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Opportunities and Challenges of Activity Tracking in Gaming

Finnish exercise game X

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Abstract

Activity tracking, measurement of one's physical activity. In the last decade, activity tracking has become a topic of growing interest in fitness- & gaming fields. This research, in a form a bachelor's thesis, focuses on their combination, exergames. Just previously, exergames have shown to be a great tool for motivating people to increase their physical activity. Together with the development of activity tracking solutions, this has become possible.

The research problem of this thesis was the lack of success of the client company's mobile game. The research aims to find the relationship between exergames and motivation towards physical activities, and the public view of the client company's activity tracking focused mobile game. On the side of that, this research aims to find the game's strengths & flaws, which the company can further use for the development of the game and its marketing strategies. Mixed methods were chosen as the research approach as its consistent of combining both quantitative and qualitative in a single study. Pragmatic philosophy was followed. Quantitative research was carried out with a structured survey and 146 respondents were found with convenience sampling. Qualitative research was carried out with structured interviews and seven candidates were selected with purposive sampling to better fit this research.

The research suggests that the activity tracking exergames have positive impact on increasing people's physical activity. Client company's physical activity side of mobile game followed the general view of activity tracking solutions and received consistent feedback in structured interviews, but questions also rose on one component of the game. The conclusion of this research is that the client company's mobile application has great potential of being successful. Activity tracking games are played by people from all age groups, thus enabling a large potential player pool. With further game development and increased marketing, the possibilities of the clients' mobile game are endless.

Keywords/tags (subjects)
Activity Tracking, Exergame, Fitness, Gaming, Mobile Gaming, Market Research

Miscellaneous (Confidential Information) ***Chapters 4, 5, 6 and appendices 4, 5, 6 are confidential and they have been partly or entirely removed from the public thesis. Grounds for secrecy: Act on the Openness of Government 621/1999, section 24, paragraph 17 and 20: business or professional secret. Period of secrecy is five years, and it ends on 13.11.2025.***

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Tiivistelmä

Aktiivisuuden mittaaminen on tapa seurata ihmisten fyysistä aktiivisuutta ja sitä kautta motivoida heitä liikkumaan. Viimeisen vuosikymmenen aikana aktiivisuuden seurannasta on tullut kasvava kiinnostuksen kohde sekä kuntoilijoiden että pelinkehityksen piireissä. Tämä tutkimus keskittyy edellä mainittujen yhdistelmään, pelillistettyihin kuntoilusovelluksiin eli ns. exergames-kategoriaan. Viimeaikaisten näyttöjen mukaan liikuntapainotteiset videopelit ovat osoittautuneet erinomaisiksi apuvälineiksi motivoimaan ihmisiä lisäämään heidän fyysistä aktivisuuttaan. Aktiivisuuden seurannan ratkaisujen kehittymisen ansiosta tämä on mahdollista aiempaa laajemmin.

Tutkimusongelma keskittyi tutkimuksen kohteena olevan mobiilipelin aikaisempaan huonoon menestykseen. Tavoitteena oli löytää tietoa exergamesien ja motivaation yhteydestä sekä yleistä näkemystä asiakasyrityksen mobiilipelistä. Tutkimuksella pyrittiin löytämään kohdepelin vahvuudet ja heikkoudet, joita yritys pystyisi hyödyntämään pelin ja sen markkinointistrategioiden kehittämisessä. Tutkimusmenetelmäksi valittiin monimenetelmällisyys eli kvantitatiivisen ja kvalitatiivisen tutkimuksen yhdistäminen. Tutkimusdata kerättiin verkkopohjaisella kyselyllä sekä strukturoiduin haastatteluin. Kvantitatiiviseen osioon vastasi 146 ihmistä ja teemahaastatteluihin valittiin seitsemän vastaajaa harkinnanvaraisella otannalla.

Saadut tulokset indikoivat tutkitulla pelillä olevan markkinapotentiaalia. Aktiivisuuspainotteisia pelejä pelaavat kaiken ikäiset ihmiset, mikä luo pelille laajan kohdeyhteisön. Haastatteluissa ilmenneet näkemykset kohdepelistä olivat yhdenmukaisia yleisten aktiivisuuden seurantaan liittyvien arvioiden kanssa. Pelin jatkokehittämisellä ja markkinoinnin lisäämisellä havaittuihin suuntiin kohdeyritys pystyy vaikuttamaan pelin tulevaan menestykseen.

Avainsanat (asiasanat)

Aktiviteettiseuranta, Exergame, Fitness, Pelaaminen, Mobiilipelaaminen, Markkinatutkimus

Muut tiedot (Salassapidon tiedot) ***Luvut 4, 5, 6, ja Liitteet 4, 5, 6 ovat salassa pidettäviä, ja ne ovat osittain tai kokonaan poistettu julkisesta työstä. Salassapidon peruste: Julkisuuslain 621/1999 24§, kohta 17 ja 20: liike- tai ammattisalaisuudet. Salassapitoaika viisi (5) vuotta, salassapito päättyy 13.11.2025.***

Content

Figures

Tables

All tables omitted due to confidentiality

1 Introduction

This thesis is built around a single mobile game with a new type of concept. Usage of activity tracking games and Exergames have increased in different fields, but knowledge of their best potential use and userbase is still low. By conducting this research in a form of thesis, the authors aim to create value for the company X. Their concept of activity tracking game is interesting as it utilizes the real world maps in similar way to for example Niantic's Pokémon-Go but unlike the afore mentioned game, Company X's mobile game gives more emphasis on the physical activity side of activity tracking. Gathering knowledge about perceptions towards fitness and activity tracking games is huge for the company as they can plan their future actions better with the data authors are gathering. The thesis literature is based on research and journals that are amongst the field of fitness, activity tracking, and exergames.

There are few of activity tracking games online, which lift physical activity to the pedestal, therefore the authors' plan is to be part of that newly growing field with data gathered from surveys, interviews, and existing literature. The importance of this research comes from conducting the literature together and gathering data through surveys and interviews. This enables the authors to get a better understanding of the field and at the same time gaining value for the client company.

For the authors, the decision of choosing this as their subject was very easy. Both of authors interest towards sports and video games are strong. This acts as authors advantage as authors are producing a research on a subject that combines these two in a fascinating way. Furthermore, activity tracking in games and Exergames can be seen to be the future as they are already used in places such as schools and rehabilitation, hence in a sense, the authors are gaining knowledge of a field that has great potential. This on the other hand can give the authors also a competitive advantage in job environment as authors already have developed knowledge in the respective field.

Context & Motivation

The case application used in this thesis is made by a small Finnish video game company. The client company did not wish their name to be used in the thesis due to their personal reasoning, and therefore going forward, the company, which developed the app in question, will be referred to as **company X**. Furthermore, the name of the app itself shall be retracted, for instance in the interview appendix, as it would out the identity of the client company. The application at hand has been removed from the public market for further development since the time when the research began. The authors are not employed by company X and hence are writing the research for the company free of charge. Furthermore, nonexistence of ties to the company allows the research to be unbiased, though the goals of research were agreed upon with the client company.

The motivation behind doing this research is essentially that, because company X is relatively small in its size, they do not possess a sizable marketing research department, hence creating a need for this thesis. Lack of marketing research is not an uncommon problem amongst independent video game companies. Independent meaning those companies, who do not have large publishing companies assisting smaller companies with market research and their game to reach the masses. In order to establish transparency, it is good to note that this is the authors' bachelor thesis, part of its motivation is to complete the studies of authors and not only to further the public scientific knowledge on this topic.

1.1 Research Questions and Objectives

There are three primary objectives for this thesis, first of which is to analyze the current competitive state of the client's mobile game application. The analysis is best done through a thorough SWOT analysis. The second objective is to find out gamification's motivational impacts on doing physical activities. Third and final objective is to provide the client company demographical data on who are playing activity tracking games and seek to open the reasoning behind this.

To summarize, the research questions were formed based on the needs of the client and the result was the following three questions:

- How gamification is currently being used in motivation for physical activities?
- What is the public view on the activity tracking using mobile game?
- Who are playing activity tracking games and why?

1.2 Structure of the Thesis

This thesis continues with a literature review as do many other studies. In the literature review the reader will be acquainted with two key aspects of the overall study, activity tracking- and the video game side. The flow of the review is designed to take the reader through the two aforementioned aspects and finishing with a summary of the theoretical framework, which is meant to combine the two key aspects, creating a framework of knowledge so the reader can better benefit from this thesis. Moreover, the summary acts as a return point to which the reader can return at any moment if they wish to have a refresh regarding the knowledge base used in the research. Following the literature review is the methodology chapter. There the reader is better familiarized with the specifics regarding the execution of the research. Due to nature of the thesis, research results and further discussion, conclusions and finally suggestions based on the research shall be confidential to provide the client company the value they requested. Moreover, general confidentiality is required to maintain the client's privacy.

2 Literature review

While looking at the relationship between mobile games and motivation towards fitness, it is important to understand certain concepts regarding fitness and gaming. These concepts include learning of what they are as concepts, how they have been/are being executed, who uses them & how, and where they are being used at. The literature review is executed in a way that the chapters have a natural flow in means of information and that they support each other. By doing this we want to ensure that the authors are not confusing readers by having chapters following each other without any rallying points. The literature review begins with the examination of fitness related concepts & literature and finishes up with the examination of gaming demographics and gaming related concepts & literature in the means of exergames.

In the following chapters a theoretical framework is developed in order to optimize the comprehensiveness of the research done.

2.1 Measuring fitness activity

As the research seeks to investigate activity tracking in gaming, fitness related concepts naturally are not in the spotlight. Nevertheless, fitness is an important aspect of activity tracking in gaming, and even more so in tracking of other physical activities. Therefore, it is necessary to lay down some groundwork regarding fitness in order to contextualize possible correlations found in the data collected for this research. Activity tracking was deemed to be a fitness related concept as well, due to its extensive use in physical activities outside of video games.

2.1.1 Perception of Fitness

Fitness is a broad term, and it could mean multitude of things. therefore, it is important to clarify that in the framework used in this thesis, the perception of fitness consists of two parts. First of them is how does one perceive their own physical condition and wellbeing, while the second regards what kind of attitudes one has towards the term fitness and physical activities?

The way people perceive their fitness can be divided into following five scales. The five different scales are: Endurance, Strength, Flexibility, Body composition, and Fitness (Figure 1).

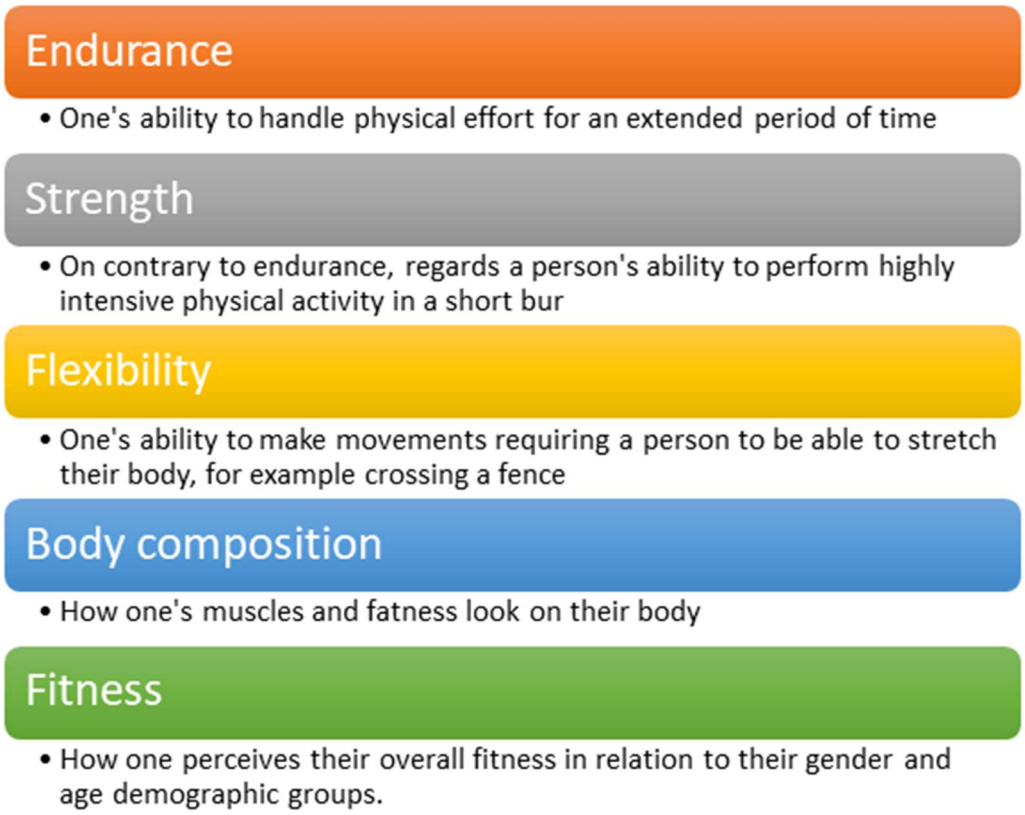

Figure 1. Scales of fitness perception

There are also some personality traits which affect people's perception of fitness. Research shows that all the aforementioned categories except flexibility are strongly correlated with anxiety and self-esteem. (Brisswalter, Delignieres, & Marcellini 1994.) Across the working-age groups, men with anxiety and low self-esteem resulting from these categories have been found to be less likely to do physical activities, due to low

social support and motivation (Kaasalainen, Kasila, Komulainen, Poskiparta, & Villberg 2013). Also, people's fitness self-perception has an impact on their attitude towards fitness.

People have their own attitudes towards fitness, which are affected by internal and external sources. Internal sources regard everything originating from the person themselves, for example, already discussed fitness self-perception, and demographic characteristics.

A study found that weight has an indirect impact on attitude towards training and competition sports amongst adolescent people. Heavier weight had negative impact on attitude, due to poor performance in sports leading to critique from teammates for instance. Obese people were found to have a positive attitude regarding social sports, where the aim was not purely to beat the opponent. (Chen-Stute, Kellmann, & Kopczynski 2014.)

The external factors, which affect peoples' attitudes towards fitness differ across demographic groups. While social factors such as peer support are very important for adolescent boys, girls of same age hold personal and environmental factors to higher importance. This difference can best be noted with the fact that boys have been found to participate significantly more in physical activities taking place in informal physical environments, on the neighborhood streets for example. Although, the most significant external factors are social, physical environment has an impact on the attitude towards fitness as well, though, not as significant as social factors. For example, in the case of company X areas and neighborhoods, which are considered favorable for walking, positively affects people's attitude towards walking as a physical activity (Barr-Anderson, Erickson, Lytle, Patnode, Sirard, & Story 2010, 6-9.)

Trends also have an impact on the level of physical activities undertaken. For instance, gamification of walking into an activity tracking-based walking competition is argued to increasingly incentivize people to partake in physical activities (Althoff, Leskovec, Saberi, & Shameli 2017, 13-14).

2.1.2 Activity Tracking

Activity tracking can be seen in a lot of places in today's world, but most prominently it can be noticed in physical activities. There are wide range of activity devices ranging from heartbeat sensors to more complex devices, which make use of gamification of fitness activities. One example of such devices is Fitbit, a slick looking wristwatch which began its journey as only a step measuring bracelet. Regardless of sex 33 percent of youth currently use mobile applications in the category of fitness Health & Fitness, however there are many more ex-users of these kinds of applications than there are current users (Kowalczyk, Sas-Nowosielski, & Szopa, 2016), which speaks out about customer retention issues in Health & Fitness application category.

Figure 2. Example of a Fitbit (Fitbit, n.d.).

Example of Activity Tracking Solution

The Fitbit shown above (Figure 2) measures for instance, how many steps has the wearer taken, or how long of a distance horizontally or vertically has the user moved. The users can set themselves goals for these measures, which will then motivate them to reach their goals and even go beyond to have a feeling of exceeding their limits. This does not mean that everybody should go out and buy a Fitbit to get instantly motivated to do sports. A research article released in Personal and Ubiquitous Computing journal found that "The motivational features of activity tracking devices may only complement already existing motivations of the users, but do not create incentive for more physical activities on their own." (Jarrahi, Gafinowitz, & Shin, 2017) So, the motivation for sports must come originally from the person themselves, at least when it comes to the benefits of a Fitbit. There has been done research on further gamification of fitness, by creating video games which can

track activity or can even be connected to activity tracking devices such as Fitbit (Arya, Etemad, Zhao, 2015).

2.2 Gaming Analytics for Fitness

Gaming, the remaining half of the exergames. Now that we have covered the fitness/exercising part of the literature review, it is important to breakdown the gaming concepts of the ensemble. Gaming in this combination is the attraction, so it is important to break it down to sections to understand the phenomena of exergaming, who uses it and how it is being used. Researching all the above-mentioned factors help us the authors to be able to help readers to better understand the concept of exergaming, which is still fairly new. Also, to help readers to better understand the data displayed later on in the thesis.

2.2.1 Development of Gamer Demographics

Gaming is generally seen as a hobby of male, and gaming by females has been kind of a taboo in the past. Although the general view held the previous opinion as a taboo, statistics speak against it. Before mobile gaming was a thing, in the 90's, there were no large differences between the number of males and females who play games on a computer surprisingly, but males, especially younger ones, have been more likely to play more in a day than females (Griffiths, Hunt, 1995, 189-191)

Mobile gaming as a concept started its journey around the year 2002, when technology enabled mobile operators to commercialize phones that could download games. The mobile market officially boomed and started forming its own structure in 2007, when Apple released its first touchscreen iPhone. At the time of the mobile gaming boom, people aged 45 and older increased their gaming on mobile devices by 52%. At the same time in aged 18-24 it increased just by 2% (Feijoo, Gomez-Barroso, Aguado, Ramos, 2012, 212-218). Feijoo, Gomez-Barroso, Aguado & Ramos suggest, that these numbers might be affected by the lower barrier of entry to gaming, and mobiles as a new platform of gaming seen more appealing by older people.

Going forward to present, things have changed a lot in the mobile gaming world. Taboos and such things no longer exist, and females have conquered the market. The statistic provided by Udonis, a leading mobile marketing agency show, that in 2019, an immense 63% of mobile gamers were female, and 51% of all gaming happens on mobile devices. Also, the age demographic has changed a bit from the first boom. On average, a female player is 36 years, and a male player is 32 years old (Knezovic, 2020). The Article from Feijoo, Gomez-Barroso, Aguado, Ramos does not provide an exact age average, but from the rise of the amounts of older aged players, we can deduce that the age demographic at the time has been higher. Of course, this is an assumption and further examination is needed to prove this.

What we can take from this, is that the mobile gaming world is large and offers a large, unique target group. Unique in the sense that females are dominating the gamer demographic charts, something that probably no one would have believed 10 years ago. The low barrier of entry to mobile gaming and almost every phone nowadays able to run almost every game, provides endless possibilities.

2.2.2 Activity Tracking in Mobile Gaming

Activity tracking in mobile gaming was already used in an augmented reality and location aware game called Ingress, before becoming hugely popular and well known with the release of Niantic's Pokémon Go in 2016. In Pokémon Go, you join one of three Pokémon clans and walk around in the real world, catching different kinds of Pokémon's from varying types of environments. Player can find Pokémon eggs inside the game, which can only be hatched by walking a certain distance, therefore encouraging the player to do a physical activity to aid the in-game progress. The tracking system of Pokémon go is done so that if the player going too fast with either a bike or a car, the game will not take the activity on account towards the eggs being hatched. The reasoning of this is safety, as its not encouraged to use phone whilst driving. The game is available on both Android and Apple platforms.

Ever since the start initial reports stated that Pokémon Go has increased time spent walking. Niantic has been successful in getting inactive individuals active with their

game format (LeBlanc, Chaput, 2016, 7). Data from Microsoft shows that Pokémon go can aid increasing physical activity levels by about 25% (Althoff, White, Horvitz, 2016, 9). Niantic has also reported that they will release additional technology as support tools for the game (LeBlanc, Chaput, 2016, 6). Activity Tracking included in a game can boost activity levels of people, and the above-mentioned statistics support the hypothesis.

2.3 Exergames as A Category

Exergames (word portmanteau from exercising and gaming) as a term has different definitional views and even the word "exergames" is questioned. Most proposed definition by health & fitness – and gaming authors is as follows. "Exergames are the combination of exertion and video games including strength training, balance, and flexibility activities. Exergaming is playing exergames or any other videogames to promote physical activity" (Oh, Yang, 2010, 1).

Exergames, like games in general, are generally enjoyed by the adolescents. Although main userbase being the youth, on the side of its main use entertainment, exergames are also used to prevent and cure depression as its been found that physical activity is proven to improve mental health of people, that suffer of depression (Rosenberg, Depp, Vahid, Reichstadt, Palmer, Kerr, Norman, Jeste, 2010). Videogames in general are typically related to problems with childhood obesity and physical activity. It has been found that physical activity is known to decrease in adolescence. This is influenced by the transition from high school to college. (Schwarz, DeSmet, Cardon, Chastin, Costa, Grilo, Ferri, Domenech, Stragier, 2018.)

A study by Vernadaksi, Zetou, Derri, Bebetsos & Fillippou, (2014, 806) found out, that kids enjoy playing exergames more compared to traditional games or exercise. The results also showed this being irrespective of their weight status. The study suggests that providing more unique ways of exercising (exergames), can motivate children to exercise more. This suggests that the active lifestyle could carry on past the point in which an adolescent is leaving to study or generally pursue personal life. Whether the lifestyle carries on as playing exergames or doing outdoor physical activity is up

to the person itself. Exergames on the side of it can maintain the lifestyle if they are seen fun and enjoyable to spend time on.

Example of Exergames Solutions

Wii Fit and Wii Sports launched by Nintendo, are one of the most popular exergames that have been launched to date. Combined, both games have sold over 110 million copies since their launch (Top Selling Title Sales Units, Nintendo, N.d)

Figure 3. Example of a Wii Fit System. Pinterest (N.d)

As a system, the Wii Fit comes with a balance board as displayed in the games box in Figure 3. The board has for strain gauge load sensors mounted in each corner of the board to estimate the center of gravity and to track movements (Agmon, Perry, Phelan, Demiris, Nquyen, 2011, 161). The system interacts through a motion-detection system. Wii-Fit's purpose is to improve balance, strength, flexibility, and general wellbeing. Alongside the physical benefits, the game is also naturally meant for entertainment. Wii Fit has a wide variety of games, ranging from yoga, to different kinds of exercising to all the way to Zumba and dancing.

Figure 4. Example of a Wii Sports System. (Nintendo, N.d)

Wii Sports uses the same motion detection system. Players are equipped with motion-sensitive remote, as displayed in the Figure 4's unboxed Wii Sports box. The system includes a Bowling, Baseball, Tennis, Golf & Baseball game. Multiple players can battle against each other in a game of tennis for instance. In which a player replicates a real-life swinging movement with the remote and the real-life action is then displayed on the screen and the virtual character hits the ball, if timed correctly. Wii Sports can even be used as a warm-up tool before exercising the actual sport outdoors.

Small empirical study found out, that a group which played Wii Sports Bowling before playing the game on an actual ally, performed better compared to the non-training group. (Dörrfuss, Bader, Wegener, Siemon, Schwake, Hofman, Hieber, Schmid, 2008, 1)

2.3.1 Usage of Exergames

The usage of exergaming and the term itself became more common in 2010-century. The use of exergames have become a subject of growing interest in academic research due to its nature of being used for hedonic and utilitarian reasons (Kari, Makkonen 2014, 1). The hedonic side reflecting to joy that exergames create for its users and utilitarian side reflecting to exergames use, that have been seen in environments such as rehabilitation, mental health aid, fitness classes & education.

In rehabilitation, exergames have been used in increasing amounts to increase physical activity and to improve health & physical functions especially for older adults (Skjæret 2015, 2). In her review article Skjæret found out by reviewing 60 exergaming studies in the rehabilitation field, that even though multiple studies have found benefits of exergames in different scenarios, they lack information, high quality regards to methodology and possible adverse events reports regarding safety. (ibit., 1-3). Her review article suggests that there are gaps between exergame & VR (Virtual Reality) studies as they often use different study designs, technologies and exergames that may differentiate results.

Even though Skjæret challenges the general vision of exergames providing flawless positive results in studies, they have indeed provided many positive findings. Although all the below mentioned findings by study authors suggests further examination/studying for more intelligent results, the results speak for themselves. For instance, exergames have been found out to improve the balance and some cognitive functions of Parkinson Disease patients (Barry, Galna & Rochester 2014, 5-6) and also cardiovascular and noncardiovascular benefits with minimal risks for cardiac rehabilitation (Ruivo, 2014, 1).

In mental health field, exergames have mainly been used to cure depression, but also to reduce stress level, and in reducing substance use disorders (Byrne, Kim, 2019, 9). Estimations go showing that more than one in five adults experience MDD (Major Depressive Disorder) at some point in their life's (Blumenthal, Smith, Hoffman, 2012, 13). Depression in general is treated with either psychotherapy and/or antidepressant medications. Each person is unique and may result in these treatments not being successful. Thus, exercising, and more precisely aerobic exercising has been suggested as an alternative cure approach (ibid).

The Duke Smile Studies case study found out that in longer run, depression cured with just exercise showed lower depression rates, when compared to people treated with sertraline, which is a common medicine for depression, or both treatments combined (ibid, 19). The results suggest that exercise should really be taken as a valid alternative. This shines light towards exergames, which bring in another option by combining the good results of exercising as a cure with gaming. Of course, exergames as a tool for depression cure require future research to be proven successful, but it has a potential role to play in it.

Fitness classes and gyms have also emerged into the exergames world. In many gyms you can see treadmills or exercise bikes equipped with a screen, in which the user is either running or cycling in different landscapes, and possibly racing against others in a virtual race. For instance, TacX and SpiVi are examples of companies including gaming with indoor cycling. TacX providing indoor bike trainers with virtual racing (About TacX, N.d.) and SpiVi providing indoor cycling leaderboards for gyms and studios (SpiVi Metrix, N.d). Both implementations add another element for exercising at public spaces or in some circumstances at home.

Mobile games with location-based technologies have provided opportunities to embed learning, thus enhancing engagement and learning outside the traditional options (Huizenga, Admiraal, Akkerman, ten Dam, 2009, 333). Company X could in this sense pursue their focus also to the educational side. Company X's game with its current concept, could be used for instance to motivate and boost youth's mindset in

sport classes and make exercising sports more enjoyable for individuals that generally do not enjoy it. By examination, it has been found that students engaging sports with exergames engaged in more minutes of physical activity and using all the time available to improve their scores, compared to regular physical education exercise (Shayne, Fogel, Miltenberger, Koehler, 2012, 213). These results might not apply worldwide, as environments and games might affect the results, but give positive starters for such implementations.

2.3.2 Sentiment of Exergames

Exergames in general are being seen as opportunities. Like covered in the previous chapters of this literature review, many researchers have seen exergames as opportunities to promote healthier lifestyle and as cures to some physical and mental diseases. Much of the covered literature and opinions are bias, as they bring in the views of the creators and their results without much mentioning the people's opinions, so what actually are the sentiments of the users on exergames and -gaming?

In a qualitative content analysis study of exergaming in exercising aid with chronic heart failure by Klompstra, Mårtensson, Jaarsma, Strömberg (2017, 1-4), patients found exergames great and as a fun tool to exercise with at home and alongside the physical effects, found them generally enjoyable. Sedentary adolescents see exergames as motivational, enjoyable as exercising- and entertainment opportunities (Klein, Simmers, 2008, 39-43). Adolescent also saw exergames boosting feelings of cohesion, peer support in social circumstances (Marker, Staiano, 2015, 2-3).

The 3 above mentioned sentiments are just part of the large group of same kind of positive opinions. The large amount of exergaming related studies, alongside its already popular use in everyday life, shows us that exergaming is just beginning is journey and has potential to be in huge role in the future. In which scenarios it will be important will be determined by the future. We can only wait patiently and see how this whole phenomenon of exergames evolves.

2.4 Summary of literature review

This subchapter seeks to briefly summarize the theoretical framework in a way that brings the two presented distinctly separate aspects together. When it comes to multitude of different demographics' approach in the world of physical activities, there are many factors which are characteristic to each demographic, to be considered. For example, young females keep environmental factors to a higher regard than males of the same age group, and people of higher weight are less motivated by competitive nature of some physical activities. Exergames solve most of these problems as they create a social and entertainment-centered environment for doing physical activities, furthermore they give the player an option to participate in challenges of competitive and non-competitive nature, both of which tend to have equal entertainment value.

Traditionally exergame solutions have been immobile, meant to be used at home causing them not to take advantage of the vast outdoors. With newer mobile-based exergames, the players have moved to outdoors and do not necessarily need an exergame solution other than their own mobile phone. Nevertheless, mobile exergames can take advantage of activity tracking solutions, which are designed to support physical activities. This shift in the way exergaming is approached further emphasizes physical activity. Overall, mobile exergames with emphasis on exercising are a new opportunity and they tend to have something for everyone, making physical activities more enjoyable.

3 Methodology

The client of this research requested a comprehensive and diverse ready-to-use data package from the authors. The goal of the research was to discover relationship between exergames and motivation towards physical activities, and the public view on the subject activity tracking mobile application. In this chapter, the methodology and reasoning behind it is explained and furthermore how the methods were implemented, and results analyzed.

To best meet the needs of the client, the pragmatic philosophy was followed, which fits mixed methods research very well as it philosophically allows the use of any research methods in order to fit the research paradigms (Brierley 2017). The results will be analyzed and discussed in a descriptive manner in order to open up and reflect on the research questions at hand, hence the research is descriptive in nature.

Mixed methods methodology is consistent of combining both quantitative and qualitative data in a single study, therefore making the conclusions better and more credible (Wisdom, Creswell 2013). Due to the fact that there were two authors for the research rather than one, which is more common in thesis writing, authors were able to use this more comprehensive approach to research methodology.

3.1 Research methods

This study sought to generate quantitative and qualitative results in order to diversify the value created for the client. Quantitative data is numbers and other figures, which can be analyzed through statistics, and so finding out connections in the statistics (Dudovskiy 2019a). On the other hand, qualitative data regards non-numeric information, such as structured interviews used in the research. Also, qualitative methods were used in order to create depth to the results and to further support the findings from the used quantitative method. (Dudovskiy 2019b.)

Survey was used to gather quantitative data. Although it often as well as in this case, limits the diversity of the answers from respondents to the mold that is formed upon

creation of the survey. This was a problem that had to be considered especially, because the survey consisted of primarily multiple-choice questions. The reasoning behind high number of multiple-choice questions is the ease and validity of transforming the survey data to statistics. A survey was the most viable method of gathering quantitative data, because with it, the authors were able to reach large sample and get precise up to date data. (Sincero 2019.)

In order to bring the qualitative dimension to the research, the authors decided to select some of the survey respondents for further research. The candidates were requested to use the activity tracking mobile application for a 7-day period, though as is mentioned in data collection section, this action plan had to be cancelled due to removal of the application from the public market. Instead, as a replacement for the trial period the interviewees were introduced to the application by the authors. Structured interviews on the other hand were used because they give contrast to the quantitative data collected from the survey, without straying too far from it. Also, it allowed the authors to dig a bit deeper behind the why, of research objectives. (Mcleod 2014.)

3.2 Data Collection

Survey

The survey was sent to multiple international student groups in a mobile online messaging application and through the authors' other social media channels. It was distributed in four different languages: Finnish, English, Russian, and Slovakian. Sampling was done primarily as convenience sampling, as the authors had a large community of diverse international students at hand. Although convenience sampling is one of the weakest sampling methods due to its poor generalizability, it was the most viable way of reaching such wide variety of respondents with limited resources. If convenience sampling had not been used, there would have been a high chance that the authors would have been unable to execute the research overall (Borg, Gall, & Gall 1996, 228).

The survey was done using Google Forms online tool and it was kept open for two months, allowing people to have time to answer, and still keeping external factors from affecting the survey answers. There was no set quota for survey responses, but none the less with 146 responses, the authors had well enough data in order to find statistically significant trends and correlations.

Structured Interviews

Purposive sampling was used to find the interview candidates, because it allows the selection of cases which best fit to answer the research questions (Lewis, Saunders, Thornhill 2009). As the authors had limited resources available, a smaller well-chosen sample was better than more broader sampling method such as random sampling. When it comes to the candidate selection criteria, there were two factors which the authors looked for in the sample:

- the candidate should present interest in physical activity such as walking or jogging, in order to assure the usage of the application during trial period; and
- the candidates should be of varied sex, in order to create more viable results.

The authors planned to originally have a trial period during which the sample would use the application to get familiar with it, but the application had been pulled from the application marketplace for further development at the time of executing the trial period. Therefore, the authors had to resort to giving a complete explanation and visual representation of the application in the interview. Naturally, this inconvenience will cause some problems for the results but with due diligence, the authors were able to limit the problems to negligible levels.

The interview questions were formulated after designing and executing the survey, therefore allowing the authors to dig deeper on certain themes that had emerged in the survey results. In order to increase the credibility and viability of interview data, the authors were conscious regarding their own biases, and sought to avoid such bias affecting content and wording of the interview questions. The interview process right from the beginning of designing the interview all the way to transcription, the

authors kept in mind that they should not fall into the trap of three main bias sources in questionnaires, which according to Choi and Pak (2004) are:

- How the interview questions are formed.
- How the interview process is designed, for example in the authors' case this was important to consider how the application is presented to the interviewees; and
- How the interview was in the end, practically administered, for example what was the setting of the interview.

Although Choi's and Pak's research was done specifically on questionnaires, the biases found behave in nature the similarly when using interview, as the research method.

The candidates were given the themes of the interview questions, hence allowing them to have time to reflect the themes on their experiences. The interview focused on topics and themes relevant to the subject at hand. Later during the same day each was individually invited to a telephone interview, and they were asked questions showed in the interview form appendix 3. The interviews were done until relative data saturation, which was met after 7 interviews.

3.3 Data Analysis

After closing the google survey form, the collected quantitative data was put into and analyzed using SPSS analysis software. The authors sought to reveal statistically significant correlations in the data. Tables were made based upon hypotheses as visual aids for the reader to better conceptualize the results. In order to understand the hypotheses' statistical significance, Chi Square was applied in the analysis process. The limit of significance was set at the commonly used level ($p=0,05$). Further specifying the statistical significance of the results, if p-value less than 0,1, the authors decided to define this as having a weak correlation. On the other end of the spectrum statistically very significant term is used for sufficiently low p-values ($p<0,02$).

The qualitative data collected from the interviews was subjected to thematic content analysis. The data transcribed and analyzed in NVivo and scrutinized via researcher triangulation in order to uphold the quality of the research. The interviews were transcribed edited, not verbatim, therefore leaving out redundant communication between the interviewer and interviewee. Authors created illustrative word clouds in order to present the verbal themes, which were found in the interviews. Word clouds allows easier assessment and representation of common themes amongst the interviews, all the while the interviewees' anonymity remains untouched (DePaolo, Wilkinson 2014).

3.4 Research Ethics

The research was subject to multiple different potential ethical pitfalls. The authors did their best to avoid such pitfalls and execute the research, analyze the data in an academic and unbiased manner. This chapter will go through the potential biases the authors may have in process of the research and what kind of ethical downfalls there could have been, resulting in an assessment of credibility and quality of the research process. Overall, by recognizing biases and other ethical pitfalls, the authors wish to increase the research's transparency and hence its credibility. The authors' biases could come into play at every stage of the research, in following paragraphs, five different types of biases will be gone through, beginning with design bias. The following biases are based on a study by Noble and Smith (2014, 101).

The design bias is a very fundamental bias, which can affect the end results and conclusions significantly. It regards the authors' personal prejudices impact on what and how the research questions are formed, and how the methodology is designed. (Noble & Smith 2014, 101.) As the research was done per request by the client company, the client's needs affect how the author's designed the research. Though, the authors were given free hands over the research design, so only the research questions were affected by the company.

The second bias is selection bias, can also be called sampling bias, meaning that the authors would have had some sort of agenda behind how participants were recruited

and how potential participants were chosen (Noble & Smith 2014, 101). The research was done as bachelor's thesis and the authors were not as driven to gather the best possible sample, as they could have been if it was part of their professional careers. Therefore, the sample gathered for the study, may be impacted by a convenience bias to a small degree, though because the authors recognized this issue, they sought to form a diverse, unbiased sample.

The next bias is data collection bias, which implies personal beliefs affecting the way data is collected (Noble & Smith 2014, 101). For the executed research, the authors' personal beliefs may have affected the manner in which the survey questions were formed. For example, the questions could have been formed in a way that encourage answering in certain way, which matches authors' agenda. The authors deemed it necessary to test the survey on peers, in order to find out whether such bias would be present.

Fourth bias according to Noble and Smith (2014, 101) is the analysis bias, simply referring to the authors potentially having an agenda, for which they look for supporting patterns and discrepancies in the data. The authors were able to minimize this bias by declaring all statistically significant results in the quantitative results, and furthermore, attaching the interview transcriptions as appendices in the end of the research.

Fifth and final bias is publication bias, implies that the authors leave the research not published, if they would not find statistically significant data (Noble & Smith 2014, 101). For the research at hand, this bias was a non-issue, due to it being a bachelor's thesis in nature, and requiring to be published, if the authors wished to advance in their studies.

In order to uphold the quality of the study, which could be hindered by poor execution of the qualitative side, the authors took steps as to avoid certain pitfalls. For example, in order to assure the qualitative data was analyzed in an unbiased and high-quality fashion, the authors used researcher triangulation to analyze the transcripts and the data formed from said transcripts. Moreover, the overall quality

of the study was sought to be kept high and credible, by each researcher peer reviewing one another's work on regular basis. Nevertheless, it is important to note, that even though having two authors allowed the research to be peer reviewed over the course of the research process, neither of the students are professionals. Hence, there may have been some pitfalls that they fell into in the research, and the authors were never the wiser that such pitfalls had happened.

4 Research Results

(Confidential, in the appendices of the version to be evaluated)

5 Conclusions and Discussion

(Confidential, in the appendices of the version to be evaluated)

6 Suggestions

(Confidential, in the appendices of the version to be evaluated)

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Appendices

Appendix 1 Correlation tables

Table 4: Chi-Square Tests

Do you consider yourself as healthy and strong?	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	14.364[a]	6	0.026
Likelihood Ratio	15.674	6	0.016
Linear-by-Linear Association	0.668	1	0.414
N of Valid Cases	146		

a. 8 cells (66.7%) have expected count less than 5. The minimum expected count is .71.

Table 5: Chi-Square Tests

Attitude towards phrase fitness	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	1.759[a]	2	0.415
Likelihood Ratio	1.958	2	0.376
Linear-by-Linear Association	0.856	1	0.355
N of Valid Cases	146		

a. 2 cells (33.3%) have expected count less than 5. The minimum expected count is 2.55.

Table 6: Chi-Square Tests

Do you consider yourself as healthy and strong?	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	8.998[a]	4	0.061
Likelihood Ratio	9.952	4	0.041
Linear-by-Linear Association	4.854	1	0.028
N of Valid Cases	146		

a. 3 cells (33.3%) have expected count less than 5. The minimum expected count is 1.07.

Table 7: Chi-Square Tests

Can a game encourage physical activity?	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	9.658[a]	4	0.047
Likelihood Ratio	9.326	4	0.053
Linear-by-Linear Association	7.016	1	0.008
N of Valid Cases	146		

a. 3 cells (33.3%) have expected count less than 5. The minimum expected count is 1.32.

Table 8: Chi-Square Tests

Importance of fitness in culture	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	23.655[a]	12	0.023
Likelihood Ratio	24.476	12	0.018
Linear-by-Linear Association	3.352	1	0.067
N of Valid Cases	146		

a. 11 cells (55.0%) have expected count less than 5. The minimum expected count is .72.

Table 9: Chi-Square Tests

Importance of fitness in one's culture	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	18.537[a]	8	0.018
Likelihood Ratio	20.336	8	0.009
Linear-by-Linear Association	6.860	1	0.009
N of Valid Cases	146		

a. 8 cells (53.3%) have expected count less than 5. The minimum expected count is .29.

Appendix 2 Survey form

Fitness games/apps survey

* Required

1. 1. Please select your gender./Пожалуйста, выберете ваш пол./Vyberte vaše pohlavie./Valitse sukupuolesi. *

   Mark only one oval.

   - ◯ Male/Мужской/Muž/Mies
   - ◯ Female/Женский/Žena/Nainen

2. 2. Please select your age category./Пожалуйста, выберете к какой категории относится ваш возраст./Vyberte vašu vekovú kategóriu./Valitse ikäryhmä. *

   Mark only one oval.

   - ◯ 0-15
   - ◯ 16-25
   - ◯ 26-35
   - ◯ 36-45
   - ◯ 46+

3. 3. Which country are you from?/Из какой вы страны?/Z ktorej krajiny pochádzate?/Mistä maasta olet kotoisin? *

   Mark only one oval.

   - ◯ Finland/Финляндия/Fínsko/Suomi
   - ◯ Slovakia/Словакия/Slovensko/Slovakia
   - ◯ Russia/Россия/Rusko/Venäjä
   - ◯ Other: _____

4. 4. What kind of impression do you get when you come across the word "fitness"?/ Какое впечатление у вас вызывает слово «Фитнесс»?/ Ako na vás vplýva slovo "fitness"?/ Millaisen vaikutelman saat sanasta "fitness"? *

   Mark only one oval.

   - ◯ positive/Позитивное/pozitívne/positiivinen
   - ◯ neutral/Нейтральное/neutrálne/neutraali
   - ◯ negative/Негативное/negatívne/negatiivinen

5. 5. Do you think that mobile games/apps named with the word fitness are only targeted to physically healthy and strong people?/ Как вы считаете, мобильное приложение/игра, в имени которого фигурирует слово «Фитнесс», направлено только на физически активных и спортивных людей?/Myslíte si, že mobilné hry/aplikácie pomenované slovom fitness sú zamerané len na fyzicky zdravých a silných ľudí?/ Koetko, että kännykkäpelit ja -sovellukset joissa on maininittuna termi fitness on suunattu ainoastaan ihmisille joilla on hyvä fyysinen kunto? *

   Mark only one oval.

   - ◯ Yes, Definitely. /Да, абсолютно./ Áno, rozhodne./ Kyllä, ehdottomasti.
   - ◯ No, I think they are for everyone./ Нет, я считаю, что они созданы для всех./ Nie, myslím si, že sú pre každého./Ei, ne ovat tarkoitettu kaikille.
   - ◯ I do not know./ Я не знаю./ Neviem./ En tiedä.

6. 6. Do you consider yourself as a physically healthy and strong person?/Вы считаете себя физически сильным и здоровым человеком?/Považujete sa za fyzicky zdravého a silného človeka?/ Koetko olevasi fyysisesti terve ja vahva henkilö? *

   Mark only one oval.

   - ◯ Yes./Да./Áno./Kyllä.
   - ◯ No./нет./Nie./Ei.
   - ◯ I do not know./ Я не знаю./ Neviem./ En tiedä.

7. 7. Which of these features would keep you coming back to the app?/ Какие из нижеуказанных свойств помогут поддерживать вашу заинтересованность в данном приложении?/ Ktoré z nasledujúcich prvkov by vás presdvedčili znovu sa vracať k aplikácii?/ Mikä seuraavista ominaisuuksista saisi sinut käyttämään sovellusta uudestan? *

Check all that apply.

- [ ] In-Game Rewards/Бонусы внутри игры/Odmeny vrámci hry/Pelin sisäiset palkinnot
- [ ] Real life Rewards/Бонусы из игры с возможностью использования в реальной жизни/Odmeny v reálnom svete/Tosielämän palkinnot
- [ ] Competitions/соревнования/Súťaže/Kilpailut
- [ ] Challenges/ Новые испытаия/Výzvy/Haasteet
- [ ] Connection of activity aided progression/Связь вашей активности с прогрессом в приложении/Fyzická aktivita ako herný komponent/Aktiivisuudesta kertyvä edistyminen
- [ ] Entertainment value/Повышенное значение развлекательных свойств/Zábava/Viihdearvo
- [ ] Other: _____

8. 8. Do you think that a game has a potential to encourage you to be more physically active?/ Считаете ли вы, что у игры есть потенциал помочь вам приобрести большую заинтересованность в физической активности?/ Myslíte si, že by vás mobilná hra mohla povzbudiť k fyzickej aktivite?/Koetko, että peleillä on potentiaalia kannustaa sinua fyysisesti aktiivisempaan elämään? *

Mark only one oval.

- ◯ Yes./Да./Áno./Kyllä.
- ◯ No./нет./Nie./Ei.
- ◯ I do not know./ Я не знаю./ Neviem./ En tiedä.

9. 9. How important is fitness in your culture?/ Оцените в цифрах, насколько важное место занимает фитнесс в культуре вашей страны?/ Ako dôležité je fitness vo vašej krajine a kultúre?/ Kuinka tärkeää fitness on kulttuurissasi? *

Mark only one oval.

- ◯ 0-30%
- ◯ 31-50%
- ◯ 51-75%
- ◯ 76-85%
- ◯ 86-100%

Appendix 3 Interview form

Sukupuoli / Sex:

1. Minkä ikäinen olet? / How old are you?

2. Urheiletko sinä? Jos et, oletko harrastanut urheilua aikaisemmin? / Do you exercise regularly? If not, have you exercised previously?

3. Kuinka usein ja kuinka paljon kerralla? / How often and how much on one time?

4. Voiko ja kannattaako mielestäsi liikunta ja videopelit yhdistää? / Can and should you, in your opinion, combine physical activities and video games?

5. Mitä mieltä olet yleisesti videopeleistä / what is your general opinion regarding video games?

(selitä X-pelin toiminta)

6. Mitä mieltä olet X-pelistä? / what is your opinion regarding X game?

7. Pelaisitko tällaista peliä, samalla kun käyt kävelylenkillä tai muuten ulkoilemassa? /would you play this kind of game, when you are going for a walk or just generally outside?

8. Uskotko että X peli voisi motivoida ihmisiä jotka ei liiku paljon, liikkumaan enemmän? / do you believe that the game X could motivate those who do not do a lot of sports, to do more physical activities

9. Tuliko mitään mieleen aikaisemmista kysymyksistä joihin haluaisit jotakin lisätä? / did anything come into your mind regarding any of the questions?

10. Onko teillä muita kommentteja? / Do you have any other comments?

Kiitos! / Thank you!

Appendix 4 Research Results

The content has been omitted due to confidentiality.

Appendix 5 Conclusions and Discussion

The content has been omitted due to confidentiality.

Appendix 6 Suggestions

The content has been omitted due to confidentiality.