam the computer, break game audio and even corrupt game save files, preventing the player from continuing their earlier games. However, the modifications are often updated as well, and these problems tend to grow weaker over time. In the light of these severe performance issues, it is worth noticing that players still felt that this kind of behavior would be acceptable for modifications, as they are created by hobbyist programmers on their free time and provided for free. Additionally, the participants were ready to make the extra effort to make the game working, as if it was part of the fun. All the respondents had the technical skills required to do this, but it should not be assumed that this would be the case in the larger gaming community.

In games, controllability seems to have a major effect on the user experience. This controllability includes controlling e.g. the character or any other entity whose actions the player can affect as well as being able to interact with the game through the user interface, e.g. choosing between game items like weapons in *Skyrim*. Multiple respondents felt that when the game character or any game aspect would behave in an unexpected manner or not according to commands, it would cause frustration and have a negative impact on the UX. Any inconsistency or illogicality in game mechanics would have the same impact.

Related to controllability, a recurring aspect in the interviews when discussing the functioning of *Skyrim*, was the usability of the inventory and game menu. Nearly every one of the respondents felt that the in-game user interface for browsing items, skills and other game content was designed for the game console versions of *Skyrim*. This was due to the feeling that it was designed to be used with a controller. All the respondents mentioning this issue had fixed it by installing a modification, that had a redesigned user interface. According to the participants, this made the game more usable with mouse and keyboard they used to play the game, instead of a controller used with consoles, however one respondent did mention using controller after noticing that it is much easier to scroll through the menus with it. Increased playability was repeatedly mentioned to make the respondent more satisfied with their experience. However, one respondent mentioned the possibility of using a controller, when the game was seemingly designed to be used with it instead of a mouse and a keyboard.

6.1.3 Content and user experience

Most of the respondents told that they had increased the amount of content in the game with modifications. For example, the respondents could add more quests and items, but also completely different aspects to the game with modifications, such as more realistic weather and environmental effects which would fundamentally change the game mechanics. When asked, the respondents explained that this additional content would enable them to have more experiences in the game world. Furthermore, many of the respondents mentioned that staying in this specific game world was the incentive for installing modifications with additional content. According to one participant, the game offers a good backbone upon which the players can build their own experience with mods.

Specifically, the variety in content that the players could access with modifications was praised by many respondents. Modifications allowed they to do things that were not possible within the original game. Such additions were major changes to the game mechanics, such as introducing the physiological effects that hunger or environment can have on the game character.

When asked about what might irritate in games, it was mentioned that plot holes and mindless events even in the game story can annoy the players. Additionally, superficial character development within the plot line seemed to be unsatisfying. This seems to be in line with the fact that some respondent told that they want to gain more depth into the game with modifications. Furthermore, one participant mentioned that if the game has a rather linear form and does not allow the player to affect the events, it is considered as annoying. Having an open world, where the player may roam freely and do activities in their own order and pace, allows a better experience. Naturally this kind of game world attracts also players of *Skyrim*, as it is an example of such a game.

An important thing found in the interviews was that not all additional content provided by modifications was considered to improve the user experience, since some mod quests had bad plots, modifications provided unexciting content or the assets and items were not consistent with the original game world. Overall, the quality of the modifications would vary, but as was mentioned before, the respondents were rather understanding if the modifications were not always completely polished. However, generally the users felt that the additional content had improved their user experience as well as their satisfaction with the game. This was mainly due to the ability of modifications to prolong the game life, as a lot of exciting content and experiences could be accessed only with modifications.

Based on these findings, it seems that it is not the amount of the additional content or even the quality of the content that decides whether the additional content provided by modifications will improve user experience. Instead, the content needs to be interesting and exciting but also provide challenge, to allow the player to gain flow state.

6.1.4 Aesthetics and user experience

Aesthetics have a complex relationship with the user experience of a game. Games like Skyrim offer the possibility to adjust the level of graphics based on the player's hardware's capabilities. With relatively poor hardware, the game can only run smoothly when the graphics are set on a lower level. On the other hand, high-quality photo-realistic graphics might require a very powerful PC in order to run properly. The participants were aware of their hardware's capabilities and some even mentioned examples on the changes they had made on hardware and how that had affected the experience with a certain game. As the participants were aware of the level of their hardware, they could estimate their user experience while understanding the limits the hardware might had set to the visual setting. When the participant knew that their hardware would be capable of even a higher level of graphics than what would be allowed by the game settings, they would turn to mods, adding visual aspects and level of detail unmatched by the original game.

Many respondents told that they were immediately impressed by the visual appearance of *Skyrim* when they originally started playing the game. However, it was common that modifications were used in order to improve the aesthetics even further. As a certain respondent mentioned, the game does not look so good anymore as it is several years older and technology allows superior graphics to new games. This might be why it was also common among the respondents to install modifications to improve the visual appearance of the game. Therefore, the visual aspect seems to have a rather major effect on the user experience. Additionally, visual appeal seems to help immersion and be an indirect enabler for flow. As many respondents mentioned, they play games in order to "escape reality" and this becomes naturally easier, if they are having the experiences in a realistic and immersive world with high-quality graphics. Ap-

pealing visual aspects also make the game more interesting for the players and enable enjoyment. It was also mentioned that visual aspects can be irritating and therefore disturb the gameplay, which has the opposite effect to the experience.

Many respondents explained that they had altered the *Skyrim*'s visual appearance with mods. One participant even mentioned that the improvement of user experience through the installation of modifications was only thanks to the improved visual appearance, not the fact that modifications had also improved the stability of the game and reduced bugs. However, those respondents that had experience on playing the game with lower graphical settings claimed that it did not have a major effect on their UX, as the visual appearance was still perceived as sufficient. Therefore, it is still difficult to define the exact effect of aesthetics on user experience, as it is in a fundamental role. When high-level graphics are not possible, deficiencies can be tolerated, seemingly even more than deficiencies in usability or the performance. But when these basic building blocks of user experience are in order, i.e. the game has no stability issues and is easy and fun to use, as well as satisfying the basic graphical requirements, users start to demand more also from the visual aspects.

6.1.5 Minor factors affecting user experience

In addition to the themes that were derived from the interviews, there were other recurring topics as well that relate to the UDIs' relationship with UX. These are progression and self-development (PSD), socializing, and external factors.

In PSD, the progression refers to the progress that player makes within the game, such as completing quests and tasks, and developing the game character's attributes. Self-development on the other hand means the player improving their own skills to interact with the game, i.e. becoming better in the game. First, one participant mentioned that linear progression in a game is usually boring and therefore affecting the UX negatively. In linear games the player does not have any choices in what he will do next. Instead, they confront challenges in a certain order, and cannot choose which are they are facing next. This is naturally a vague concept, since games can have different degree of linearity in them. For example, in *Skyrim*, the player is able to choose which faction or guild he will join and does not have to complete any step of the main quest in order to still spend countless hours in the game, completing other quests and adventuring while developing the game character. Many participants considered this as a major reason for having great experiences in *Skyrim*. Self-development in PSD on the other hand refers to the players' ability to improve their skills in the game. For example, when asked about annoying things in games, one participant mentioned that their inadequate skills had caused frustration, because they could not make any progress in the game. Modifications can help the players' PSD and therefore improve their user experience. For example, a several participants reported using map modifications in order to make the map clearer, which would help them to find objects related to quests

easier. Additionally, a modification that was used to skip cut-scenes or animations where the player would only have to wait, was considered improving one participant's UX. However, since modifications can also cause bugs, they might hinder the players progression in the game and also their development, if the player is not able to interact with the game properly.

Although the social aspect of gaming was not originally in the scope of this research, it came up in the interviews continuously and is therefore covered here shortly as a minor factor. As it has come become apparent, players tend to socialize with other players also when they play single-player games. This happens often through the gaming community, where the players share information on the games. Modifications made by other players, knowledge sharing on gaming tactics, as well as other players' technical support used with technical problems improve the overall gaming experience. On the other hand, in competitive multiplayer games where the players interact with other players through the game, the competition and being better than others can also have a big influence on the experience. Co-operative games and player interaction that happens in them was not mentioned in any way during the interview. However, this does not mean that the socializing happening in those games would not have any effect on the UX. Social aspects can however have also a negative effect in games. For example, several respondents mentioned that many of their bad experiences in games include poorly behaving people in online multiplayer games. For example, they would intentionally upset others and cheat. Other factors causing social aspects to affect UX negatively mentioned by the interviewees would include poor user-generated content but also competitiveness. This implies that competitiveness's ability to affect UX could related to the player's preference on the game genres.

Finally, some external factors that were mentioned to affect the players' UX should be discussed. For example, if a player had an inadequate PC that would not be able to run the game properly, that would affect the UX negatively. However, as it was mentioned earlier, one respondent explained that even though their system could not run *Skyrim* with the best graphical settings, they would still enjoy the game and did not consider this affecting their user experience. Therefore, this also seems to be related to the player preference on what they value in games. If it is the visual aspects and realism, the poor system performance can have a major effect. Additionally, a few respondents mentioned that in competitive games, network performance can play a big role on the experience, especially in games that require fast reactions. For example, a short lag causing the player to think he has shot the opponent before they could react, while in reality, the server has recorded the opponent's action first and therefore ending in the player's character dying, can cause frustration. Additional external factors that were mentioned to affect UX negatively are related to the game development. First was games having too little content in the original game itself, and offering downloadable content (DLC), that is available for extra charge and have for example extra quests, maps, or characters. However, this was only mentioned by one player, who would support "traditional" business

models for games instead, where the player makes a one-time payment after which they have access to all content that the game offers, including the original games and all future updates. Another aspect was that a few respondents felt that many games are released unfinished. This would have only a negative effect on the UX, as it would often cause the game to have bugs and therefore reduce the usability and impact the UX negatively. While the business models used by game companies are outside the scope of this research, these findings do offer interesting things to be considered in game development and research. Especially the effect that such poor user experiences have on the game company brand should be studied.

6.2 UDIs as a coping strategy

When dealing with usability errors and usability issues, the users told that oftentimes they would turn to modifications and gaming community knowledge in order to cope with these issues. Especially, issues causing the game crashing, bugs appearing and usability issues, but also problems progressing with the game were considered so disturbing that the players felt they should be overcome, even if those issues were not fixed by the developer themselves.

The online gaming community seemed to help players in multiple ways. First, the community enabled sharing knowledge between the players. This way the players could find information on e.g. finding quest-critical game items, solutions for usability problems, and modifications. After gaining the information the players can try to apply this information. This was the case with for example the original user interface of *Skyrim*, that had multiple usability problems according to the participants. The players would fix these usability problems by installing a mod that provided an alternative user interface, designed specifically for mouse and keyboard. Additionally, the community would act as a form of tech-support for the players installing modifications and experiencing problems for example in terms of modification compatibility. Players also mentioned getting additional information on games, such as explanations of the game story from the community. In competitive games, several respondents mentioned gaining knowledge to be applied for self-development when they were looking to improve their skills.

As discussed in the chapter 2.1 and Table 1, individuals perform creative actions when aiming for productivity (level 1 creativity) and trying to make things their own (level 2 creativity). Based on some participants' answers, it looks like modifications can be used to make the gameplay more efficient, i.e. the player aims to complete quests more easily with the help of information searched from the online gaming community as well as with modifications, that help to find certain items or skip cutscenes.

Figure 1 illustrates the different strategies that the participating players used to cope with usability issues. These strategies eventually come down to

three different coping mechanisms explained in chapter 2, avoidance, adaptation and mastering.

When a player faces a usability issue they do not want to fix or are not capable of dealing with, they stop using the product and therefore use avoidance strategy. This kind of usability issue can be a bug preventing the game from launching or corrupting save game files, or any problem affecting the experience in a level exceeding the player's tolerance. The participants reported acting according to avoidance only when a game was already familiar to them and they had played it multiple times and therefore had little incentive to go through the effort of getting it working again. However, the exact stage where this becomes relevant is difficult to define, as players have different views on when there are still enough interesting activities to be done in the game. For example, in a competitive game, the game setting is always the same and the experiences vary thanks to player development and different opponents. But in single-player games like *Skyrim*, a repeating scene can quickly become boring and the player can perceive that their experience has become so saturated, that there is no incentive to continue the play, especially if it would require extra effort to fix a technical problem.

However, if the player does not want to stop using the product completely, but instead adapt to the situation and adjust themselves to cope with the issue, they can change their use habits. An example of a player adjusting their behavior was increasing the frequency of saving the game progress. This was reported to be used by a participant, when they felt that the game would crash often. Rather than stopping the play completely, they would prepare themselves for upcoming occurrences of such situation by saving the game state more often, therefore, adjusting their behavior and adapting to the situation.

Finally, if the players felt they wanted to confront the usability issues and prevent them from occurring at all, there were found to be three different strategies that could be applied in such a situation. These are fixing a problem on their own, searching a solution online and installing a mod. Fixing the problem on their own requires the player to be able to apply their technical knowledge in order to address to issue. None of the participants had experience from creating mods and this option might be more valid for the lead users who also create mods. The second option is searching online for the solution, a strategy which includes online support provided by the game company but also game communities, where players exchange their knowledge on the games. None of the participants mentioned contacting the game support for help, but had relied on the online communities on issues varying from game crashing to help on progressing in quests where they had faced a roadblock, and to find information on modifications' compatibility between each other, if there seemed to be an issue. This strategy was chosen if the issue was not familiar for the player or required more knowledge than they did already possess. The last, and a seemingly very popular strategy among the participants was to install modifications in order to cope with usability issues. Modifications installed for this are designed specifi-

cally for addressing any issues that might have not been covered already by the developer.

It should be mentioned however, that no reason was found that would prevent the player from switching from one strategy to another. Additionally, when aiming for mastering the technology and getting a solution to the problem, the player can use all the three strategies leading to mastering in any situation, not just one, if the specifications of the problem allow this. As an example of this, one participant mentioned they had a problem causing stability issues and they did not have sufficient knowledge to fix it themselves. Therefore, they searched for the solution online and found a guide on how to fix the problem, by installing mods.

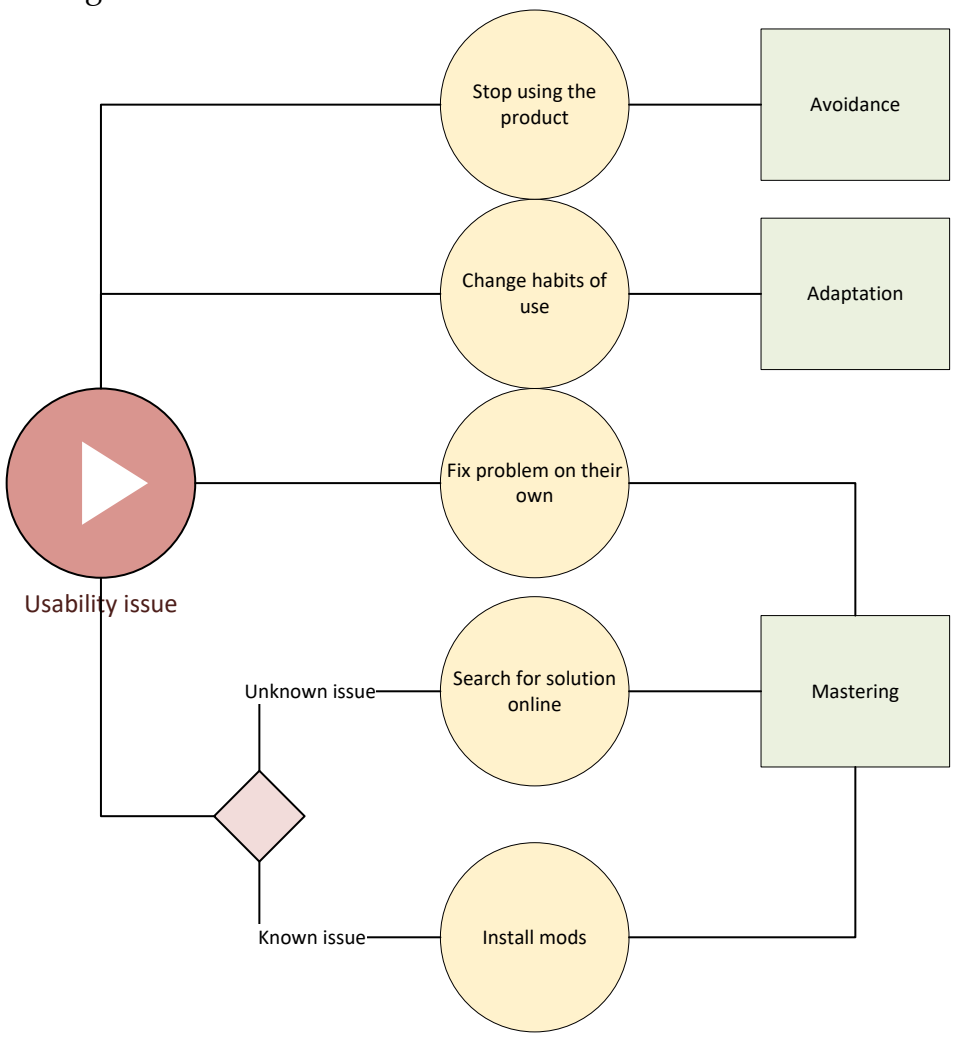

Figure 1 Player coping strategies

7 DISCUSSION

In this chapter, the results and their impact are discussed. First, the main points found from the literature are presented. Then, the implications of the empirical research are discussed. Finally, the chapter concludes examining the two hypotheses introduced earlier in the thesis and they are examined from the viewpoints gained from the interviews.

7.1 Insights from literature

Based on the literature, no conclusive evidence was found on using user-driven innovations as a coping mechanism. However, there were implications that user-driven innovations are in an important position concerning usability problems, since consumers are already able to utilize the provided solution space to solve their own problems. Furthermore, gaming communities are a major channel for players to share their experiences, which tells that not only lead-users use user-driven innovations to solve their problems. Instead, sharing information and knowledge is common in the gaming communities for other user types as well.

7.2 Implications of empirical research

Gerling et al. (2011) suggest that the input type, i.e. keyboard and a mouse or a controller, does not itself the overall experience itself, as long as the specific input type is familiar to the player. However, the designers might struggle trying to make solutions that fit both the PC gaming with mouse and keyboard, as well as console gaming with a controller. Considering the participants' answers on the poor design of Skyrim's user interface, it might be reasonable to assume that certain user interfaces can be more usable on a controller than with a mouse and keyboard, in terms of effectiveness and ease of use.

In the empirical research, all participants possessed required technical skills to troubleshoot malfunctioning game and to deal with things such as usability and stability issues. However, there is no reason to expect that this would be the case within the larger PC gaming community, even though modifications are widely used with PC games. Further study would help to understand, in which extent are modifications used as a "tech support" for players, as it seems evident that it is at least a possibility for the technically oriented players, and offers a coping strategy. Additionally, the possibility that the more technically oriented players tend to choose PC over consoles should be considered, since PC games allow more modifying and developing technical skills. However, the improved technical skills can be the consequence as well instead of the motive for PC gaming.

The coping strategies brought up in the literature, including avoidance, accommodation and mastering, seemed to match the behavior of players facing usability issues rather well. However, not all strategies were suitable for gaming context in this research. For example, partnering was not considered from the player aspect. As it was discussed in the chapter covering coping, creativity is related to coping. This was also discovered in the empirical research, as using mods require creativity and vision – some respondents felt that some aspects of the game could be improved and knew that there were mods available. They used their creativity to build an own kind of experience, as few participants called it, with the help of mods.

In general modifications seemed to aid the level of user experience a lot and improve it vastly. However, as it was mentioned by several participants, some modifications had poor quality and did not affect the user experience in a positive manner, but the opposite. Nevertheless, it seems that modifications of bad quality do not tend to be as wide spread, as players often get information on the modifications prior to installation via the gaming community. Additionally, modifications often have ratings and players can see, how popular they have been, which might affect the player's willingness to try out a single modification. All participants had experience from playing games in general with and without modifications and could therefore provide valuable insights on having two different experiences and compare them between each other.

7.3 Hypotheses

Next, the hypotheses presented earlier in the thesis are discussed by reflecting their claims to the implications of the empirical research.

7.3.1 Hypothesis 1

Hypothesis 1 was introduced in chapter 2.3 as follows:

Players facing usability issues will (depending on the type of usability issue):

- adapt to situation
- try to fix usability issues
- abandon the game
- start over

Each of these methods were mentioned to be used when dealing with usability issues. An example of adaptation by one participant was accepting poor user interface and continuing to use controller with *Skyrim*. Another adaptation instance was mentioned, when a participant explained that they had increased the frequency on which they would save the game due to unpreventable and unpredictable crashes. Examples of fixing usability issues were installing modifications and looking for information in the gaming community on how to fix problems. However, a prerequisite for this seems to be some level of technical knowledge on how to install modifications, since it was mentioned that the fear of breaking the game would prevent from installing modifications. This was the case for a certain participant even they had prior experience on installing modifications. In this study, game abandonment was only mentioned to occur when the players had already lots of experience with *Skyrim*, and therefore little incentive to cope with confrontational strategies, in order to continue playing. Starting over would occur, when it was no longer possible to continue playing with old game save files. This was mentioned to be the case, when these files had corrupted, or a bug had broken the game in such a way, that it was not possible or meaningful to continue due to e.g. broken quests.

Overall, hypothesis 1 is therefore relevant on the different coping strategies that players adopt in order to deal with usability issues. However, there are underlying factors affecting the strategy choice that are not considered in the hypothesis, and should be therefore considered further. Examples of such factors are the technical skills and level of knowledge of the player and level of saturation achieved playing game. However, more factors could be revealed in further studies.

7.3.2 Hypothesis 2

The second hypothesis, as introduced in chapter 4.4 claimed that "*user-driven innovations can affect the user experience of games positively or negatively*." Let's examine this claim from the view of the themes, as they each have their own role in user experience. As it was explained in the results, performance and usability issues could be either fixed or caused with modifications. They could fix bugs, but also cause problems due to incompatibility with each other. Additionally, as modifications are not made by professionals, they were mentioned to have a varying quality, therefore sometimes affecting performance in a negative way. When discussing the additional content provided by mods, it was discovered that this content would not always be of high quality. This kind of content was not always in line with the original game and therefore not suitable for the

game. However, a lot of extra content could be gained through modifications and some of the quests and stories in the modifications were perceived as good, therefore improving the user experience. Finally, aesthetics could also be altered with modifications. This was revealed to mostly improve the visual appeal of the game. However, as it was mentioned, modifications vary in quality and as there are hundreds of modifications available for single a game, it is likely that not every one of those modifications improve the visual aspects, but can also lower the visual appeal. Therefore, it is possible that aesthetics can be also affected in a positive or negative manner with modifications. In conclusion UDIs seem not only to be able to affect the UX positively or negatively, but also each of the themes can be greatly affected.

8 CONCLUSION

This chapter covers the concludes the thesis with a summary, contributions to research and practice, the limitations of the study and finally implications for future research.

8.1 Summary and contributions

In this thesis, the goal was to study how players can use user-driven innovations to cope with usability issues occurring in games and the effect of user-driven innovations on user experience. The first part consists of a literature review, where usability is examined along with usability problems and user experience in games. After this, coping was covered from the viewpoint of creativity, its linkage to technology was explained and finally confrontational coping strategies were explained. Then, user-driven innovations were examined, along with co-creation and co-design strategies used in their creation. Additionally, UDIs were discussed from the viewpoint of lead-users and toolkit-approach. The empirical section consisted of explaining the methodology used for gathering data, analyzing it with a thematical analysis and presenting the results as well as discussing the relevance and the meaning of the results.

As it was interpreted from the interview data, players can use UDIs to cope with usability issues occurring in games. However, their tendency to do so depends on several factors, such as the familiarity and severity of the problem, and the player's experience with the game. Furthermore, the UDIs tend to affect UX in many ways and they are used consciously to do this. They can affect the games' performance, usability, content and aesthetics. These were chosen as the themes, as they define what kind of experience the player will have with the game. Each of the themes can be impacted either in a positive or negative manner with UDIs, often depending on the quality of the UDI.

The results of this research will help future game development to assess their possibilities to open their games to certain extent and offer toolkits to help

modification development. Furthermore, game developers can use this information as they assess the user experience of their past games and plan for new ones. Additionally, the results can be used in considerations of choosing business models for games, as modifications can provide games with noticeable extra value.

8.2 Limitations

More literature on the topics exist, which could have been utilized in this research and which would have enabled a better contribution, since it could have improved the literature findings on the topic. Additionally, the data for this thesis was gathered only with Skype-interviews rather than following the actual gameplay. Mentis and Gay (2003) mentioned that there is a difference on users remembering when they have felt frustrated and when the frustration is actually happening. Because of the selected data gathering method there might be some aspects of usability issues that have not been properly covered.

The results of this study are poorly generalizable, since it is a qualitative study based on personal experiences and opinions (Hirsjärvi et al., 2004, 155). Therefore, further research is needed, even though the questions have been cross-examined and reflected upon existing theories. Further research could be conducted as a quantitative study with a larger pool of participants playing with and without modifications, including an interview but also following the actual gameplay in order to reveal things users might not remember after playing. After all, Mandryk et al. (2006) mentioned, participants answer sometimes differently, when they know that their answers are being recorded even they would not realize it themselves. Therefore, all the answers given in the interviews should be considered with caution. Additionally, Mandryk et al. (2006) mention that the player's experience about an entertainment technology such as a game should be assessed with a playback of the gaming situation and hear the player's thought immediately after the actual interaction. This way the player would not be disturbed from the immersive situation during the actual gameplay, which would be the case with think-aloud techniques, commonly used with productivity systems (Mandryk et al., 2006). In this study, the interviewees mentioned that there had been months or even more than a year between the actual gameplay and the interviewees. Furthermore, the players might not be used to describe their experiences and feelings they have had during playing. Especially, they might be able to describe what has happened in detail, but the motivation for their actions, consequences and mental consequences might be difficult to explain, at least in an objective manner. Additionally, it is possible that the questions have been biased as well, which can be explained with the lack of experience conducting such research.

Additionally, as Braun and Clarke (2006) mentioned, thematic analysis made also based on the data of this study, has its own limitations. When performing thematic analysis, the researcher has an active role searching for the

themes and they might reflect the assumptions and expectations of the researcher.

8.3 Future research

It remains to be seen, what is the future of the relationship between community-created content and video games. Games are the game companies' main medium of contacting their customers and therefore they are also interested how their customers perceive them through the games. Because of this, it is of the companies' interest to also be aware of how their games might be modified and how this could affect their brand. Furthermore, it would be interesting for the developers to see, whether models and best practices for involving user-innovations in game development could be created. Additionally, this aspect could be interesting also for other software companies as well.

As it was discovered in the interviews, the gaming community can be very active in creating content and fixing bugs the developers have not yet fixed. It would be interesting to study, whether this has a negative effect to the willingness of the developers themselves to keep updating their games. From the perspective of the developers it would be also interesting to study the factors affecting players' decisions to stop playing a game completely, if they feel that they are not able to deal with usability issues in any other way or do not have any incentive to start fixing the problem. Especially, since it seems that this is the case when the players have already played the game a lot. However, depending on how the developer is generating profit out of the game, it could be that they do not see this as an important aspect, especially if their games do not have any in-game purchases or paid downloadable content. Nevertheless, understanding user behavior through their coping strategy selection would still give more insights to be utilized in future game development.

In general, there is little research of the effect that user-created IT artefacts have on user experience. This thesis provides a starting point for a more comprehensive study, that could include different games and a more varying set of participants.

In this study, all the participants had experience installing and using game modifications. However, it would be interesting to study this from the perspective of the lead-users. In the literature, the motivation for creating modifications arises often from about self-actualization and having a creative past-time activity, but also a medium of employment for hobbyist programmers. However, it would be reasonable to study more what motivates the lead-users as a community to further co-operate and act as independent organizations, striving for improved games.

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APPENDIX 1 INTERVIEW STRUCTURE

Background information/Taustatiedot:
Sex/Sukupuoli: M/F
Age/Ikä: _____
Degree of education/Koulutusaste: _____
Occupation/Ammatti: _____
Field/Ala: _____

Experience in video games:

- When did you start gaming?
- What types of games have you been playing?
- How much playing in general / week?
- How has the amount of time you spend playing games changed over time?
- What is it about the games that you enjoy most?
- What types of things annoy you about the games?
- Have you installed mods to games? Why/Why not? Consequences?
- Have you used internet forums or social media to gather information about games? For what purposes?

Experience with *Skyrim*:

- How did you start playing *Skyrim* (who introduced you)? What were your first reactions to the game?
- Time in *Skyrim* (Overall in Steam)?
- How would you describe your experience with *Skyrim* in general?
- How would you describe the functioning of the game?
- Have you confronted any technical or other functional issues with *Skyrim*?
    - if yes: How have you reacted to them (actions and feelings)?
    - If yes: Have they affected your gameplay experience?
    - If yes: Does your hardware meet the requirements of the game?
- Were the problems solved, do they still persist?
    - If yes, how were they solved?
- Have you installed any modifications?
    - Why/Why not?

    - For what purposes?
    - If yes: are you aware of the effects they have had on gameplay experience?
- How have they affected your experience? (more satisfaction/dissatisfaction)
- Have you installed any modifications in order to overcome technical issues?
- Have you used any internet forums or social media to gather information about *Skyrim*? For what purposes?

GLOSSARY

Bug – a technical problem or a defect occurring in the game, affecting the game's behavior
Cutscene – a sequence of non-interactive gameplay, often consisting of a video clip or animation, including some action or conversation, usually further explaining the plot or carrying it forwards
Gaming – the act of playing video games
Lag – delay occurring between the player action and server reaction
Mod – *modification*, a modification made to a video game's files in order to adjust e.g. game play, graphics or to fix bugs
Modder – *hobbyist programmer*, person creating modifications
Patch – update to a game, released to improve the game with e.g. fixing *bugs*