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**HOW AUGMENTED REALITY GAMES CAN IMPROVE
SOCIAL HEALTH
- CASE POKÉMON GO**



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ABSTRACT

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The aim of this study is to research augmented reality games' health and social health benefits. The aim is to find out Finnish Pokémon GO players opinions and feelings of social belonging. In addition, other health benefits that augmented reality games generate are examined focusing on Pokémon GO. Research methods of this thesis are a literature review of the theories and an online survey as a quantitative research method.

Augmented reality games that lure the player outside are evolving and growing in numbers. There are many games that motivate physical activity, but few of them generate social belonging and face-to-face contact with others. Low physical activity levels, social anxiousness and lessening social contacts are an increasing problem for the individuals and for the society. Studies show that games promoting physical activity generate positive effects on the early usage of the game, but the effect seems to lessen with time. This study gives valuable information on the Finnish players' social playing habits and their gender differences.

The results of this study show that there are no major gender differences in the social playing habits of Finnish players. Finnish players, in general, like the Pokémon GO community and only few players play the game always alone. The theoretical part and the results both gesture that the game generates an increase in physical activity and encourages social connectedness.

Keywords: Pokémon GO, augmented reality, exergame, health games, social connectedness, physical activity

TIIVISTELMÄ

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How augmented reality games can improve social health – case Pokémon GO

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Tämän tutkielman tarkoituksena on tutkia lisättyä todellisuutta hyödyntävien pelien sosiaalisia ja terveydellisiä vaikutuksia. Tutkimuksen tavoitteena on selvittää suomalaisten Pokémon GO pelaajien mielipiteitä ja selvittää yksilöllistä kuuluvuutta. Lisäksi selvitetään muita terveydellisiä vaikutuksia, joita lisätyn todellisuuden pelit, keskittyen Pokémon GO peliin, tuovat. Tutkimusmenetelmänä käytetään kyselytutkimusta.

Lisätyn todellisuuden pelit, jotka vievät pelaajan ulos, ovat koko ajan kehittymässä ja lisääntymässä. Liikuntaan kannustavia pelejä on jo paljon, mutta harvat niistä saavat pelaajat kokemaan sosiaalista kanssakäymistä kasvokkain toisten ihmisten kanssa. Liikunnan vähäisyys, sosiaalinen ahdistuneisuus sekä sosiaalisten suhteiden heikkeneminen ovat suuria ongelmia sekä yksilön että yhteiskunnan kannalta. Pelien on tutkittu antavan positiivisia vaikutuksia pelaamisen alkuvaiheessa, mutta niiden pitkäaikaisvaikutteita tulee tutkia lisää. Tämä tutkimus antaa arvokasta tietoa pelin vaikutuksista vuosi pelin julkaisemisen jälkeen suomalaisten pelaajien yhteisöllisyydestä ja sukupuolten välisistä eroista.

Tutkimuksen tuloksissa selviää, että sukupuolten väliltä ei löydy merkittäviä eroja. Suomalaiset pelaajat pitävät pelin yhteisöstä ja vain joka kymmenes suomalainen pelaaja pelaa peliä aina yksin. Tutkimus viittaa pelaajien lisääntyneeseen fyysiseen aktiivisuuteen ja yhteisöllisyyteen, jotka johtuvat pelistä.

Avainsanat: Pokémon GO, lisätty todellisuus, exergame, terveyspelit, yhteisöllisyys

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1 INTRODUCTION

Loneliness and physical inactivity are growing problems. 43% of elderly people have reported feeling lonely (Perissinotto, Stijacic Cenzer & Covinsky, 2012). Loneliness can be a feeling of loneliness, living alone or social isolation (Holt-Lunstad, Smith, Baker, Harris, & Stephenson, 2015). Loneliness has before been connected mostly with elderly people, but loneliness is a growing problem in societies. Recent studies show that 32% of university students globally admit to feelings of loneliness and 42% have considered dropping out due to physical or mental health issues (Sodexo, 2017). A recent study shows that nearly half of Americans are sometimes or always feeling alone and generation Z, adults ages 18-22, is the loneliest generation of all. Loneliness produces many unwanted health risks, it decreases productivity and vitality, which means disconnection between mind and body. (Cigna, 2018.) Loneliness is as bad for health as heavy smoking and alcoholism, and the lack of social relationships has a greater risk of premature mortality than obesity (Holt-Lunstad et al., 2015). Reducing social isolation and increasing populations social relationships have a positive impact on public health and should be promoted and taken into consideration. Social ties can be used as a prevention to loneliness and premature mortality. (Umberson & Montez, 2010.)

More than one in four adults globally are physically inactive. The inactivity level has remained the same since 2001. Physical inactivity is nowadays mainly due to urbanization, as violence, traffic, pollution and lack of recreational areas for physical activities like parks and sidewalks are increasing and people being less active during their leisure time. Physical inactivity increases risk of poor health, like cardiovascular disease, cancer, diabetes and mental health conditions. Globally 81% of adolescents (aged 11-17 years) and 23% of adults do not meet the physical activity recommendations. Physical inactivity leads to obesity and health problems. In 2016, almost 40% of adults globally were overweight. (World Health Organization, 2018a.) Time outdoors and physical activity increase vitamin D levels, strengthens immune system, lowers stress level and reduces attention deficit hyperactivity disorder symptoms (Labrique, Carabas, Carras & Lee, 2016). Physical activity has

significant health benefits, and it lowers the risk of noncommunicable diseases and overall mental health. It also has an impact on feelings of loneliness and social connectedness. (New Cig, 2018; Umberson & Montez, 2010; WHO, 2018a.)

Getting people outside to socialize and being physically active is hard to do. The best results come when the motivation to do so comes from the individual themselves. Health and fitness apps attract the already active population. Exergames that are designed not to look like exergames, as in active video games that promote exercise, are more likely to get sedentary people be more active. (Althoff, White & Horvitz, 2016; Kogan, Hellyer, Duncan, & Schoenfeld-Tacher, 2017; Labrique et al., 2016; Wong, 2017.) Slow walking cannot replace the recommended physical activity of at least brisk walking or jogging but getting sedentary people physically active and outside their homes is better than nothing and a good start for a healthier life (UKK, 2018; Wong 2017).

The long-term effects and how people play games together needs to be researched more. The studies have shown (i.e. Bonus et al., 2018; Labrique et al., 2016; Vella et al., 2017) that Pokémon GO has reached sedentary people and people who suffer from socially anxiousness or have a lack of social contacts outside to play. Most of the studies have been made right after the game was launched and not many studies have yet to discover the long-term effects these types of games can have. The problem is to keep people motivated to play and avoid boredom. This study will make an overview of these augmented reality exergames and the health benefits Pokémon GO has generated and find out Finnish players social habits while playing.

The purpose of this study is to examine how augmented reality games can improve social health and specialize in Pokémon GO. The research objective was to study Finnish Pokémon GO players a year after the game release and learn how much they think the game effects on a social level and how much they have walked since starting to play. The empirical part of the study is executed as a quantitative research and the research questions for it were:

1. What health benefits does Pokémon GO generate?
2. What are Finnish Pokémon GO players' social playing habits?
3. Are there gender differences in Pokémon GO's Finnish players social playing habits?

This thesis includes a literature review and an empirical study. The literature review contains augmented reality and exergames and their health benefits of Pokémon GO. The first content section goes over the basics of augmented reality, how it can be used and different types of augmented reality, its history, possibilities and challenges. The second section about the health benefits in case of Pokémon GO and exergames are handled shortly. The health benefits include physical health, social health in social connectedness and social anxiousness.

The research methodology will be handled in chapter four and it includes the research objectives and problem, the method, data analysis and reliability and validity. Results are discussed in chapter five to compile the gathered data and what it means. Discussion of the research results, conclusion and implications, research limitations and suggested future research are in chapter six.

The results of this study show that there are some differences in Finnish Pokémon GO players, there are no major differences. A bigger portion of male players thinks that the game has improved their physical activity a lot, the female respondents felt it more moderately. The players in general like their community and only every tenth player plays the game always alone. Many players have been introduced to the game by others and most would recommend the game for others as well. The theoretical study and the results of this study both refer to increased physical activity and social connectedness generated by the game.

2 AUGMENTED REALITY

Physical world has gained few extra realities in the last years, the oldest additions are from the 1960s. The main additions are virtual reality, augmented reality, diminished reality and mixed reality. (Kipper & Rampolla, 2012; Herling & Broll, 2010; Juraschek, 2018.) Physical world is the one we live in right now, without any digital enchantments. Virtual reality is a complete 3D representation of the actual world or of objects, the user enters an entirely artificial digital environment that appears as a real environment. In augmented reality objects are integrated to a live view screen to supplement reality. (Farshid, Pachen, Eriksson & Kietzmann, 2018; Kipper & Rampolla, 2012.) Science fiction has been a major source of ideas for technology and has driven us towards new realities and made them happen (Farshid et al., 2018).

Virtual reality and augmented reality have in common that they either create a visual with information and programming or an experience with sensory and simulations. While augmented reality only needs a sufficient smartphone or tablet, virtual reality usually uses special gloves, earphones and goggles that all receive information from the computer system and the user's actions. (Kipper & Rampolla, 2012.)

Mixed reality can be defined as the continuum between the physical world and virtual world (Champney, Salcedo, Lackey, Serge & Sinagra, 2016). Diminished reality is the direct opposite of augmented reality. In diminished reality objects from the physical world are taken away, but in augmented reality they are added in. (Herling & Wolfgang, 2010.)

2.1 Definition of Augmented Reality

Augmented reality gives another way to interact with reality. Augmented reality is between reality and virtual reality. As a technology augmented reality has been alive for quite a while, but in the last decades its possibilities have been studied and used (Furth, 2011). It enables users to get a whole new user

experience going further than original software can (Jens & Grasset, 2013). Augmented reality is a live view of the physical world with a layer of information that can be for example virtual objects, sounds and video merged to the real life through technology like screens and lenses to let the user see a mixed reality (Farshid et al., 2018; Furth, 2011; Thinkmobiles, 2018).

Kipper and Rampolla (2012) say that the world is full of information that the people cannot see, and augmented reality is a way to present them in a way that can be seen and used. The information on screen can be interactive and digitally usable. The purpose of augmented reality is to ease the user's life. (Kipper & Rampolla, 2012.) Augmented reality can also be used to generate new data and not just provide previously collected data (Farshid et al., 2018). Augmented reality is defined by three characteristics that it needs to fulfill. The first is it combines both real and virtual-world. The second is that augmented reality is interactive in real-time in a real environment. The last point is that it operates and is used in a three-dimensional environment. (Bhutta, Umm-e-Hani & Tariq, 2015.) If the video or feed is not interactive, it is not augmented reality, then they are just like 3D movies that include photo realistic virtual 3D objects implemented with the physical world. (Kipper & Rampolla, 2012.)

Augmented reality has two main categories for its purposes; entertainment and a tool to help and improve decision-making and actions on daily-tasks. It can be used, for example, for marketing, maintenance and repair in manufacturing, healthcare, public safety, education, arts, gaming and entertainment. (Furth, 2011; Kipper & Rampolla, 2012; Mind Commerce Staff, 2013.) Different organizations have already found possible opportunities in AR, forests can be seen before and after logging, how a new apartment house or neighborhood camouflages into the environment. Augmented reality's purpose is to offer value by offering and generating information for the user to see and use. (Farshid et al., 2018.) One of the best opportunities for augmented reality by Hughes (2014) is the educational field where the students could use it to help them for a better understanding. This opportunity could be used in many other fields as well with the same ideas as in the educational field. Augmented reality is not just a technology, but a field of research, a vision of the future, a new commercial industry and a new way in arts (Kipper & Rampolla, 2012).

2.1.1 Augmented Reality Usage

Augmented reality needs a display to display information to the user. The main three displays are: mobile handheld displays, video spatial displays and spatial augmented reality and wearable displays. (Kipper & Rampolla, 2012.) Augmented reality can be used on mobile devices, special augmented reality devices, augmented reality glasses, augmented reality contact lenses and virtual retinal displays. A common user's top device is a mobile device, like a smartphone. (Thinkmobile, 2018; Mind Commerce, 2013.) The spreading of smartphones in general have brought a huge number of users. Using augmented reality games is generally cheap because many already have the

needed devices to run the games. The games also work with the cheaper mobiles as well, so it does not need as much monetary investments. The popularity of mobile augmented reality games is also due to their price as they are usually free to use and only getting extra things in the game is charged. Kipper and Rampolla (2012) envisioned augmented reality glasses and head-mounted displays to become as common as smartphones in time. Even though this prediction has not yet become common goods, augmented reality is growing. Almost everyone has the needed hardware needed to use augmented reality in their smartphones and that has grown the interest to develop augmented reality even more, especially for mobile platforms (Mullen, 2011). In 2015 there were depicted 1.86 billion smart phone users worldwide, and an estimated 2.71 billion users in 2019 and the number of mobile phone users in general estimated to be over five billion in 2019 (Satista, 2019).

Augmented reality can also be used with heads-up displays and head-mounted displays, like the ones seen in movies and television documentaries. The heads-up display will show extra information in the windshield of a car or an airplane (Kipper & Rampolla, 2012). Many car manufacturers, like Volvo and Toyota, have started to make these heads-up displays to show, for example, the current speed, speed limit and hazard warnings in some of their cars (Volvo, 2018, Toyota, 2018). Heads-up displays and head-mounted displays in augmented reality are usually used in military flying, but they have a lot of potential in education, healthcare and engineering as well as in remote working. For remote workers head-mounted displays could give a stronger sense of being in the work place, these workplaces are called « Augmented Virtual Environments ». (Kipper & Rampolla, 2012.)

Pattern augmented reality finds a marker or a basic shape and replaces that with another element. This is usually used to recognize users body parts such as face and hands to see where the hands are how the face is turned and lined. (Kipper & Rampolla, 2012.)

Augmented reality browsers are like internet browsers but instead they show the information in the physical world and let the user browse it. In augmented reality browsers the information is attached to certain GPS locations which allows the user to see them in the right places, but it can also use pattern recognition and outline methods to recognize the surroundings. (Kipper & Rampolla, 2012.)

Surface augmented reality uses touch responsive screens, floors and walls. Combining surface computing and augmented reality can create an environment where any surface and between surfaces can be interactive, the combination of these technologies is called spatial computing. Known technologies that use these are Lightspace and Kinect. (Kipper & Rampolla, 2012.)

Spatial augmented reality, commonly known as SAR, uses video-projectors, holograms and other technologies to display the information straight on the object. SAR does not require other displays to be carried as the technology integrates into the surrounding environment. SAR enables many

opportunities especially to designers and engineers to see and customize for example control components on a mock-up or painting or airbrushing and seeing the colors and design beforehand. It can also include interactive tools thus becoming a functional prototype without installing expensive physical components. (Kipper & Rampolla, 2012.)

2.1.2 Augmented Reality Types

Augmented reality can be displayed on many devices, like handheld devices and head-mounted displays, but it needs technologies and different components to work; like simultaneous localization and mapping and sensor data for calculating the distance to objects. Components can include cameras and sensors, processes, projectors and mirrors. It will need a monitor to show the end-product, a hardware to run the program and software to execute it. (Thinkmobile, 2018; Mullen, 2011; Kipper & Rampolla, 2012.) Augmented reality usually works with either a special marker or GPS location. Nowadays there are five types of augmented reality; markerless, marker-based, projection-based outlining and superimposition-based augmented realities. (Thinkmobiles, 2018; IGreet, 2017.)

Mullen (2011) divided augmented reality into different categories: location orientation and computer vision and marker and markerless (Mullen, 2011). Kipper and Rampolla (2012) on the other hand divided augmented reality into two categories: mobile and fixed and the functions into the augmented perception of reality and the creation of an artificial environment. Mobile augmented reality means a version where it is movable, and the user can move in almost everywhere with it. A fixed system is set up in a place and can be used only there. The augmented perception of reality gives the user the reality with enhances it. The creation of an artificial environment is imaginary and allows the user to see what is not real. (Kipper & Rampolla, 2012.)

Marker-based augmented reality has been referred to as computer vision and image recognition. It needs a special object that is scanned with the camera. The sign can be, for example, a printed QR code or another special sign. (Thinkmobiles, 2018; Mullen, 2011.) Markerless AR, also known as location-based augmented reality uses GPS, a compass, a gyroscope and an accelerometer to get data on the user's location and where the device is pointed at. The data then defines what content is shown on a certain area. (Mullen, 2011; Thinkmobiles, 2018.) According to Kipper and Rampolla (2012) the steps follow similar process whether it is marker or location-based. Marker-based augmented reality follows the physical object the marker is on and location uses grid coordinates to assign digital information. (Kipper & Rampolla, 2012.)

Projection-based augmented reality projects light to surfaces and sometimes allows interactions with it. Usually these are different kinds of holograms that are more familiar from movies. (Thinkmobiles, 2018.) Superimposition-based augmented reality replaces parts of the original view wholly or partially. It recognizes the object and is used in apps like IKEA

Catalog. (Thinkmobiles, 2018.) Outlining augmented reality looks a bit like projection-based augmented reality and it uses object recognition to find boundaries and outlines. This is used for example in car parking, engineering and architecture. (IGreet, 2017.)

Computer interfaces have come a long way to where they can offer us augmented reality interfaces. The first interfaces were arcane and foreign that had to be used on their own terms. Monitors and screens gave people real-time view of the command line, before people had to use for example binary tape and punch cards. Augmented reality can bring the information on any surface the user can see and so frees the interface from the known monitors and screens. The first big impression of augmented reality interface was made in Tom Cruise movie *Minority Report* in 2002, that had a huge gesture screen that was then seen as what future computing might look like. The gesture screen in the movie was real and was created by Oblong Industries, but they have yet to become regular appliances as spatial operating environments in for example conference rooms and meeting areas. (Kipper & Rampolla, 2012.) Interaction in augmented reality applications happens mainly on a personal level. There is usually only one person looking at the data at the same time. Interaction can also happen in different ways, they are called: tangible, collaborative, hybrid and multimodal interfaces. (Sobh & Elleithy, 2015.)

Fusing augmented reality and mobile technologies has enabled the creation of mobile augmented reality applications. The growth of mobile game industry has also helped in spreading the augmented reality games department. (Furth, 2011.) Even if games are the most seen and thought implementation for augmented reality as free games, it nowadays is a billion-dollar business and still growing. In 2013 augmented reality was predicted to bring over 2 billion USA dollars in 2016 (Mind Commerce, 2013). In 2016 the market share of augmented reality was over 6 billion USA dollars that *Pokémon GO* alone brought 950 million USA dollar revenue. Statista predicted in 2017 that the market share of augmented reality grows to over US\$ 250 billion by year 2021. (Takahashi, 2017; Statista, 2017.)

2.1.3 History of Augmented Reality

Augmented reality was developed from image processing and computer vision to marker-based technologies to newest markerless location-based systems. Augmented reality started its journey to consumers' knowledge as science fiction, like many other technologies have. The beginning of augmented reality starts as far as the early days of computer science and those thoughts made it to big screen movies like *The Terminator* in 1984 and *Robocop* in 1987. Those movies presented cyborg characters that viewed the world augmented by a stream of annotations and graphic overlays in their vision system. (Mullen, 2011.)

One of the first known examples that represented augmented reality was Morton Heilig in 1962 who designed *Sensorama*, a motorcycle simulator

(Kipper & Rampolla, 2012). The first known system that was called augmented reality was Ivan Sutherland's *The Sword of Damocles* in 1968, that used a head-mounted display and six degrees-of-freedom trackers (Arth et al., 2015). Muro Krueger, who invented *Videoplace* in 1975, is considered one of the original pioneers of virtual reality and interactive art created using augmented reality system (Kipper & Rampolla, 2012). The term augmented reality was developed in 1992 by Tom Caudell and David Mizell (Arth et al., 2015).

The first cultural development for augmented reality was in 1994 by Julie Martin who produced the first ever augmented reality theater production (Mullen, 2011). Milgram and Kishino (1994) defined the reality-virtuality continuum. In 1996 Rekimoto developed *NaviCam* and advanced the idea of a 2D matrix marker. Ronald Azuma defined the three characteristics for augmented reality in 1997: it combines real and virtual, it is interactive in real-time and it is registered in 3D (Azuma, 1997). In 1999 Total Immersion was founded as the first augmented reality solutions provider. In the same year Kato released the *ARToolKit* to open source community allowing and enabling others to create their own augmented realities and Holler, Feiner and Pavlik created the first wearable augmented reality system. (Kipper & Rampolla, 2012.)

In the 21st century, augmented reality games started to come. *AR-Quake* by Bruce Thomas and *Battlefield Augmented Reality System*, known as *BARS*, by Simon Julier et al. were created in 2000. The first touch to mobile multi-user augmented reality systems came as early as in 2001 by Reitmayr and Schmalstieg. The first augmented reality Browser was developed by Kooper and MacIntyre in 2001 that acted as an augmented reality interface to the internet. In 2004 came the first system for tracing 3D markers on mobile phones. This system, created by Mathias Möhring, was the first video see-through augmented reality system on a mobile phone. (Arth et al., 2015; Kipper & Rampolla, 2012.) The *Invisible Train* was the first multi-user augmented reality application for handheld devices. The *ARToolKit* by Anders Henrysson came in 2005 and it enabled others to become augmented reality designers as well. (Arth et al., 2015.) The Finnish Nokia initiated a project called "the Mobile Augmented Reality Applications in 2006", where they created an augmented reality guidance application using multi-sensor functions in mobile phones. In 2008 and 2009 came new applications that used GPS and compass data for registration. (Kipper & Rampolla, 2012.)

The development of augmented reality began to fully emerge and flourish with smart phones. Before smartphones the users lacked the needed hardware and thus leaving the developers with fewer possible users. (Mullen, 2011.) After 2009 research and development on augmented reality has had high expectations and huge investments. The advances in mobile device capabilities have given a strong drive and a possibility for augmented reality solutions. (Arth et al., 2015.)

Augmented reality was already used in advertising by companies such as car companies and Lego in 2012 (Kipper & Rampolla, 2012). In 2010 Lego created a pioneering point-of-sale augmented reality marketing campaign. They

set up computer screens in toy stores that sold Legos where the customers could show the Lego box to the screen and see what the completed set would look like. (Mullen, 2011.) Major companies begin to acquire and invest in technology companies that are focused on augmented reality and virtual reality and technologies around them, for example Apple Inc acquired PrimeSense and Facebook purchased Oculus VR (Arth et al., 2015).

2.1.4 Challenges in Augmented Reality

Augmented reality has faced many challenges and problems on the way. With the older models of augmented reality, the need to address others and their opinions of the users wasn't really a problem. A game called Ingress got players up and outside. To play the game, the user needs to point the mobile phone to different places like a tourist taking pictures, it was from the same company, Niantic, as Pokémon GO. When Ingress came, most people weren't familiar with the game and many players got looks of disdain from other people. The game also needed higher data speeds to work properly. (Mind Commerce Staff, 2013.) As the newest addition to this, Pokémon GO has now superseded these thoughts getting masses to play at the same time.

The data speeds have increased enormously from the establishment of Ingress. When Pokémon GO was published the data speeds and the hardware requirements had evolved a lot. The problem was not with data speeds or the user's hardware, but with the huge popularity the game gained in the start. The developers hadn't prepared for such a huge success and the game suffered from this as the servers couldn't handle the massive amounts of players. This problem occurred every time the game was released in a new country. These problems are usually temporary as the developers commonly increase their servers and the user population steadies in time after the initial popularity.

Bhutta et al. (2015) divided the challenges and limitations of augmented reality to social acceptance -, technical -, visualization -, tracking -, recognition -, UX -, privacy -, registration -, performance and mobility challenges, portability and outdoor use, environmental issues and usefulness. They raise technical issues of poor battery life, camera quality and sensor accuracy. Visualization, tracking, environmental, performance and portability all contain mostly technological problems with the camera and the ability to perform all the needed aspects well enough. They focus on other technologies more on augmented reality technologies, like Google glasses, than cellphones that can run augmented reality. (Bhutta et al., 2015.)

Augmented reality faces both technological and ethical problems. Different sites have collected lists that they think are the biggest challenges in augmented reality. Scientific research papers found on the challenges of augmented reality contain mostly technical problems. However, the technical problems are debatable, modern luxury smartphones already have advanced technology including multi-core CPUs and dedicated GPUs and a variety of sensors. The problems that have been pointed out for hardware are so forth

mostly more for advanced technologies for augmented reality and not for the everyday mobile device users. (Shea et al., 2017.) Online lists made after the Pokémon GO game was published, made by companies and experts, are more concerned about ethical problems than technological problems. Privacy, security and anonymity were included in most lists. These contained concerns of users' own judgment and cybercriminals. There was also a concern for the locations of augmented reality, the contents of it and distinguishing real from augmented. (McEnvoy, 2017; New Generation Applications, 2018; Banister & Hertel, 2018; Roesner, 2017.)

3 EXERGAMES AND HEALTH BENEFITS OF POKÉMON GO

This chapter will overview games that use exercise and the possible benefits that can be obtained from them. The first section will go over exergaming, the next chapter presents Pokémon GO as an example game. After that will come physical health benefits, games social connectedness and social anxiousness. The last three sections are concentrated on the benefits that Pokémon GO has generated and research based on that.

3.1 Exergame

Exergaming is a form of digital gaming that requires aerobic physical effort. It exceeds sedentary activity level and includes strength- balance-, or flexibility-related activities from the player. These aerobic physical efforts determine the outcome of the game for the player. (Kari & Makkonen, 2014.) Exergaming can have positive impacts, exergaming can reduce sedentary behavior and increase social well-being (Kari, 2017). Physical activity and exercise are two different things and usually researchers in other than health sector fail to define what they mean with exercise. Physical activity is defined as any activity that can be done, it can be active and sedentary, like walking, doing dishes and sleeping. (Oh & Yang, 2010.) It is “any bodily movement produced by skeletal muscles that requires energy expenditure” (WHO, 2018b). Exercise on the other hand is planned, structured, repetitive and purposeful and used to improve or maintenance physical fitness. Exercise is a subcategory to physical activity. (WHO, 2018b.) Cooperative exergames produce a higher motivation to play the game than competitive exergames. Cooperative exergames hold possibilities in engaging sedentary people in physical activity. (Staiano, Abraham & Calvert, 2012.) Because of these previous definition confusions of exergames, it has then been defined more precisely as aerobic physical efforts. This means that

exergaming is a game, that requires the player to exceed sedentary activity level. (Kari & Makkonen, 2014.)

Long-term engagement in exergames seems to be hard to achieve, and it has a lot of reservation from parents, teachers and caregivers that hindrance possible users and positive outcomes. Exergames have also been found to need customized experiences for different fitness level users to achieve better results. (Benzing & Schmidt, 2018; Höchsmann et al. 2017.) The long-term usage weakness in exergames is mostly due to lack in variety in the current available exergames. The players stop playing the game when they get bored, to get players to be more interested in the games they need to develop new features and continue the storyline to be more interesting. Exergames can also replace traditional physical exercise, which is a big threat if the exergame does not offer similar or higher intensity exercise. Exergames also increase screen time and many people have fears of exergames negative effects on health. (Benzing & Schmidt, 2018.) Exergames need more research to show what kind of benefits they can really offer and how the possible threats and weaknesses could be conquered.

Active video games, also known as exergames can facilitate light- to moderate-intensity physical activity promotion. Playing exergames heart rate, oxygen consumption and energy expenditure significantly increase from resting. (Peng, Lin & Crouse, 2011.) Exergaming includes physical activity and is also cognitively engaging this improves users' cognitive function. (Best, 2013.) Exergames have also been reported to increase users' reaction time, coordination and mathematical skills (Burgess Watson, Adams, Azevedo, & Haighton, 2016). Exergames have many strengths. They can increase the motivation and enjoyment of physical activities, it can reach specific populations, it is adaptive, specific and scalable. Exergames have opportunities to increase health with physical activity, it can be used as a therapeutic tool, it can help implicit and explicit learning and promote neuroplasticity. It could also include video game characteristics to enhance potential benefits and increase adherence. Exergames have been thought to be used to get young and sedentary people to move more, but because developing and tailoring the games to be attractive to certain target audiences, it would be economically better to be applied commercially, but this needs more collaboration between science and industry. (Benzing & Schmidt, 2018.) Exergaming can meet the intensity levels of exertion set by the U.S. Department of Health and Human Services. Kari (2014) found the typical levels of exertion provided by exergames are light-to-moderate with children and young adults, but less for the elderly. The exertion can vary between players, demographics, gaming intensity and skill level and game types. Kari's (2014) research also concluded that although exergaming can be an enjoyable activity it does not support long-term benefits for physical fitness and little for physical activity. (Kari, 2014.) Exergaming is more popular among children and young adults. Exergames interest younger people and the number of players diminishes as the age segment grows. (Kari, Makkonen, Moilanen, & Frank, 2012a.) In Kari, Makkonen, Moilanen & Frank's

(2012b) research exergaming was slightly more common among women and young men, but the dependency between gender and the playing of exergames was not statistically significant. (Kari et al., 2012b.)

Exergames have been around for a longtime, an exergame can be a video game or a mobile game. Most mobile exergames are also augmented reality games. Dance Revolution was the first major exergame from 1999, Nintendo Wii Fit from 2007 and Xbox Kinect from 2009 (Ranker, 2019). The most popular mobile exergames, that are also described as augmented reality exergames, are Jurassic World Alive, Ingress and Pokémon GO and the newest member of the genre The Walking Dead: Our World (Jurassic world alive, 2019; The walking dead: Our world, 2019). Other popular mobile exergames are Zombie's Run and Geocaching (Zombies run game, 2019; Geocaching, 2019). Harry Potter: Wizards Unite and a normal exergame Run an Empire are the upcoming games that are still waiting to come (Run an empire, 2019; Harry Potter; Wizards unite, 2019). Many exergames, like Pokémon GO, don't brandish themselves as exergames because they are designed as entertainment games and the exertion is just a part of the games' mechanics.

3.2 Pokémon GO

Pokémon GO is a mobile game that was established in 2016. The idea was to bring the Pokémon world to our world using augmented reality. The game was developed by Niantic that is known for their other games that use location based augmented reality. The game favors groups and playing together with others through raids and assignments. The game also encourages physical activity without being obvious. (Pokémon GO, 2018.) Pokémon GO has not only been a success in moving people, but financially as well. The app generated over \$1 billion in revenue in the first year, being the fastest app ever to cross that mark. In 2018 the game had already been downloaded over 800 million times. (Niantic Labs, 2018.)

Pokémon is short for pocket monster, they are creatures that live in their own universe like ours alongside humans and in the wild. Currently the Pokémon world inhabits over 800 different Pokémon's. Pokémon was created by Satoshi Tajiri as a hobby, but they are currently owned by Game Freak, Nintendo and Creatures. (Pokémon GO, 2018; Hilliard, 2018.) The first Pokémon games were Pokémon Red and Pokémon Green that were released on Nintendo's handheld console Game Boy in 1996. The first trading cards came later in the same year. (Frank, 2016.) The Pokémon television series started in 1997 and has currently twenty-one seasons, almost every season has its own movie as well that features that generations special legendary Pokémon's (IMDb, 2018).

Pokémon GO has also generated some unwanted effects. The game has been used to scam and exploit other players. Players' phones and money has been robbed, and they have been misguided to false locations. Some people

have also got malicious malware from downloading illegal copies and participating in scams. The game could also be used to find other people and their locations and so on put them at risk. In United States of America people have also been concerned about wandering to crime high places while playing and police racial bias while playing and wandering around. Pokémon GO as well as any other game might also interfere with normal life, like causing conflicts, spending too much money on the game and neglecting school, work or sleep. (Labrique et al., 2016.) Dordard et al. (2016) listed main findings in their research; inappropriate ways of playing, not paying attention to surroundings, negative environmental impacts, reinforcement of utilitarian and exploitative relations between human and nonhuman nature and distraction from real species and their problems. The inappropriate ways to play include driving a car while playing, which got 100 000 Twitter tweets in ten days and many reported car accidents. It also includes not paying attention to surroundings, distracting oneself can cause harm to the player and to others around. Players have also been reported trespassing and placing themselves in dangerous situations. (Wagner-Greene, Wotring, Castor, Kruger, & Dake, 2016.) The game might also encourage people to capture real life animals and fight them against each other and get their attention only on virtual creatures they can see and not the endangered species on far-away countries that need real help. (Dordard et al., 2016.) However, research has shown that these negative incidents are particularly rare and are mostly speculations of possible scenarios (Kari, 2016).

However, despite the few negative perspectives of Pokémon GO, there have been a lot of research proving that the game generates more positive effects than negative in users physical and mental health. Pokémon GO can generate many kinds of behavioral change, not just on physical activity or social behavior. These changes are more multifaceted, the players found their routines more meaningful, express more positive emotions and got motivation to explore. (Kari, Arjoranta & Salo, 2017.) The next sections will go deeper into the benefits Pokémon GO generates from physical health benefits, social connectedness and social anxiousness.

3.2.1 Physical health benefits

Physical activity increases positively well-being and with healthier food it also helps prevent overweightness. In 2016 there were over 1.9 billion adults that were overweight, meaning almost 40% of the world adult population. The increase in overweight people is mainly due to a more sedentary nature of living. Giving people good choices and encouraging them to move more helps them to help themselves. (WHO, 2018c.) Getting people outside to socialize and being physically active is hard to do. The best results come when the motivation to do so comes from the individual themselves. (Labrique et al., 2016; Wong, 2017).

Adults (ages 18 to 64) need to have at least 150 minutes of briskly or 75 minutes of strenuous physical activity weekly to better their endurance and health (UKK instituutti, 2018). This should also include muscle-strengthening activities at least twice a week. To gain additional health benefits it should be increased to 300 minutes a week. Globally every fourth adult is not active enough. Children of ages 5 to 17 should have physical activity at least 60 minutes daily and need muscle and bone strengthening activities at least three times a week. (WHO, 2018a; WHO, 2018d; UKK instituutti, 2018.)

Health and fitness apps usually attract the already active population. Pokémon GO seems to be attract users that get less than the average activity. The average daily step increase was 1473. The step amount was connected to the users' interest in the game. (Althoff et al., 2016.) None of the found studies had found significant differences across genders, ages, BMI levels and prior activity levels in relation to the increase in physical activity (Althoff et al., 2016; Howe, 2016; Kogan et al., 2017).

Sixty-four percent of the players in Kogan et al. (2017) study felt that the game increased their physical activity. The game got player's outside that would normally stay indoors and wouldn't walk or jog much (Wong, 2017).

The recommended physical activities require brisk or jogging and slow walking cannot replace it. Getting sedentary people to walk and outside is a start to an active lifestyle, even though it might not be enough to reach physical activity recommendations, it is a good start and better than nothing. (UKK, 2018; Wong 2017.) The nontraditional game-based interventions seem to be better approaches in reaching the low activity level people (Althoff et al., 2016). Commercial games that are disguised as health apps seem to attract sedentary people and reach long-term adoption than traditional health and activity apps (Labrique et al., 2016).

Pokémon GO's effect on physical activity dropped over time and was linked to game enjoyment (Kogan et al., 2017). In Howe et al. (2016) study the players' daily steps had gone to their original levels after six weeks. This suggests that the game needs to present new features and keep the users' interest in the game for the positive effects to have a longtime effect. Another way is to get more games like it for users to use, not everyone likes Pokémon and might be interested in something else. Other likewise games are Ingress, Jurassic World Alive, The Walking Dead: Our World and Harry Potter: Wizards Unite (Pottermore, 2017; Webster, 2018).

Promoting outdoor time and increasing physical activity effects positively on other aspects in health too. These are for example increased Vitamin D levels, strengthened immune system, lower stress levels and reduced attention deficit hyperactivity disorder symptoms. (Labrique et al., 2016.) Physical activity has significant health benefits, it lowers the risk of noncommunicable diseases and increases overall mental health. It also has an impact on feelings of loneliness and social connectedness. (New Cig, 2018; Umberson & Montez, 2010; WHO, 2018.) Games that can attract people to certain locations or outside in general have also the ability for negative health aspects. Depending on the locations

they can encourage people to spend time in for example fast-food restaurants. These decisions are for the game companies who make contracts with different partners to advertise their businesses, and so they could promote healthier life choices. (Labrique et al., 2016.)

User's had collectively walked over 4.6 billion kilometers while playing in the two first months of the game. In 2017 the amount had grown up to 15.8 billion kilometers that is about the same as the distance from Earth to the edge of our solar system. In 2018 the walked amount by players was in tens of billions of kilometers. (Niantic Labs, 2018; Wolchover, 2011.) Kari (2016) found out that 46.4% of critical incidents that had been reported, happened when the game was played for both fun and exercise. This shows Pokémon GO's and other augmented reality games can make exercise more fun and enjoyable. (Kari, 2016.)

3.2.2 Games social connectedness

Feelings of loneliness can be decreased with social connectedness. Loneliness can be a feeling of loneliness, living alone or social isolation (Holt-Lunstad, Smith, Baker, Harris, & Stephenson, 2015). Almost half (43%) of elderly people have reported feeling lonely (Perissinotto, Stijacic Cenzer & Covinsky, 2012). Recent studies show that a third (32%) of university students globally admit to feelings of loneliness and almost half (42%) have considered dropping out due to physical or mental health issues (Sodexo, 2017). A recent study shows adults ages 18-22 are the loneliest generation of all. Loneliness produces many unwanted health risks, it for example decreases productivity and vitality, which means disconnection between mind and body. (Cigna, 2018.) Loneliness can be compared to heavy smoking and alcoholism, and the lack of social relationships has a greater risk of premature mortality than obesity (Holt-Lunstad et al., 2015).

Loneliness has deep relations to a person's physical, mental and social health. Balance is critical between sleep, work, socializing and "me time" to lower loneliness. Having the right amount of physical activity or more gives a higher change of feeling part of a group, having a lot in common with others and of finding companionship when wanted. People who have less than desired, are more likely to feelings of loneliness. (Cigna, 2018.) Social relationships have both negative and positive effects, but lack of social ties has greater negative effects. Reducing social isolation and increasing social relationships have a positive impact on public health and should be promoted and taken into consideration in decision-making. Social ties can be used as a prevention to loneliness and premature mortality. (Umberson & Montez, 2010.)

Games can provide environments for social connectedness with either the online community or other players in real life. Online communities are formed in multiplayer games online and they can also be formed in the games' forums and websites outside the game. Social connectedness and a sense of belonging can also be formed with other player's even if the game is not a multiplayer game. For example, in Pokémon GO the game itself is one player game with

social connection features and multiplayer choices. In Pokémon GO the sense of belonging can come from the online forums or with other players they meet face-to-face. Research have shown that Pokémon GO gives the players a sense of belonging to both places and other players, strengthened ties with family and friends, changes on how they spent the time with them and acting as an ice breaker for social situations (Vella et al., 2017).

Shared passion for the game was mentioned as one of the key elements to play and to play with family and friends (Vella et al., 2017; Althoff et al., 2016). The passion could be from nostalgia or from recommendations from others, usually family members or friends.

The game developers have different ways to enable social connectedness and how to encourage it. The game developers might have thought of these effects on the game to happen or have deliberately made it to encourage it. For example, in Pokémon GO the game encourages players to play outside, accessibility and to integrate it to everyday life. The game offers players a means to care for their relationships by providing new settings where to play the game (Vella et al., 2017). The game is free to use, and many people already have the means to play it by owning a smartphone or other device that can run the application. The game mechanics also help people to play the game as the game itself is easy to use, even if the person is not familiar with games from before. This has given different generations a possibility to play the game together and a way to strengthen their relationships even more. The game can be played by either in gaps or full time, this means that people don't necessarily have to give up their other activities and integrate the game to those they do (Vella et al., 2017). It can also give them a new way to spent time together outside.

Ethnically playing outside is much appreciated and encouraged in the western countries, because it is seen as healthy behavior. The game supports playing outside with lures to get people to same places together. These outcomes rely heavily on the game mechanics and the effects wouldn't be so systematic if it the game wasn't accessible enough. (Vella et al., 2017.)

Pokémon GO act's as an icebreaker between strangers (Vella et al., 2017). The game is acting as a bridge between players giving them a common conversation topic. It can help people to overcome social anxiety and learn to converse with strangers. It also gives the players a way to connect even if they have never met before as the game often requires team work for example in raids.

Social interaction is an important motivation in gaming, but getting new friends is different than interacting with the existing ones. Pokémon GO improves well-being by giving an opportunity to maintain old friendships. Yang and Liu (2017) found out that the motive of relationship initiation was associated with both higher bridging social capital and higher loneliness. This could mean that lonely players are more motivated to get new friends through the game. (Yang and Liu, 2017.) The more the users' play the game the more

likely they are to initiate friendships and strengthen existing friendships (Bonus et al., 2018).

3.2.3 Social anxiousness

Social anxiousness can be hard to overcome and the means to help those who suffer of it are limited. One of the good ways to overcome social anxiousness is to get the initiation from the person himself. Even though Pokémon GO game has a public nature as it has physical world face-to-face interactions that many other games don't have, playing the game is not predicted by users' levels of social anxiety (Bonus et al., 2018; Labrique et al., 2016). Vella et al. (2017) found out that Pokémon GO led to different situations and opportunities where players could overcome barriers to other players. The research found out that the opportunity to get new friendships was not the reason for socially anxious people to go out to play, but the passion for the game that got them to different social places. In some countries the authorities have also noticed the affect Pokémon GO has had on social anxious people and got them to go outside and have had improvements also in depression through promoted physical activity (Tateno, Skokauskas, Kato, Teo & Guerrero, 2016).

When physical exercise makes the heartrate rise, and it triggers the body's flight-or-fight instinct, the brain releases chemicals called brain-derived neutronic factor and endorphins. These chemicals are made to facilitate peak performance and help the body, but they also induce feelings of well-being. (Withney, 2012.) Physical exercise helps diminish anxiety and depression in almost every cause. The exercise gives a boost to energy, the brain-derived neutronic factor gives clarity that helps with mental sharpness and decision-making and endorphins give feelings of euphoria improving the mood. (Tartakovsky, 2015.) Exercise helps with almost every mental health problem but motivating a depressed person to exercise is the problem. Rarely any specifically developed mood-altering apps catch on with the patients, and the best ones seem to be developed by accident, like Pokémon GO. (Grohol, 2016.) The best way seems to be to forget 'exercise' and think instead of 'fun' and 'being active' (Tartakovsky, 2015). Tateno et al. (2016) found out that passion was the driving force to get anxious people to play, that way they were not thinking about going out as exercise or talking to people but motivated themselves by having fun.

In research by Bonus et al. (2018) the new positive and happy memories from the game can relate to shifts in well-being. The research also pointed out that the gameplay was associated with reduced nostalgic regret, which was high among socially anxious players, that suggests that these positive gameplay experiences might help them to reduce reflecting past negatively and help them with social anxiety also in long-term.

Augmented reality and virtual reality have been used to treat anxiousness and phobias but most of these are to get the person to confront their fear and expose them in a controlled and safe environment (Acar, Miman & Akirmak,

2014). These treatments require a lot of motivation from the patient and getting the patient find the motivation is hard. If the person can find the motivation themselves, it is much more effective and better than forcing them outside or to confront their fears.

4 RESEARCH METHODOLOGY

This chapter presents the research methodology used in this study. First it goes through the research questions, then data gathering method and data analysis of the survey for the quantitative research.

4.1 Research objectives and research questions

The purpose of this study is to examine how augmented reality games can improve social health and uses Pokémon GO game as a case. The research objective was to study Finnish Pokémon GO players a year after the game release and learn how much they think the game effects on a social level and how much they have walked since starting to play. The empirical part of the study is executed as a quantitative research and the research questions for it were:

1. What health benefits does Pokémon GO generate?
2. What are Finnish Pokémon GO players' social playing habits?
3. Are there gender differences in Pokémon GO's Finnish players social playing habits?

4.2 Research methods

This research's methodological approach is an exploratory study, meaning that no prior hypotheses are presented. The study was conducted as a quantitative study. The quantitative analysis was based on data from a survey made for this study. The research method was decided on quantitative research and the research was decided to be implemented as a survey that was compiled to support quantitative analysis. An online survey method was decided to reach a wide audience (Heikkilä, 2014).

The literature search was conducted through several databases to get better and wider results. The main research papers were looked up using Google Scholar, AIS eLibrary and IEEE Xplore library. Additionally, sources were searched from the studies bibliographies. The main search terms used were: “augmented reality”, “Pokémon GO health benefits” and “games health benefits”. From the found articles the most cited ones were preferred. However, as some topics in this study have not been widely studied yet, many articles and websites have been used, for example, for comparison and different perspectives. The search was limited to more recent studies of augmented reality, excluding few sources. The studies of health benefits of Pokémon GO were newer by default as the game launched in 2016 and there was no previous research in that topic before that.

The purpose of this study was to explore Finnish players habits in playing Pokémon GO and get a good overall view of their physical activity and social playing habits. Because of this, the research was decided to be quantitative research. A quantitative study gives an overall picture of the correlations and differences between variables. Its purpose is not to find out why or how something happens, but to answer questions of “how many”, “how much” and “how often”. (Vilkka, 2007.) The questions in the online survey strove to find answers to the research questions.

The empirical part’s quantitative study was implemented with an online survey with multi-option answers. The survey contained eleven questions, and it was directed to Finnish Pokémon GO players. The survey was shared on Pokémon GO community Finnish Facebook group to target a bigger audience of different style players. The online survey was executed as an online questionnaire. A questionnaire should be clear and easy to use and fill out, it should be short and no longer than 15 to 20 minutes long. A questionnaire can hold for example multiple-choice questions, lists where the respondent chooses their favorites or lists them in order of importance. (KvantiMOTV, 2010.)

4.2.1 Data collection method and analysis

To collect the data, an online survey in Finnish was conducted to reach Finnish audience. The data collection took place in July 2017. The survey was created with Google Forms survey tool. The survey contained eleven questions, and it explained the purpose of the study and the survey was open for two weeks. The survey was designed to be short and simple to gain more answers to get a better overview of the players habits. Two questions were added as extra questions after the survey was released due to responders’ suggestions. The respondents were not given any rewards for participating in the survey and the responding took place anonymously.

The aim of the study was to get an overview of Finnish players habits, so the target group was selected to be Finnish players. Defining the target group to Pokémon GO players was needed because the questions were designed to answer players’ thoughts. The Pokémon GO Finland -Facebook group was

selected to share the survey as it is the biggest common social platform for Pokémon GO players in Finland without the restrictions of living area. The purpose was to reach players from both rural and urban areas. The survey was implemented in Finnish and meant for people with experience in Pokémon GO. The survey was based on eleven questions without open answer questions. The responders had a possibility to give feedback and share their thoughts on the comment section on the Facebook page where the link for the survey was.

The questions in the online survey were multiple-choice questions. The respondent would choose an answer that they felt best described them. Ten out of eleven questions were closed structured questions and the first question was a mixed question with both given options and an option to write their own gender. The first questions answers were then transformed into “woman”, “man” and “other” so that they were usable in the analysis.

1. What is your gender?
2. What age segment do you belong to?

3. Why do you play Pokémon GO?
4. How often do you play Pokémon GO?
5. Do you play alone or with others?

6. Have you moved more with the game than before it?
7. How many kilometers have you collected?

8. Did you start playing on your own or by someone’s recommendation?
9. Have you recruited others to play the game?
10. Do you like the Pokémon GO community?
11. Would you recommend the game to others?

The data was analyzed, and a chi-square test was performed for most of the questions to study the relationship between genders. All the statistical chi-square tests used in this research use an alpha level of .05. A chi-square test is used for testing relationships between variables. The test includes a null hypothesis which implies that the two categories are independent. It evaluates the test of independence when using a cross tabulation. (Statistics Solutions, 2019.) All the questions were also analyzed by percentages to find out how the respondents divided.

5 RESULTS

The gender distribution of this sample was more towards females as 72% (n 595) of the respondents were female and only 26% (n 218) being male, the rest two percent were other or didn't want to answer (n 20). The altogether responds were 833, the distribution can be seen in the figure 1. The two questions that were added later to the study received fewer answers. The question of why they play the game received 316 answers of whom 83 were men, 222 women and 5 who chose "other" as a gender. The second question that was later added was the walked amount with the game, it got 583 answers of which 150 were men, 417 women and "others" 16.

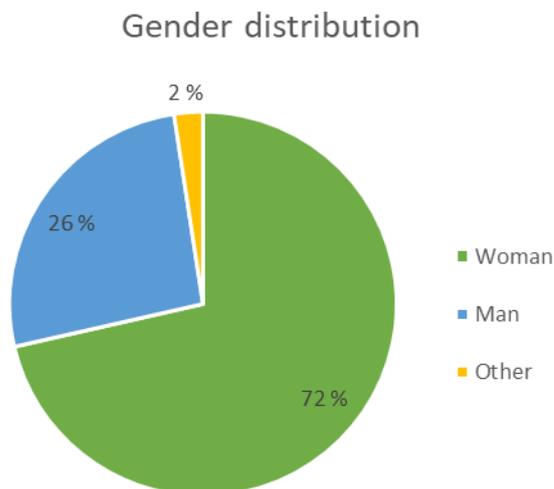


FIGURE 1 Gender distribution between Finnish Pokémon GO players

The age distribution in the survey was balanced between three major portions. 36% of the respondents were 16 - 25 years old and 32% were 26 - 35 years old. 36 - 50 years old respondents were 22% of the total and 51 years and older were 6 percent. 15 years and under were only 5% of the respondents. The pie figure of the distribution can be seen below (figure 2).

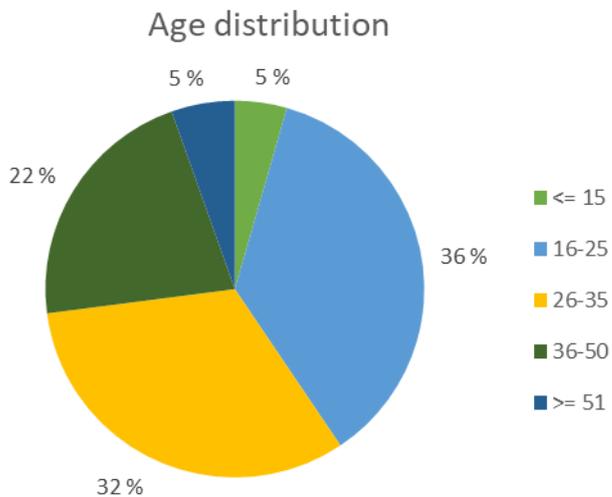


FIGURE 2 Age distribution between Finnish Pokémon GO players

The age distribution between genders shows that there are significant differences in player's ages depending on their gender (figure 3). The null hypothesis is that gender and player's age are independent. The chi-square test of independence was performed to examine the relationships between gender and player's age. In this test were women (n 595) and men (218). The relationship between gender and age was significant, $X^2(4) = 25,29$; $p < 0,001$. The null hypothesis is thus rejected, and it can be concluded that there is a relationship between gender and player's age. The player population of men constructs more of young players (under 25 years old) than in women and women players are more often young adults to middle ages than men.

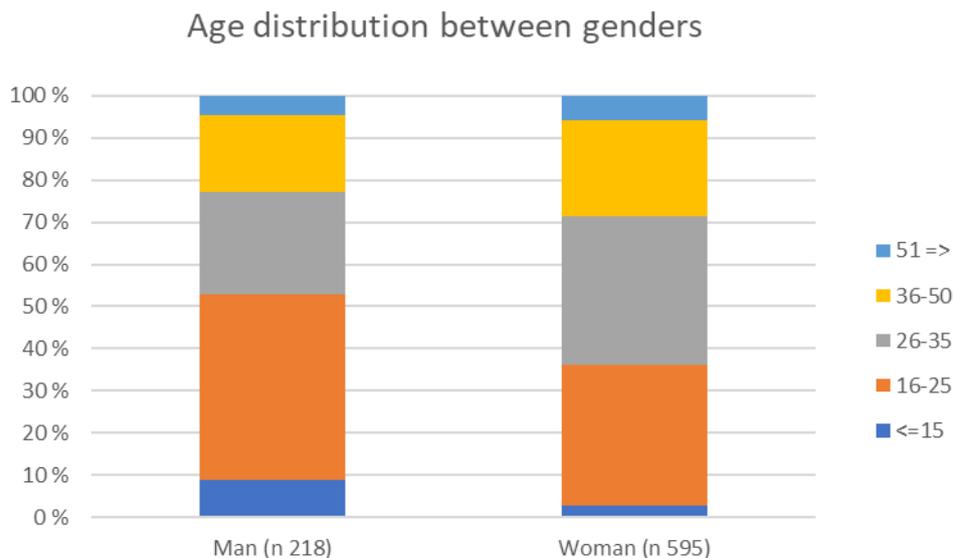


FIGURE 3 Relationship between gender and age

One question was about users' reason for playing Pokémon GO. 7% reported playing it for both physical activity and the game itself. Only two percent play the game for the physical activity aspect and not fun. 27% play the game for fun. 316 players responded to this question, this can be seen in figure 4. 316 people responded to this question. The reason to play between genders was examined with a chi-square test of independence to see if there was a relationship between genders. In this test were women (n 222) and men (83). The null hypothesis is that gender and reason to play are independent. The relationship between gender and reason was not significant, $\chi^2(4) = 3,55$; $p=0,497$. The null hypothesis is accepted, there is no significant relationship of gender and reasons for playing.

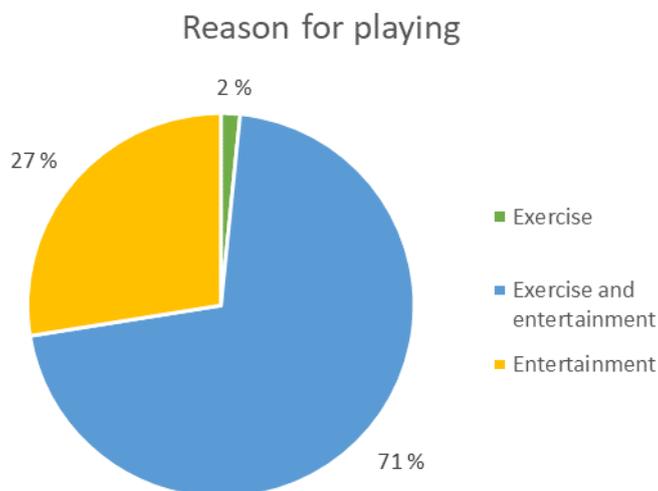


FIGURE 4 Reason for playing Pokémon GO

76% of the respondents reported playing the game daily. Weekly players were 17% of the respondents. Only two percent said they play the game sometimes and other two percent play the game very rarely. The distribution can be seen in figure 5. The frequency to play between genders was examined with chi-square test of independence to see if there was a relationship between genders. The null hypothesis is that gender and gameplay frequency are independent. In this test were women (n 595) and men (218). The relationship between gender and gameplay frequency is not significant, $\chi^2(4) = 7,33$; $p=0,119$. The null hypothesis is accepted, there is no significant relationship of gender and gameplay frequency. Gameplay frequency does not vary between genders.

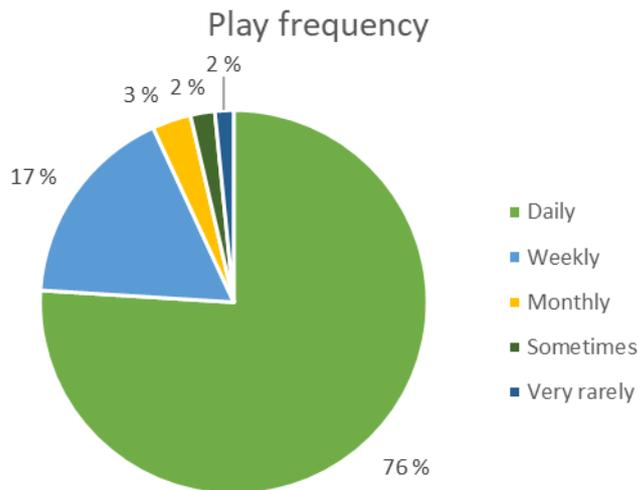


FIGURE 5 Pokémon GO gameplay frequency

Pokémon GO game is a game many people play together with others (Kari, 2016), it has been connected to strengthen social connections and form new ways to spent time together. In this study, only ten percent reported to always playing alone, see figure 6. 38% of the respondents reported to rarely play with others. Four percent reported to always play with others, and 18% said they often play with others. Almost a third of respondents (30%) play the game sometimes with others.

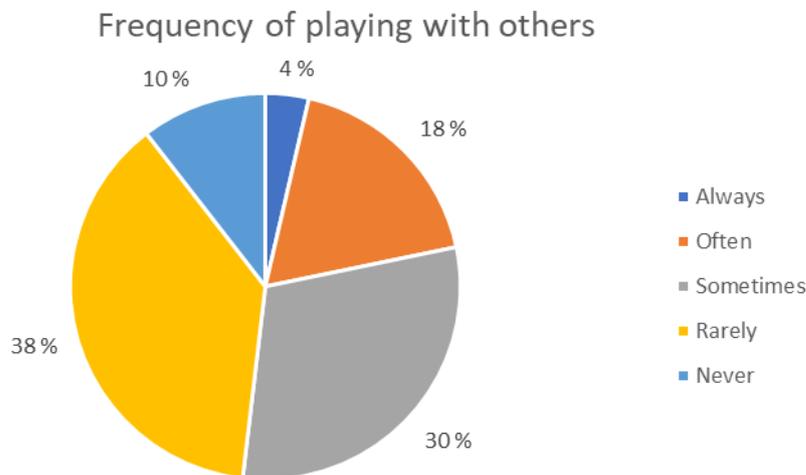


FIGURE 6 Frequency of playing Pokémon GO with other

The frequency to play with others between genders was examined with chi-square test of independence to see if there was a relationship between genders. The null hypothesis is that gender and social playing habits are independent. In this test were women (n 585) and men (218). The relationship between gender and social playing habits was not significant, $\chi^2(4) = 6,11$; $p=0,191$. The null hypothesis is accepted, there is no significant relationship of gender and social playing habits. There are around ten percents of both male

and female players who play the game always alone. The other playing habits are also very similar between genders and the gender does not significantly affect the social playing habits. This can be seen in figure 7.

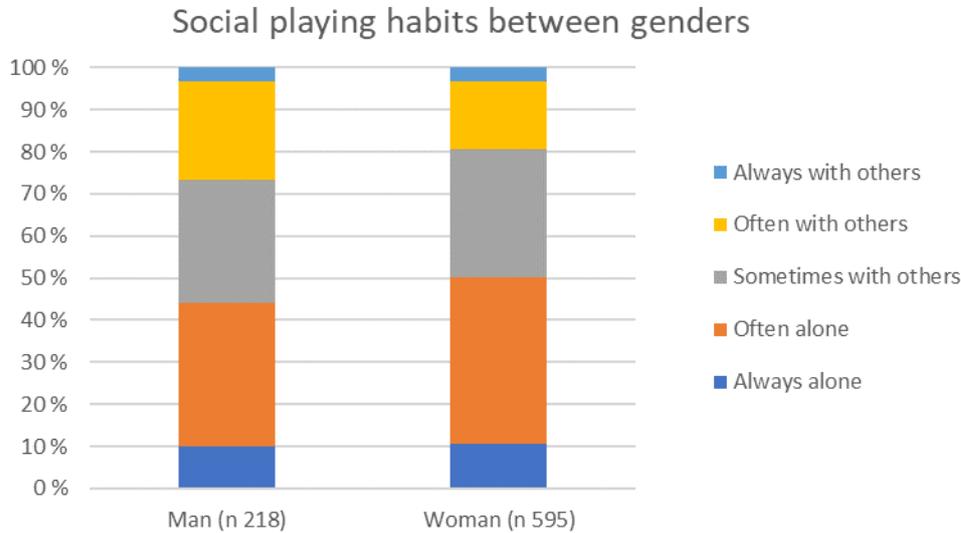


FIGURE 7 Pokémon GO users' frequency of playing with others between genders

Many researches have studied how the game has increased players physical activity levels. The studies have shown that the physical activity level usually decreases back to the original in a month (i.e. Kogan et al., 2017; Howe et al., 2016.) In this study 6% said that the game had not increased their physical activity, 24% felt it had slightly increased and 35% thought that it had increased. 23% in the study felt that the game had increased their physical activity level significantly and 12% thought that the game had increased it a lot. This can be seen in figure 8.

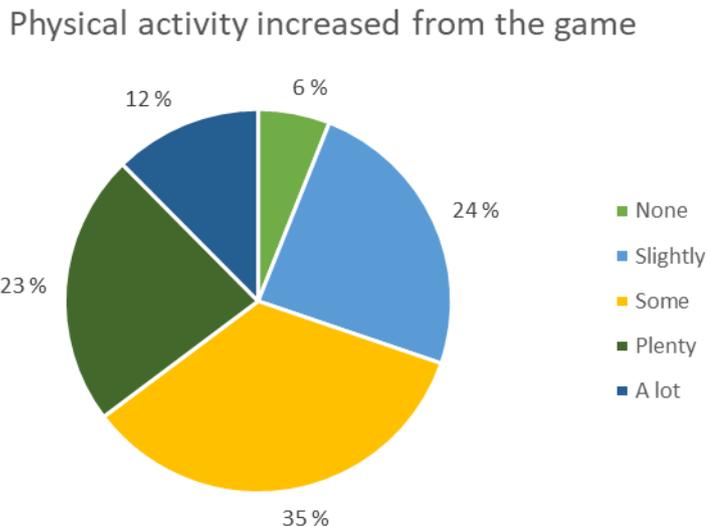


FIGURE 8 How the user felt their physical activity level increased from the Pokémon GO game

The increase of physical activity between genders was examined with chi-square test of independence to see if there was a relationship between genders. The null hypothesis is that gender and increase of physical activity are independent. In this test were women (n 585) and men (218). The relationship between gender and increase of physical activity was significant, $X^2(4) = 0,014$; $p=0,014$. The null hypothesis is rejected, there is a significant relationship between gender and the increase in physical activity. This can be seen in figure 9. From this it seems that men are more likely to be on extreme levels than women. Men are more likely to not gain physical activity after starting the game, but they are also more likely to increase it enormously than women. Women seem to be more likely to gain moderate amount of physical activity increase. Men seem to be more equally divided in different levels of physical activity increase than women.

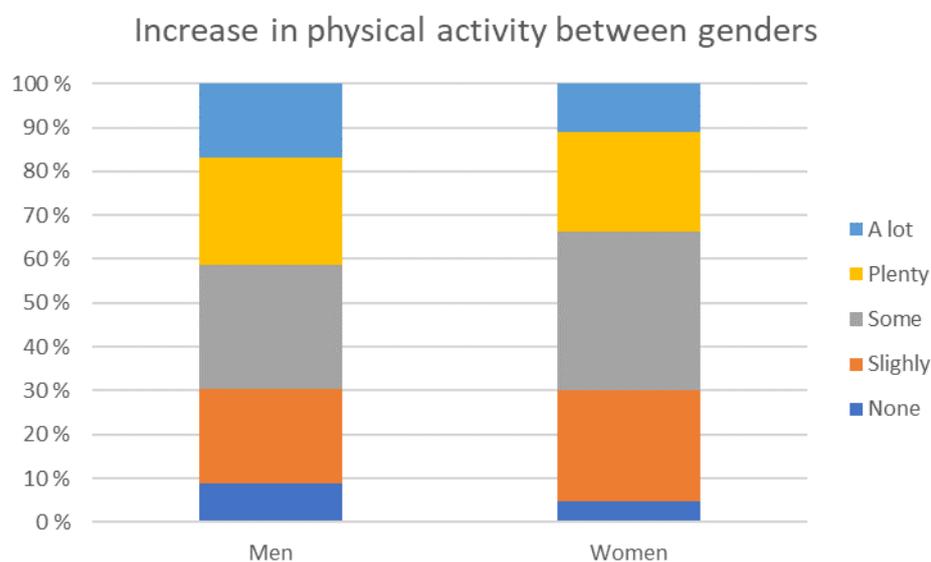


FIGURE 9 Increase in physical activity due to Pokémon GO between genders

The survey did not include a question of responders' game play time so far or when they had started the game. There were few people who have not walked at all with the game or have walked only slightly. This can be due to for example them just starting the game or playing the game without walking. Many players had already achieved over 3000km in the game. The 1000km point seems to be a bottleneck as many players are in it and many are coming towards it, but after that it decreases. However, over half of the respondents (52%) have walked over 1000km already. This can be seen in figure 10. The number of walked kilometers between genders was examined with chi-square test of independence to see if there was a relationship between genders. The null hypothesis is that gender and the number of walked kilometers are independent. In this test were women (n 417) and men (150). The relationship between gender and the number of walked kilometers was not significant, $X^2(9) = 10,06$; $p=0,346$. The null hypothesis is accepted, the player's gender does not affect the walked kilometers.

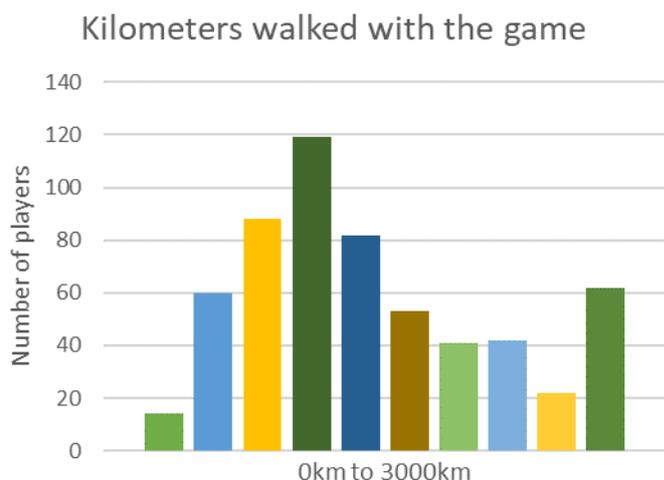


FIGURE 10 Walked distance with Pokémon GO

33% of the respondents have started playing Pokémon GO by someone's recommendation, see figure 11. Over half of the respondents (63%) started playing on their own accord. The rest four percent were not sure how they started playing the game. The prevalence of players starting the game by someone's recommendation or by their own accord between genders was examined with chi-square test of independence to see if there was a relationship between genders. The null hypothesis is that gender and the prevalence of players starting the game by someone's recommendation are independent. In this test were women (n 595) and men (218). The relationship between gender and the number of walked kilometers was significant, $X^2(2) = 11,51$; $p=0,003$. The null hypothesis is rejected. The player's gender does effect on whether they start playing on their own accord or by someone's recommendation. Women are more prone to start playing the game more by someone's recommendation than men.

Did the playing start from a recommendation

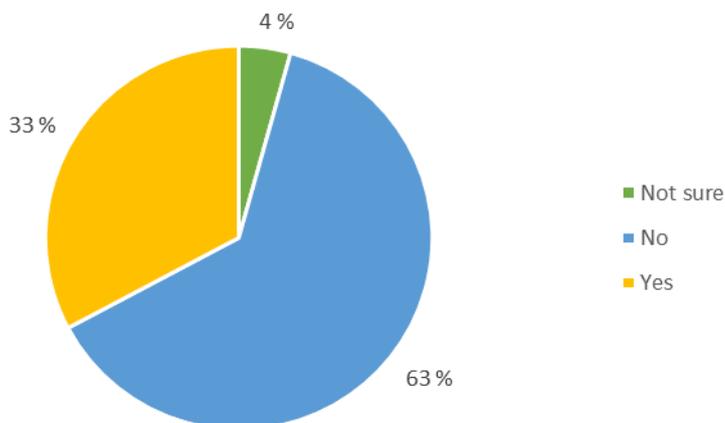


FIGURE 11 How many started playing Pokémon GO from others' recommendation

Majority of the respondents, 67%, said that someone else has started playing by their recommendation and only 33% have not recruited others to the game, see figure 12. The number of respondents that have recruited new players between genders was examined with chi-square test of independence to see if there was a relationship between genders. The null hypothesis is that gender and the number of walked kilometers are independent. In this test were women (n 595) and men (218). The relationship between gender and players who have recruited new players was not significant, $X^2(1) = 0,05$; $p=0,823$. The null hypothesis is accepted, the player's gender does not affect whether they recruit new player's or not.

Has the user recruited new playes

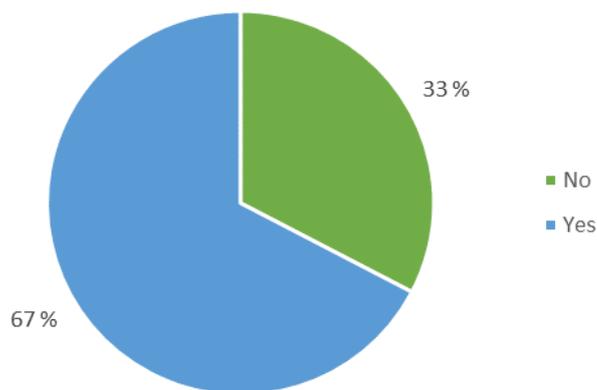


FIGURE 12 How many of the users have recruited new players

Almost all (96%) like the Pokémon GO community (figure 13). The community in this means altogether communities that can be in real life and in virtual environments that are about Pokémon GO game. Liking the community of Pokémon GO between genders was examined with chi-square test of independence to see if there was a relationship between genders. The null hypothesis is that gender and liking the community are independent. In this test were women (n 591) and men (217). The relationship between gender and liking the community was not significant, $X^2(1) = 3,78$; $p=0,052$. The null hypothesis is accepted, the player's gender does not affect whether they like the community or not.

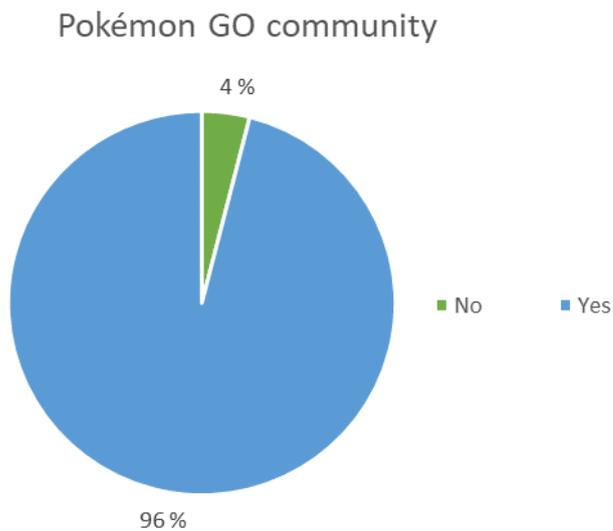


FIGURE 13 How many of the Finnish Pokémon GO players like the Pokémon GO community

Only one percent of the respondents reported they would not recommend the game to others. Eight percent were not sure whether they would recommend it or not, but over 90% said they would recommend the game to others, see figure 14. The likeness to recommend the game between genders was examined with chi-square test of independence to see if there was a relationship between genders. The null hypothesis is that gender and if the players would to recommend the game are independent. In this test were women (n 595) and men (218). The relationship between gender and whether they would recommend the game or not was significant, $X^2(2) = 10,91$; $p=0,004$. The null hypothesis is rejected, the player's gender does affect whether they would like to recommend the game to others or not. Women are more likely to recommend the game to others than men.

The game's recommendability to others

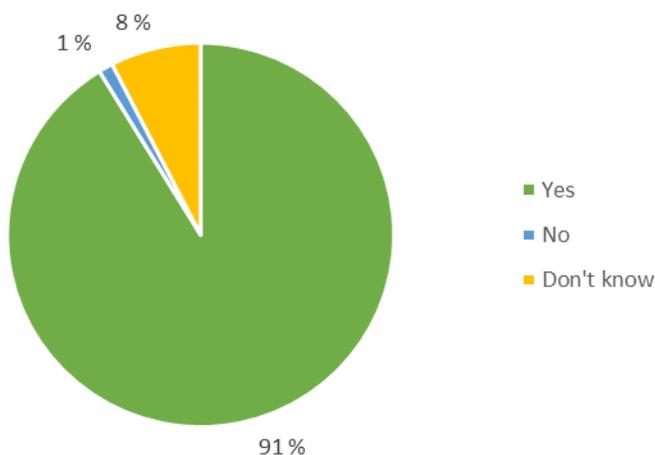


FIGURE 14 How many would recommend the Pokémon GO game to others

6 DISCUSSION AND CONCLUSION

This chapter will go over the most important research results. This chapter will also include the limitations and reliabilities of this study and the suggestions for future studies.

6.1 Research results analysis and discussion

The purpose of this study was to examine the augmented reality exergame Pokémon GO as a social game and how it can promote social actions and behavior and improve the players well-being in general. Player's social playing habits were analyzed. The research data was collected from actual players of the game using an online survey. The data was analyzed using a quantitative approach and cross tabled with chi-square tests.

The first research question was about the health benefits that Pokémon GO game generates. This question was examined with a literature review. Different research has found some major areas where well-being has been increased by the game. The game encourages physical activity and social connections. The game has been reported to attract people with less than average activity levels (Althoff et al., 2016). In Kogan et al. (2017) study over 60% felt that the game had increased their physical activity. In the survey for this thesis only six percent felt not the game had increased even slightly their physical activity. 70% felt that the game had increased their physical activity more than slightly. Physical activity lowers the risk of noncommunicable diseases, increases overall mental health and it has an impact on feelings of loneliness and social connectedness (New Cig, 2018; Umberson & Montez, 2010; WHO, 2018).

The game also encourages players outdoors and got people outside that would normally stay indoors (Wong, 2017). Spending time outdoors has many positive health effects, like increased vitamin D levels, a strengthened immune system, lower stress level and reduced attention deficit hyperactivity disorder symptoms (Labrique et al., 2016).

Pokémon GO gives the players a sense of belonging to both places and other players, strengthened ties with family and friends, changes on how they spent the time with them and acting as an ice breaker for social situations (Vella et al., 2017). Social connections have a significant impact on well-being. Decreased social connections lead to feelings of loneliness and other mental problems. The game acts as a bridge between players giving them a common conversation topic (Vella et al., 2017). It can help people to overcome social anxiety and learn to converse with strangers. It also gives the players a way to connect even if they have never met before as the game often requires team work. The more the users' play the game the more likely they are to initiate friendships and strengthen existing friendships (Bonus et al., 2018).

Physical exercise helps diminish anxiety and depression in almost every case (Tartakovsky, 2015). Socially anxious people were able to exercise and socialize through the passion for the game and having fun (Tateno et al., 2016). In this study only two percent played the game solely for exercise and 27% played it for fun. The game seems to work better on motivating mental health patients and physically inactive people to be more active and exercise as well as converse with other people (Grohol, 2016). In research by Bonus et al. (2018) the new positive and happy memories from the game can relate to shifts in well-being from reduced nostalgic regret. It means that the positive experiences can help reduce negative reflection of the past and think more positively. (Bonus et al., 2018.)

The second question was about Finnish Pokémon GO players' social habits. This was researched through the quantitative study made for this thesis. Four percent of the respondents play the game only with others and ten percent always alone. Playing with others is most likely thought as playing with other people, but the survey did not specify if this includes for example small children and pets or not. Over half of the respondents play the game at least sometimes with others. Of the 633 respondents that played daily, 19 play the game always with others and 66 always alone. In contrast, those who play the game very rarely, none play the game always with others but mostly alone. Weekly players play in percentage terms more often with others than daily players. 22% of weekly players play the game often with others and 33% play the game sometimes with others while the percentages are only 17% and 30% in daily players.

33% of the respondents started playing by someone's recommendation and 67% have recruited others to the game. Users who only play alone recruit less in percentages (37%) than the others. Players who play even rarely are very likely to promote the game to others. Players who play the game at least sometimes with others have the recruit percentage over 70. Only four percent of the respondents did not like the Pokémon GO community. Users who play the game always or almost always alone have more respondents who do not like the community than those who play the game always or almost always with others. 9% of the respondents think the game is recommendable to others.

The third research question was about the gender differences in Pokémon GO's Finnish players' social playing habits. The survey concluded that there are no significant differences between genders in reason for playing, gameplay frequency, social playing habits, walked kilometers, whether they recruit new players and liking the community. These findings are supported by previous studies of Pokémon GO's health benefits (i.e. Althoff et al., 2016; Howe, 2016; Kogan et al., 2017) where no significant differences between genders and ages was found in relation to the increase in physical activity.

There were slightly significant differences in players age between genders and the increase in physical activity, playing started by a recommendation and whether they think the game is recommendable to others. Male players are more often young adults than female players and women are more often adults. Women think they have increased their physical activity moderately and a greater percentage of men think the game has enormously increased their physical activity levels. Men are more prone to start the game on their own accord than by someone's recommendation than women and women are more likely to recommend the game to others than men. However, these differences were not very significant as there were no major differences found between the genders. Men and women both have experienced positive outcomes from the game and many have had increases in well-being from increased physical activity and social playing habits from playing with others.

The game creates an opportunity for healthier life choices by giving motivation to exercise in a way that does not feel like exercising. The game reaches audiences that would normally not be motivated to exercise by being a video game itself that many sedentary people use. The game has been reported to reach sedentary people, and it has also increased others physical activity. The downside to this is that many players have replaced all or some of their high intensity exercise with the game. This can lead to not desired health consequences, but on the other hand it can also improve the users' social needs.

The game encourages players to interact with others and even if they are not comfortable to speak directly to others, being outside with others like-minded people and being a part of a group does help social needs and may in time encourage direct contact with the other players. Reaching other people can be hard and difficult, but having a common interest helps in starting a conversation. Spotting Pokémon GO players can be quite easy which helps finding the potential conversation opportunities. Even though there are many other augmented reality games as of now, the opportunity of a social moment is still there, even if it might be a little harder than before to spot players of the same game. That does not remove the possibility of a conversation between players, if both games are augmented reality games they still offer a conversation topic.

It seems that the game has the same positive effects on all players' in different countries despite the player's gender, age or other qualities. A hectic lifestyle gives little time for nurturing social connections, it is important to find time for others to avoid loneliness. Finding a compromise or a way to spend

time with others and do something at the same time is new way to find time for others. The game creates a good opportunity for users to spend time with others in a new way by combining a game and exercise in a way that can be done together but also independently at the same time. It gives a way to improve both social and physical well-being in a fun way.

6.2 Research conclusions and implications

Augmented reality has many possibilities and opportunities in the future. For now, it could be used more especially in helping decision helping in organizations. AR games and applications can help in public health and in other sectors to save a lot of money. The games that bring out the best public health results seem to come more from the commercial side that are designed for entertainment. Getting players moving gets them physically active, which in turn increases general well-being.

Pokémon GO game increases users' social relationships strengthening old social ties and creating new relationships. The game has been proven to help socially anxious players and people, who usually wouldn't go outside, go outside even if they would not talk to others, but it is a step for the better. The positive outcomes though seem to be short-term as the attraction for the game fades, this would need more frequent updates for the game or similar new games to come on a regular basis. The games need to be passionate enough and designed for a long-term play to encourage and engage users longer. In conclusion these findings show that augmented reality games have a very promising future in commercial and public sectors in affecting peoples' well-being and lives.

6.3 Research limitations

This study has a few notable limitations. The chosen method of online survey limited the respondents to those that have internet access. The studied game, Pokémon GO, requires data connection to play, it can be assumed the lack of internet access didn't leave out any potential respondents. Another limitation is the distribution of this study as it was distributed only in one online community area. This means most likely that only players that are in the particular social media platform and are registered in the group the study was distributed, were able to take part in the study. To minimize this limitation, the survey was distributed in the main group of Pokémon GO on Facebook that has the most participants, however the study was not promoted in any other social media platform, so only those that are on Facebook were likely to participate.

Another limitation is that this survey only concentrated on Finnish players. The study was carried out in Finnish and it ruled out any players not speaking

Finnish to participate, so this study has Finland over represented. However, this does not exclude Finnish players outside of Finland. Unfortunately, it is not possible to examine closer to players nationality or the country they were in while answering the survey from the data. The study method also prevented from making any follow-up questions.

The literature used in this study were selected with care to be extensive and comprehensive. The survey was done before the theoretical part and was more to get the respondents feelings and thoughts and not scientific data from for example pedometers and test periods. These might have influenced on how they have responded as everybody's feelings of how much they have increased their physical activity levels are and if there have been other factors as well.

6.4 Future research

These findings suggest the need for more research studies concerning the long-term effects augmented reality games could have and how they could be accomplished. Another interesting area would be to study how these games could be taken advantage of on the public health and how these could help people and the public health sector.

One area for future research would be to study the player's social playing habits into more depth, for example, to the specifics of who they play with and whether the game has created them more time for relationships and if the game has improved them or not. I suggest researchers to examine long-term players for their social habits and physical activity. Another point for future research would be to study is to find better ways to engage players to reach better results in physical activity levels and social habits.

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APPENDIX 1 SURVEY FORM

Pokémon GO kysely

Kysely kuuluu kurssiin Liikuntateknologia ja pelillistäminen. Toivottavasti mahdollisimman moni pystyisi tähän vastaamaan. Kyselyllä on vain 9 kysymystä.

Vastaaminen vie vain pari minuuttia :)

Viimeinen vastauspäivä on heinäkuun 31.7.2017.

Kenenkään henkilötietoja kerätään.

***Pakollinen**

1. Oletko... *

Merkitse vain yksi soikio.

- Nainen
- Mies
- En halua vastata
- Muu: _____

2. Ikä *

Merkitse vain yksi soikio.

- Alle 15
- 16-25
- 26-35
- 36-50
- Yli 51

3. Pelaatko peliä

Merkitse vain yksi soikio.

- Pelin takia (hauskuus)
- Liikunnan takia (hyöty)
- Molempien takia

4. Kuinka usein pelaat Pokémon Go:ta? *

Merkitse vain yksi soikio.

- Päivittäin
- Viikoittain
- Kuukausittain
- Harvemmin
- Todella harvoin

6. Oletko liikkunut enemmän pelin kanssa kuin aiemmin? *

Merkitse vain yksi soikio.

- Ei ole
- Hieman
- On jonkin verran
- On paljon
- Todella paljon

7. Suositteletko peliä muille? *

Merkitse vain yksi soikio.

- En
- En tiedä
- Kyllä

8. Aloitko pelaamaan itse vai jonkun suosituksesta? *

Merkitse vain yksi soikio.

- Ilman muiden suosituksia
- Jonkun/muiden suosituksesta
- En tiedä

9. Oletko saanut myös muita pelaamaan peliä? *

Merkitse vain yksi soikio.

- En
- Kyllä

9. Oletko saanut myös muita pelaamaan peliä? *

Merkitse vain yksi soikio.

- En
- Kyllä

10. Kuinka monta kilometriä on kertynyt?

1 vähän ja 10 tosi paljon (yli 3000km) eli 5 n.1500km. Arvioi oma kohtasi suurinpiirtein :)

Merkitse vain yksi soikio.

	1	2	3	4	5	6	7	8	9	10	
0km	<input type="radio"/>	3000km ja yli									

11. Pidätkö Pokémon Go pelin yhteisöstä?

Merkitse vain yksi soikio.

- En
- Kyllä