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The determinants for Continuance Intention in Mobile Fitness Apps adopting a Gamification approach

Vera Faßbender

Master in Marketing

Supervisor:
Prof. Maria Conceição Santos, Marketing, Operations and General Management, ISCTE Business School

Prof. Graça Trindade, Department of Quantitative Methods for Management and Economics, ISCTE Business School

September 2021

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Acknowledgments

The finalization of this project marks a milestone in my life. Since I started studying with 21 years, my academical life has been challenging and fun. I am so thankful; I have been able to dedicate so many years of my life to education.
In my bachelor I had the opportunity to study one semester in Uruguay and in my Master, I was able to study in Lisbon. So, for me studying also came with the opportunity to learn about different cultures and exploring other parts of the world. This shaped my academic and personal life, and I am thankful for this.

Along the way I had the chance to meet many people that inspired me and became close friends. They should be mentioned here, because they supported me when I did not believe in myself, comforted me when I needed a shoulder to lean on, and celebrated every of my small and big achievements.

My two supervisors, Maria Santos and Graça Trindade, I would like to thank for all the time and exceptional effort they have dedicated towards me and this project. Both encouraged me and put me back on track in case I was lost. Their guidance has been essential in the creation of this thesis.

Finally, I would like to thank my beloved parents, Werner and Hilde, and my sister Julia for everything they have done for me, they mental support and without whom, nothing would be possible.

Resumo

O estudo visa encontrar que fatores explicam a intenção de continuidade de uso dos aplicativos fitness que adotam o jogo. Para tal, um questionário foi submetido via-online a utilizadores desses (n=110), perguntando-lhes a opinião sobre a adequabilidade dos aplicativos e a sua intenção de continuar a usar. Os resultados da análise fatorial e da regressão linear múltipla mostraram que quatro fatores influenciam diretamente a intenção de continuidade: hábito, atitude, perceção da satisfação e da facilidade de utilização. Identificou-se a mediação do hábito na relação entre atitude e intenção de continuidade no uso, bem como na relação entre satisfação e a intenção de continuidade. A facilidade de uso medeia a relação entre satisfação e intenção de continuar uso. O arrependimento pós-adoção e a motivação do utilizador não se revelaram significativos da intenção de continuidade no uso. O desenvolvimento do produto deve focar-se na satisfação com estes aplicativos, pois aumenta a intenção de continuidade e a perceção de facilidade de utilização. As atitudes apoiam a formação do hábito e a facilidade de utilização. Assim, os profissionais devem compreender como se formam as atitudes e como podem influenciar o processo de design do aplicativo. Atitudes positivas são cruciais no desenvolvimento de intenções de continuidade, ajudando na formação de hábito e na facilidade de utilização. Para estudos futuros, os elementos de jogo devem ser analisados para compreender quais têm maior impacto na intenção de continuidade, bem como o efeito mediador ser testado em outras categorias de aplicativos, como os de viagens ou finanças.

Palavras-chave: Aplicativo de fitness, Intenção de continuidade de uso , Jogo, Gamification

JEL Classification system:
M31, L82/L86

Abstract

The goal of this study is to find the determinants which explain the continuance intention of fitness apps adopting a gamification approach. An online questionnaire was conducted in which gamified fitness app users (n=110) were interrogated about their opinions on fitness apps and continuance intention. The results of the factor analysis and the multiple linear regression analysis showed that four factors directly influence continuance intention – habit, perceived enjoyment, attitude, and perceived ease of use. Moreover, habit mediates the relationship between attitude and continuance intention, as well as the relationship between perceived enjoyment and continuance intention. Perceived ease of use mediates the relationship between perceived enjoyment and continuance intention. Post-adoption regret and user engagement were not detected to significantly explain continuance intention. Consequently, researchers can adopt these variables and mediators. For practitioners the findings indicate that product development should focus on enjoyment of fitness apps to increase continuance intention and perceived ease of use. Habit is a relevant determinant for continuance intention, so the triggers need to be explored which habituate usage. Positive attitudes are crucial in the development of continuance intentions. Attitudes support habit forming and the ease of use. Therefore, practitioners must understand how the attitudes of their targets are formed and how they can influence this process. For future studies, the game elements of fitness apps could be analysed to understand which have the biggest impact on continuance intention. The mediators could also be tested in other gamified app environments, like travel or finance.

Keywords: Fitness App, Continuance Intention, Gamification

JEL Classification system:
M31, L82/L86

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Glossary of Abbreviations

Applications = Apps

Information System = IS

KMO = Keyser-Meyer-Olkin

Perceived enjoyment = PE

Perceived ease of use = PEOU

Perceived usefulness = PU

Technology Acceptance Model = TAM

1 Introduction

1.1 Theme

The ubiquity of smartphones has altered people's lives. The share of the daily internet use by mobile devices per user reached 50.1 % in Q3 of 2019 (Hootsuite Report 2020). In various parts of life smartphones serve as a permanent companion. Smartphones can support people to fulfil social, utilitarian, or hedonic needs. In order to allow an optimal interaction with smartphones, mobile applications (apps) were developed to serve different user needs. 91 % of daily mobile time is spent using mobile apps. They grow in popularity, consequently app providers as well as brands try to penetrate the mobile app market.

Businesses explore strategies to engage people with their apps and generate a competitive advantage over other brands and app providers. Research in consumer behaviour of app users increased in theoretical and practical fields (Natanson, 2021). A rising trend in apps is called gamification. Gamification is the practice of integrating game-like experiences into non-game contexts (Werbach & Hunter, 2020). Since people have an intrinsic motivation to play games, these motivations could support app providers in retaining app users and by that increase the continuance intention of app users. Gamification has predominantly penetrated fitness and health apps, which serve as the main theme in this work (Setiawan, 2019).

The desire to be fit, healthy and trained increased over the last decade. Fitness as a lifestyle is trendy. Moreover, health awareness is increasing due to the rise in obesity rates worldwide (Paliwal, 2021). People search for technology that can support their attempts to become healthy and fit. Fitness and health apps can support people's well-being, and thus, have been increasing in number and downloads over the last years. Another factor that influenced the rise of fitness apps was the COVID-19 pandemic which forced people to find alternatives to practicing sports in gyms or outside, so instead home workouts and individual outdoor sports gained interest (Flurry, 2017; Net Imperative, 2017).

Gamification is oftentimes implemented in fitness apps with the aim to increase the user's motivation and engagement with the app. Various studies concluded that gamification can successfully support users in reaching their fitness goal with, at the same time, rising user engagement (Bitrián et al., 2021). This finding sounds promising for fitness app providers and brands offering fitness apps to their customers, like Nike Run Club. However, studies also concluded that the usage of fitness apps faces an issue – decreasing usage over time. One study assumes that especially younger people get bored faster and quit the app. Thus, enjoyment, usefulness and playfulness decrease fast (Hamari & Koivisto, 2015). The aim of

this work is to understand which determinants are crucial to explain the continuance intention of users.

1.2 Research problem

Besides research that concluded the beneficial usage of gamification in fitness apps to engage consumers, various studies found that gamified fitness apps attract users at first, but soon after a decline of usage and a loss of interest and excitement is detected (Huang et al., 2019; Koivisto & Hamari, 2014). Next to gamified fitness apps, the long-term continuance behaviour of apps in general is a problematic issue for many app providers. The continuance behaviour is oftentimes predicted with the continuance intention. Research found that intentions to perform many kinds of behaviours were related to carrying out the behaviour (Ajzen, 1991). Hence, this phenomenon in literature serves to be investigated in this research. Wang and Collins proposed the following question to be investigated in future research: “Why would consumers stop using a fitness app which they initially believed to be helpful for achieving their fitness goals?” (Wang & Collins, 2021). Derived from this question, this work aims to answer the following question:

Research Question: What determinants can explain the user continuance intention of gamified fitness apps?

1.3 Objectives

By answering the previous question, this work is contributing to the existing research on gamification in fitness apps. It offers service app providers information about consumer behaviour by focusing on user continuance intention of gamified fitness apps. Especially the attempt of including the construct of user engagement in the context of continuance intention, could be an insightful and new contribution for theory.

The findings of this thesis can support service providers of fitness apps in deriving measures to increase continuance intention. UX designers, marketeers and product managers might be confronted with this interrogation daily: “How can the users of our fitness app be motivated and convinced to continue using the fitness app and spend more of their daily on-screen time in our fitness app? “. To answer this question or similar ones could be daily business for many companies in the industry. Also, other app industries are trying to understand the features and motivations which encourage users to spend more time with their app.

Gamification could be an answer. So, the objective is to understand in what ways gamification fitness apps can solve this issue. Another objective of the thesis is to translate these insights into practical measures, which can be implied in the real business world.

1.4 Structure

The structure of the thesis consists of five main chapters (Figure 1.2).

First, in the literature review the topic is embedded in its context, describing the trends and facts of fitness apps and the fitness app market. Next, gamification will be introduced and the role of gamification in fitness apps will be discussed. Moreover, literature about the consumer behaviour of gamified fitness apps is reviewed.

Then, the theme of continuance intention is introduced. The evolution of continuance intention was driven by various theories. These theories will be introduced since they are fundamental for this research. Finally, the leading studies of this work are introduced. They examine the determinants of continuance intention of gamified mobile apps based on the previously introduced theories. The following funnel (Figure 1.1) shows the process of literature review, starting from broad topics and arriving at the core topic of this work: continuance intention in gamified fitness apps.

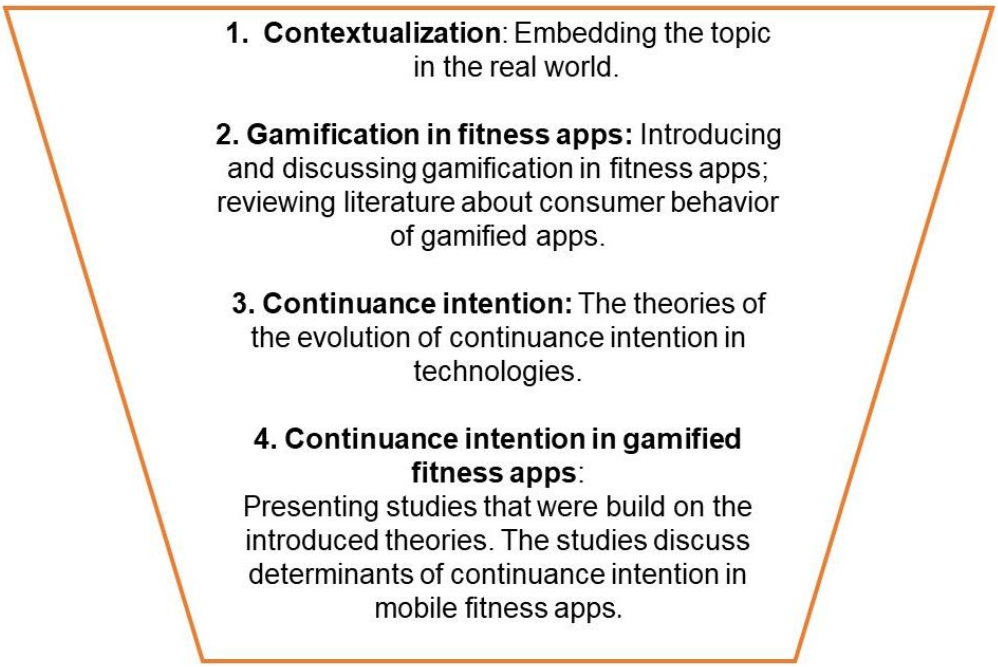

Figure 1.1: Structure of the literature review
Source: Own elaboration

The conceptual framework and hypotheses build on the literature review. The outcome of the literature review will be transferred into hypotheses and the hypotheses will be visualized in a conceptual framework.

To guarantee reliability and validity, the methodology explains the procedure of the scientific work. The data collection will be explained and justified. Based on the collected data, the analysis will be conducted to validate the hypotheses. Next, the results will be presented and in case they deviate from the conceptual framework, an updated version will be presented. In the last chapter the findings will be discussed and implications for theoretical and practical purposes, limitations and ideas for future works are expressed.

Figure 1.2: Structure of thesis
Source: Own elaboration

2 Literature Review

The literature review serves as the theoretical fundament for this work. In the following chapter the research is embedded in its context, core concepts are reviewed, and the relevant research strings are detected.

First, gamification will be introduced to build a common understanding of its definition, objectives, and implementation. Afterwards, the presence of gamification in fitness apps is reviewed. Gamified fitness apps will serve as the subject of investigation; hence consumer behaviour of gamified fitness apps will be discussed.

Theoretical frameworks will be reviewed which are relevant for the continuance intention of technology, like gamified mobile apps. Different studies of continuance intention will be introduced and finally summarized in Appendix B. They build on the previously introduced theories and therefore these theories and studies paved the way for the research study at hand.

2.1 Contextualization

In the following sub chapters the research is embedded into the context by discussing the relevance and market size of health and fitness apps.

2.1.1 Health and fitness Apps Industry

Health awareness has been increasing in the last years. Health as a lifestyle is an emerging trend in the modern society. This creates a demand for health and fitness apps to support users in self movement. From 2014 to 2017 the fitness health app usage increased by 330 % worldwide (Net Imperative, 2017). Another rise of numbers accrued due to the current Covid-19 pandemic. A 30 % increase were recorded in the expenses of fitness apps by consumers in 2020 (Net Imperative, 2021). Mobile health apps run on mobile devices such as tablets and phones. In the fitness sector they are mainly used for monitoring health and fitness. An increasing number of users integrate these apps into their daily life by utilizing the service at home, in the office or on the go. The ubiquitous format personalizes the usage for every customer and allows access to health care whenever and wherever the customer wants (Leijdekkers & Gay, 2013).

In app environments, where competition is high, app providers need to understand how to retain users. Businesses can benefit from learning how users develop continuance intention (Hsiao et al., 2016).

2.1.2 Market Size of the eService Fitness Segment

Statista forecasted the revenue in the electronic service fitness segment to reach 21,859 million US$ in 2021. Besides fitness apps, these statistics also include wearables which account for the most part of the revenue with 17,834 million US$ in 2021 (Statista 2020). Included in the revenue forecasts is the revenue of paying users, that is, paid app downloads, premium or full versions and in-app purchases. The user penetration of fitness apps will rise to 11.9 %. This number includes paying and non-paying customers (Statista 2020).

After developing the context of the industry and market size, the following chapter will start with the first core concept that needs to be reviewed: Gamification.

2.2 Gamification

By “the use of game design elements in non-game contexts” engaging experiences can be created (Werbach & Hunter, 2020, p. 26). The non-game context characterizes gamification. Instead of focusing solely on entertainment, like many games do, gamification intents joy of use, engagement, or a better user experience. According to the authors, engagement leads to a competitive advantage for businesses and thereby companies with the highest engagements will outperform their competitors (Werbach & Hunter, 2020). Several objectives exist to employ gamification in different business fields:

1. *Internal gamification*: By deploying gamification in an organization, productivity can be increased. Satisfaction with work, engagement and positive business results can be fostered by internal gamification.
2. *External Gamification*: To improve the relationship between customers and companies, external gamification is implemented. It serves marketing goals and can increase engagement, identification with the brand, revenues, and loyalty.
3. *Behaviour-change gamification*: Behaviour-change gamification aims at creating desirable societal outcomes by forming new beneficial behaviours. The scope of industries that utilize behaviour-change gamification can range from health to education and personal finances.
4. *Crowdsourcing gamification*: Crowdsourcing gamification seeks to mobilize people to work on problems together. The motivation to participate in crowdsourcing can be increased by gamification (Werbach & Hunter, 2020).

Gamification consists of various elements adapted from game design. The elements of game design can be divided into dynamics, mechanics, and components. Dynamics are on the highest level of abstraction. For example, emotions are one of the dynamics. Feelings like happiness, curiosity and competitiveness can be evoked by gamification. The dynamics

are the fundament of gamification, they show the big picture. Usually, they cannot be implemented in the game directly, but must be transported through other elements, the mechanics. Mechanics in a gamified system are generating player engagement. Some of the most relevant mechanics are the following: Challenges, Chance, Competition, Feedback, Rewards, Transactions, Win/Draw and Loss states. Finally, the dynamics and mechanics can be transported by components of games, for example: Infinite gameplay, Progression bar, Time constraints, and Tangible rewards. The three element types are visualized in Figure 2.1 (Werbach & Hunter, 2020).

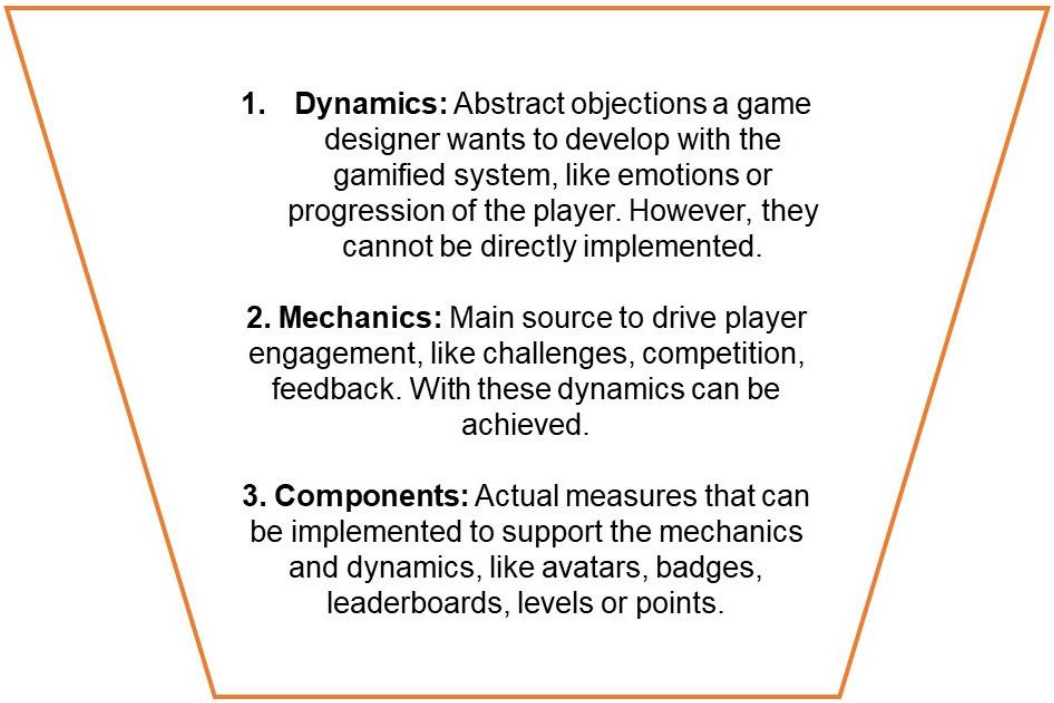

Figure 2.1: Game elements pyramid
Source: Own elaboration from Werbach & Hunter 2020

2.2.1 Gamification in fitness apps

Gamification seeks to change people's behaviours (Werbach & Hunter, 2020). Consequently, gamification is oftentimes applied in apps which can support health and fitness. The presence of gamification in fitness apps was researched by Cotton and Patel in 2019. The authors downloaded the top 50 health and fitness apps from the Apple Store and investigated whether the apps include gamification design elements. Gamification elements were present in several categories of health apps: Physical activity, weight loss, workouts, meditation/relaxation, and tracking water consumption. In total, 64 % of all apps used gamification. Especially in the areas of physical activity and weight loss, all 22 apps that were found utilized gamification design elements (Cotton & Patel, 2019). The ten most frequently used

gamification design elements which the authors found in the health and fitness apps are shown in Appendix A.

Since fitness apps are a category of apps where the adaption of gamification is high, they serve well to be investigated in this study. The next chapter summarizes and reviews the prevalent literature in the field of consumer behaviour of gamified fitness apps.

2.2.2 Consumer behaviour of gamified fitness apps

Various studies found that a common strategy to increase motivation and engagement with a fitness app can be the gamification of the application. Daily motivation of a gamified fitness app could support the user in behavioural changes and thus reach the user's long-term goals (Eisingerich et al., 2019).

Many studies tried to analyse and measure the consumer behaviour of health and fitness apps. Flurry Analytics, an analytics platform for the mobile app industry, conducted a study of health and fitness apps in 2017 (Flurry, 2017). Because it is a relevant contribution, the results will be presented in this paragraph: Health and fitness apps measured high retention rate. 96 % of users prefer only using one health and fitness app. Overall engagement is high, more than 25 % of users open their fitness app more than 10 times a week. The frequency of usage was assessed. With 33 % most people utilize the fitness app 2-5 times a week. 26 % of app users operate the app more than 10 times, and 16 % use the app 6-10 times per week. Since 2016 growth has slowed down. From 2016 to 2017 the health and fitness app usage only grew by 9 %. Fitness studio apps that provide content were growing the most since 2014 with 830 %. Workout and weight loss apps only grew by 11 % and nutrition apps even showed a negative growth rate with -26% in the year 2016 to 2017. However, workout and weight loss apps account for 73 % of all app sessions of the industry. Drivers of this growth were technologies like wearables and smartwatches. 15.6 % of users owned a portable device for the fitness tracking, like a smartwatch or fitness band. Besides, the article by Flurry (2017) claims that the usage of health and fitness apps is seasonal. During the holidays, the usage is down by 56 % in comparison to the highest usage day which is the 8th of August. Especially in January when many users are trying to achieve their new year resolutions, usage starts to grow. The usage rises then over the summer with its peak in August. During the day before and after work users spent the most times on their apps. The highest usage arises at 10 pm because those users perform late night workouts or check their data recorded throughout the day.

The motivations for users to workout with the fitness app Bodyspace were analysed by asking 184 users for their motivational affordances (Molina & Myrick, 2020). The following themes could be discovered: The app can support them in feeling good, accomplished, and

confident. Most of the users stated they gained a feeling of confidence and a positive emotional experience. Moreover, stress relief and mental benefits accounted for many users as the top motivation to use the fitness app. Users could increase their energy and health level and associate it with a sustainable uplift of their mood. Results showed that users are tracking their sports activities, sign up for classes and engage with their general health condition. Two main reasons are predominant for the usage of health and fitness apps. Firstly, the mobile fitness app can support the user emotionally by encouraging him. Secondly, the app can be an informational support in terms of knowledge and skills. Physical appearance and strength motivate users to exercising. Some users enjoy the competition the exercise and the usage of the app brings them, others noticed a decrease of social comparison and prefer the self-challenge involved. Finally, the respondents described the inspiring effect the app can have when showing what peers have achieved.

Koivisto and Hamari (2014) discovered differences by age and gender regarding perceived benefits of the gamified fitness app Fitocracy. Women perceive social benefits more than men when using the gamified fitness app, that is, recognition of peers was more beneficial to woman. The authors discovered that continuance of use can decline due to decreases in enjoyment, Perceived Usefulness (PU), and playfulness over time. Especially, younger people are more likely to become bored faster and therefore switch or abandon the app. Continued exercise intentions were more dominant for women. For older generations social connectedness, instant feedback and support could afford motivations. On top of that, self-efficacy should be increased to motivate older generations more (Koivisto & Hamari, 2014).

After gaining a better understanding of gamification, consumer behaviour and main benefits of gamified fitness apps, the attention will be drawn towards the theories that have shaped the literature of continuance intention in gamified fitness apps.

2.3 Theoretical models of continuance intention in technology

This chapter reviews the theoretical frameworks that are relevant to understand continuance intention. The most relevant studies for this work are all based on the theories introduced in this chapter.

The first model that builds a fundament for this study is the “technology acceptance model” (TAM) by Davis et al. (1989). It discusses technology adoption in organizational environments. Another model is introduced which was built on technology acceptance embedded in a hedonic context by van der Heijden (2004). Afterwards, the model of information system continuance by Bhattacharjee (2001) will be introduced. This model integrates studies of the consumer behaviour literature and the information system usage research.

2.3.1 Technology Acceptance Model (TAM)

The TAM explains the influence of Perceived Ease of Use (PEOU) and PU as determinants of user acceptance, more specifically intention to use and usage behaviour, of technology in an organizational environment. PU was defined as "the degree to which a person believes that using a particular system would enhance his or her job performance" (Davis 1989) and PEOU as "the degree to which a person believes that using a particular system would be free of effort" (Davis et al., 1989). Both variables proved to be determinants of system use. The relationship of PU and usage intention was stronger linked than ease of use and usage. The TAM model is presented in Figure 2.2.

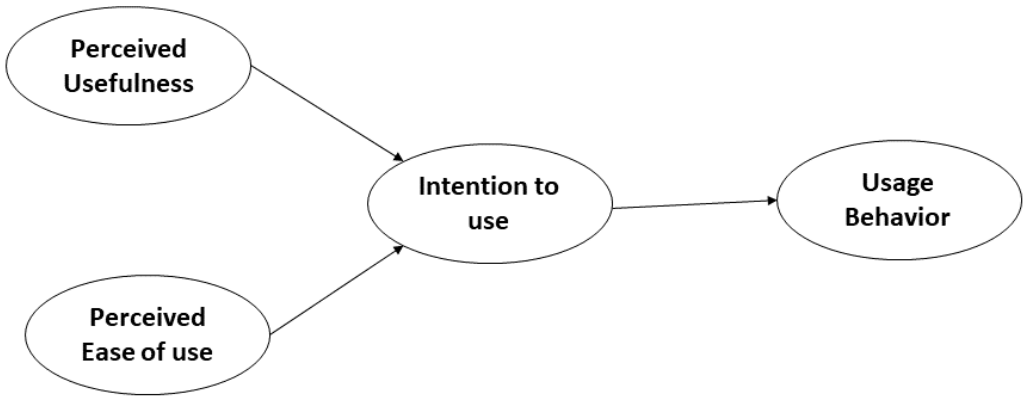

Figure 2.2: Technology Acceptance Model
Source: Venkatesh & Davis, 1996

The TAM is relevant for this work because the acceptance of technology is a prerequisite of continuance intention. Moreover, continuance intention explains usage behaviour, as can be seen in Figure 2.2.

2.3.2 User acceptance of hedonic information systems

Van der Heijden (2004) investigated the differences between productivity-oriented environment and hedonic information systems for user acceptance. The previously introduced TAM was developed in a productivity-oriented environment of an organization. In a leisure environment another influence can be added to explain usage intentions of IS: Perceived Enjoyment (PE). The author found that besides PU and PEOU, PE plays a significant role in explaining intention to use in a hedonic usage context. Also, in a hedonic context, PEOU was

more linked to the intention to use than PU. The theoretical model of van Heijden is visualized in Figure 2.3.

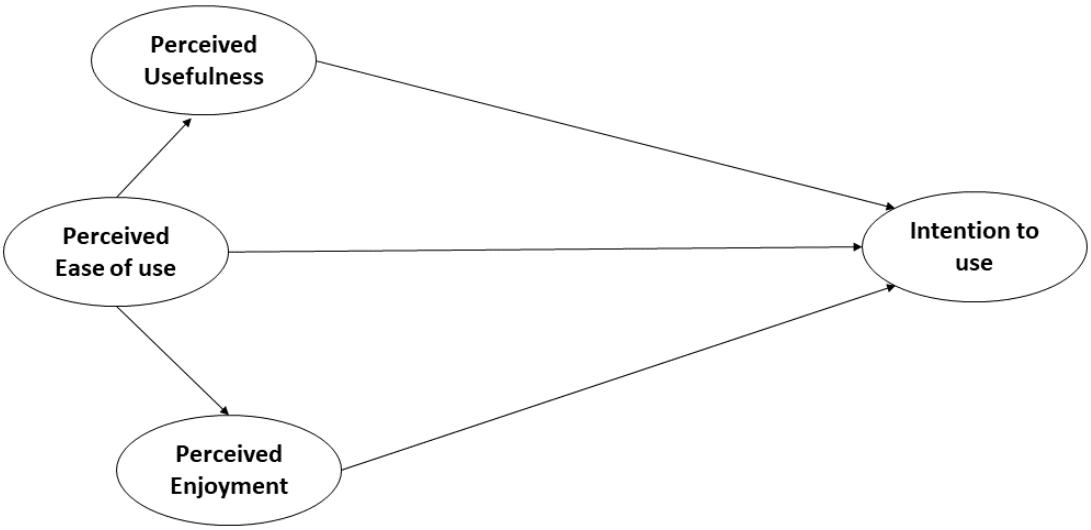

Figure 2.3: Model for user acceptance of hedonic information systems
Source: van der Heijden, 2004

The model adds a relevant aspect to this work. Since the research topic for the work at hand examines gamified fitness apps, hedonic factors to increase the intention to use technology should be considered.

2.3.3 Continuance Intention of information systems

The third theory that builds the fundament of the work at hand is the investigation by Bhattacherjee et al. (2001). Their model was inspired by the Expectancy-Confirmation Theory (Oliver, 1980). Oliver developed a cognitive model of the antecedents and consequences of satisfaction decision. He stated that consumers create a pre-purchase expectation of a product. Next, they buy the product. After buying, they experience the product performance during consumption. Finally, the expectations will be compared to the performance and can result in a confirmation, which can furthermore lead to satisfaction and repurchase intentions. Bhattacherjee et al. (2001) adverts that the consumer repurchase decision is like user's continuance decision in technology. The authors tested whether satisfaction and PU have a direct influence on the user's intention to continue using information systems. Satisfaction identifies as the users' affect with feelings about prior information system use and PU defines as the users' perception of the expected benefits of information system use. The comparison between pre-purchase expectations and actual experience of performance during usage, results in the confirmation. The model was tested in a banking environment. The users of

online services of the bank were questioned about their continuance intention and the factors that might influence the intention. The conclusion of the contribution is the following expectancy confirmation model (ECM), which can explain continuance intention in information systems (Bhattacherjee, 2001).

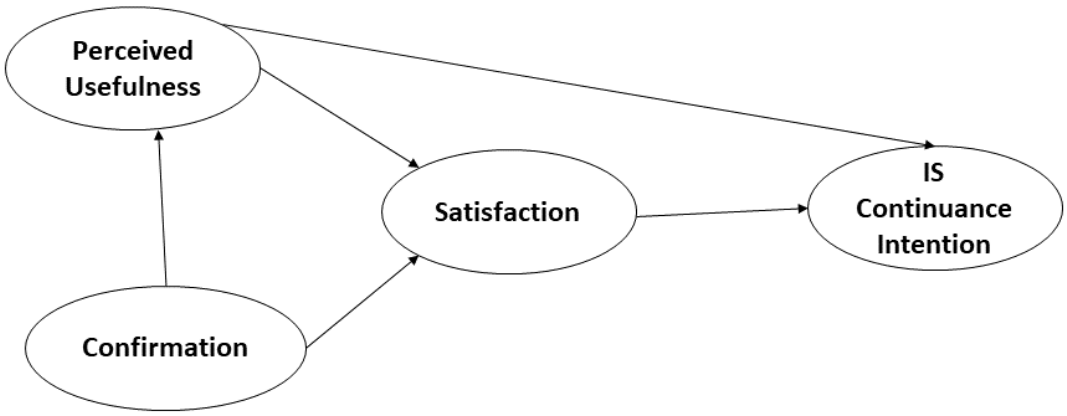

Figure 2.4: Model of information system continuance intention
Source: Bhattacherjee, 2001

This model (Figure 2.4) was chosen to be introduced, since the following literature in this research builds on it. The model has been altered and adjusted since 2001. Even though only the outcome (information system continuance intention) will be adapted for this work, it is crucial to understand the roots of it.

2.3.4 Continuance intention in mobile apps

The following studies have investigated in the field of continuance intention of technology and mobile apps. Most of them build on the theories introduced in the previous chapter. For example, a more recent study, like the study of Huang et al. in 2019, modified the model of Bhattacherjee (2001) to test the factors influencing discontinuance intention in gamified fitness apps. Hence, this study was used as the main orientation for the work at hand.

Huang et al. (2019) proved that the Model of IS continuance intention by Bhattacherjee (2001) can be applied to current technologies like gamified fitness apps. Huang et al. (2019) adopted the approach of the model of information system continuance intention (Figure 2.4) and added variables that are relevant to explain the influence on discontinuance intention in gamified fitness apps (see Figure 2.5). The added variables were adopted from other studies in the domain of technology like mobile social apps (Hsiao et al., 2016) or health apps (Cho, 2016). These variables are habit, (post-adoption) regret, PEOU as an antecedent of satisfaction, frequency of use as an antecedent of habit and gamification app value. The definitions

of the variables, that were tested to influence discontinuance intention directly, were reviewed and presented in the following paragraph.

Habit was defined as “a cognitive orientation that enhances the perceptual readiness for habit-related cues, and prevents from being distracted and from adopting other, less efficient, courses of action” (Verplanken & Aarts, 1999, p. 125). Limayem et al. (2007) embedded habit in an information technology environment and defined it as the “extent to which people tend to perform behaviours [use information technology] automatically because of learning.” In gamified fitness apps, Huang et al. (2019) state that the more the habit of using the app when exercising is ingrained, the more it will lead to continuance intention. Their study found that habit negatively influences discontinuance intention. Post-adoption regret is defined as “a negative emotion as a result of decision-making under uncertainty in the presence of alternatives” (Sun et al., 2014, p. 3). By the amount of choice users have nowadays, many times a decision is based on the adoption of other users. Due to system shortcoming, service failures or other reasons, users might stop using the app shortly after and feel regret (Huang et al., 2019). Finally, gamification app value was added. Gamification app value is a second-order construct which is assembled by two types of perceived value: social and enjoyment value. Gamification app value showed a significant influence on discontinuance intention. The empirical model of Huang et al. (2019) is visualized in Figure 2.5.

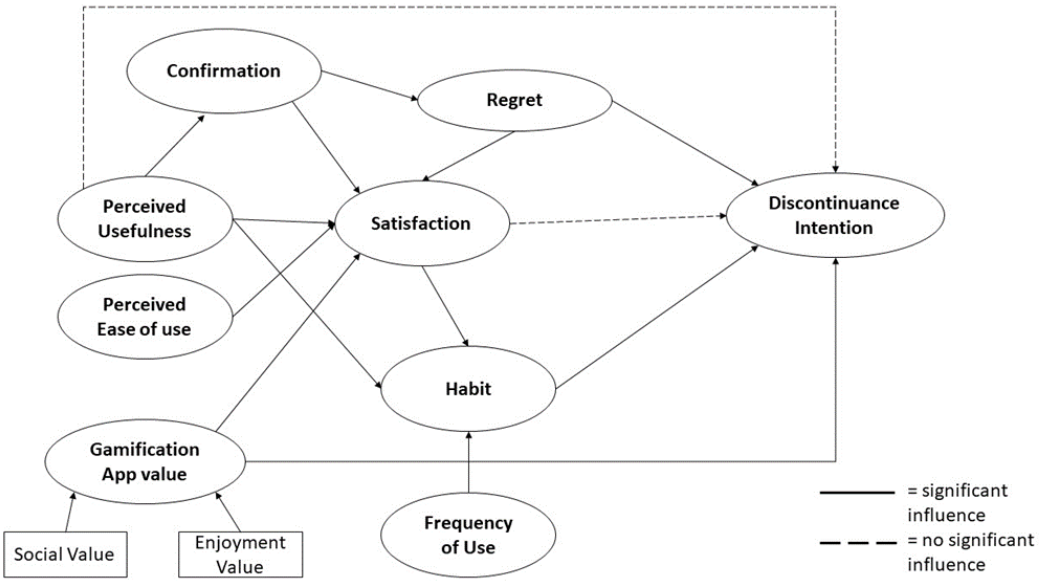

Figure 2.5: Testing results of discontinuance intention
Source: Huang et al. 2019

A study of Koivisto and Hamari (2015) investigated in the relationships of utilitarian, hedonic and social motivations, and continuance intention in a gamified fitness app, as well as the attitude towards gamification. 200 usable responses of the users of a gamified fitness application, Fitocracy, were analysed. The measurement instrument of a component-based

partial least squares approach to structural equation model was chosen. Their findings show that the use of gamification is driven by utilitarian and hedonic motivations. In the TAM model of Davis (1989) the author claims that mostly PU motivates users to accept technology, whereas van der Heijden (2004) concluded that PE plays a more significant role to explain the intention to use in hedonic IS. According to Koivisto and Hamari (2015) gamification can offer both benefits. However, social factors played no significant role in explaining use intention. Finally, the study concluded that hedonic aspects have a more important influence on the intention to use gamified fitness apps (O'Brien et al., 2018).

Bitrián et al. (2021) analysed the data of 276 users of a mobile gamified fitness app using partial least squares regression. Their study aims to explain if gamification can foster user engagement and marketing outcomes, such as continued use intention. They investigated if game elements, like social or immersion elements, can lead to psychological outcomes, for example user engagement, and by that lead to continued use intention. User engagement was characterized by O´Brien (2016): "User engagement is [..] a quality of user experience characterized by the depth of an actor 's cognitive, temporal, affective and behavioural investment when interacting with a digital system." This definition points out that user engagement in human interface interactions is affective, cognitive and behavioural in nature (O'Brien et al., 2018). User engagement can be explained by four dimensions

1. Focused Attention: It describes the feeling of being absorbed in the experience and a feeling of losing track of time.
2. Aesthetical Appeal: It defines as the attractiveness of the interface.
3. Perceived usability: It indicates a negative effect. It is experienced as the result of interaction and the level of efforts expended.
4. Reward: The reward items explain three different concepts: novelty, endurability and felt involvement.

The findings of Bitrián et al. (2021) conclude that user engagement can influence marketing outcomes like continued use intention.

Hsiao et al. (2015) explored the influential factor of continuance intention of social app use, so 378 responses were collected, and a structural equation model was developed. The main findings were that the direct determinants of continuance intention were user's satisfaction, connection with others, and hedonic motivation to use the apps.

Nascimento et al. (2018) investigated the continuance intention and its determinants also based on the model of information technology continuance intention by Bhattacherjee (2001). They collected 574 answers of smartwatch users and, with the instrument of structural equation modelling (SEM), concluded that PU, satisfaction, habit, and perceived usability can enhance the continuance intention of wearables. Habit was the most important influence on continuance intention.

The table in Appendix B serves as a summarization of the Chapter 2.2.4 by structuring the findings of the relevant contributions that were investigated in the field of continuance intention and in mobile apps. The table shows the contributions and context of the works. Moreover, the variables that were tested to directly influence continuance intention are listed. Finally, the findings of the studies are stated, that is, which variables were found to influence continuance/ discontinuance intention directly.

As a conclusion for this chapter, the literature review forms a robust fundament to develop a conceptual framework that can investigate the determinants of continuance intention in gamified fitness apps. The following chapter aims to present the hypotheses that will allow to build a conceptual framework.

3 Theoretical Framework and Hypothesis

This study focuses on understanding the determinants of continuance intention of gamified fitness apps. When considering the five studies introduced in the previous chapter of the literature review, several variables showed significant influence on continuance intention of the mobile app use. The following paragraphs will check all studies for the relevant variables which can explain continuance intention. If variables showed no significant relation with continuance intention, the variables will be excluded from the investigation and the exclusion justified. The studies will be discussed in the same order as in Chapter 2.3.4:

1. Huang et al. (2019),
2. Hamari und Koivisto (2015),
3. Bitrián et al. (2021),
4. Hsiao et al. (2016), and
5. Nascimento et al. (2018).

Huang et al. (2019) found regret, habit, and gamification app value to have an influence on discontinuance intention. Gamification app value combines social value and enjoyment value. However, gamification app value only served as a second-order construct in the research by Huang et al. (2019) and the development of the variable is not clarified enough by the authors to serve as a valid variable for this research. Though, PE is added to the theoretical model based on the study of Hamari and Koivisto (2015). They conclude that ease of use and PE influence continuance Intention. Bitrián et al. (2021) found that the continuance intention of gamified fitness apps is influenced by user engagement. Hsiao et al. (2016) explored that satisfaction, PE, habitual use, and social ties explain continuance intention in a social app environment. Since Koivisto and Hamari (2015) did not find that social influence has an influence on continuance intention in a gamified fitness app, it is not assumed as relevant for

this study. Finally, Nascimento et al. (2018) found that habit, PU, and satisfaction had a causal relationship with continuance intention. However, satisfaction and PU are excluded from the work, because satisfaction was not proven to be a relevant variable in the gamification context (Huang et al., 2019), but in social media app and smartwatch contexts (Hsiao et al., 2016; Nascimento et al., 2018). PU was excluded from the conceptual framework, because in two gamification studies on continuance intention and discontinuance intention (Hamari & Koivisto, 2015; Huang et al., 2019) the direct influence of PU was not confirmed.

To sum up, the following variables were found to be relevant determinants for continuance intention, since they were tested to have an influence on continuance intention in a gamification environment:

1. **PE**
2. **PEOU**
3. **User Engagement**
4. **Habit**
5. **Post-Adoption Regret**
6. **Attitude**

Since the focus of this work is to detect the relevant variables that can explain continuance intention of gamified fitness apps, the links between these variables and continuance intention are hypothesized. In the next chapters, the hypotheses will be established.

3.1 Hypotheses

Based on the conclusions of the literature review, hypotheses will be developed. The purpose of the hypotheses is to gain knowledge about a population based on data which was conducted from a sample of this population. By formulating hypotheses, evaluating the data obtained from the sample, and interpreting the evidence extracted from the data, decisions can be made whether the hypotheses are supported or not (Davis & Mukamal, 2006). Finally, the tests of the hypotheses can support the author in answering the research question which determinants influence continuance intention.

It was detected that PE influences the intention to use information technology (van der Heijden, 2004). PE measures the positive experiences a user makes with the gamified fitness app and might therefore be directly influencing the continuance intention (Hamari & Koivisto, 2015). Huang et al. also detected that users of gamified fitness apps do not only use the app for utilitarian reasons, but furthermore for hedonic reasons, like enjoyment

(Huang et al., 2019). Drawing from this string of findings, the first hypothesis under investigation was developed:

H1: PE positively explains the continuance intention.

Derived from the contribution of van Heijden (2004) and Davis (1989) PEOU identifies as the belief of a user that using an informational system would be free of effort. Van der Heijden (2004) tested the relationship between PEOU and the intention to use in a hedonic information system. PEOU showed a strong correlation with the intention to use. It plays therefore a pivotal role in explaining use intentions, because it can enhance the user experience (van der Heijden, 2004).

For a gamified fitness app, that might have utilitarian and hedonic reasons to be utilized, the PEOU could be relevant for the user and the continuance intention. Moreover, Hamari and Koivisto (2015) assumed that a complicated interface can stem negative experiences with the app, so PEOU might be a crucial factor that influences continuance intention. Consequently, the author posits the second hypothesis:

H2a: PEOU positively explains the continuance intention.

Furthermore, it is believed that PEOU could be a mediator between other constructs and continuance intention, because if a user is enjoying the application or has a positive attitude, the ease of use could be mediating this effect.

H2b: PEOU is a potential mediator in this model.

User engagement was oftentimes proved to enhance the continuance intention (Bitrián et al., 2021; Eisingerich et al., 2019; Suzianti et al. 2019). Highly engaged users are more prone to create valuable relationships with the apps and integrate these into their self-concept (Bitrián et al., 2021). These arguments lead to the following hypothesis:

H3: User engagement positively explains continuance intention.

If a habit is formed by applying a behaviour more frequently, the usage of the application might become automatic and the user intents to use the gamified fitness app without thinking about alternatives or considering another system to be more effective. The app use is integrated into the routines of the user (Huang et al., 2019).

Following the above string of research, habit could take on an important role in explaining the user continuance intention of gamified fitness apps; that is, the fourth hypothesis is the following:

H4a: Habit positively explains the continuance use intention.

Since PE for example could lead to habitual use, habit could be a potential mediator for this variable. Moreover, habit could mediate the relationship between user engagement and continuance intention, because if a user is engaged with an app, the app usage could become habitual. Therefore, the mediating effect of habit is condensed in the following hypothesis:

H4b: Habit is a potential mediator in this model.

If a gamified fitness app is compared to alternatives and evaluated negatively, the user might terminate the usage of the current gamified fitness app. Post-adoption regret was found to have strong influence on discontinuance intentions (Huang et al., 2019). Furthermore, post-adoption regret adds a relevant factor. It characterizes the external comparison a user conducts with the gamification app and other gamification app alternatives. So far, in this work solely internal factors were considered to influence continuance intention, for example engagement or enjoyment. Since many gamified fitness apps exist, users can easily find other apps that they will compare the performance of the current used gamified app to. So, post-adoption regret can add another external perspective to the investigation. In case the user is dissatisfied with the gamified fitness app and regrets the usage in the first place, the following hypothesis was developed:

H5: Post-adoption regret negatively explains the continuance intention.

Considering the attitude towards gamified fitness apps, they might be formed about the beliefs people have about the attributes or features of a gamified fitness app. The attitude towards the gamified fitness app can influence the continuance intention (Hamari & Koivisto, 2015). Since attitudes have been directly linked to intentions, attitude should be included in the investigation. Consequently, the last hypothesis of this work is the following:

H6: The attitude towards the fitness app positively explains the continuance intention.

After having summarized all hypotheses, the conceptual model can be constructed.

3.2 Theoretical Framework

The conceptual model visualizes all hypotheses:

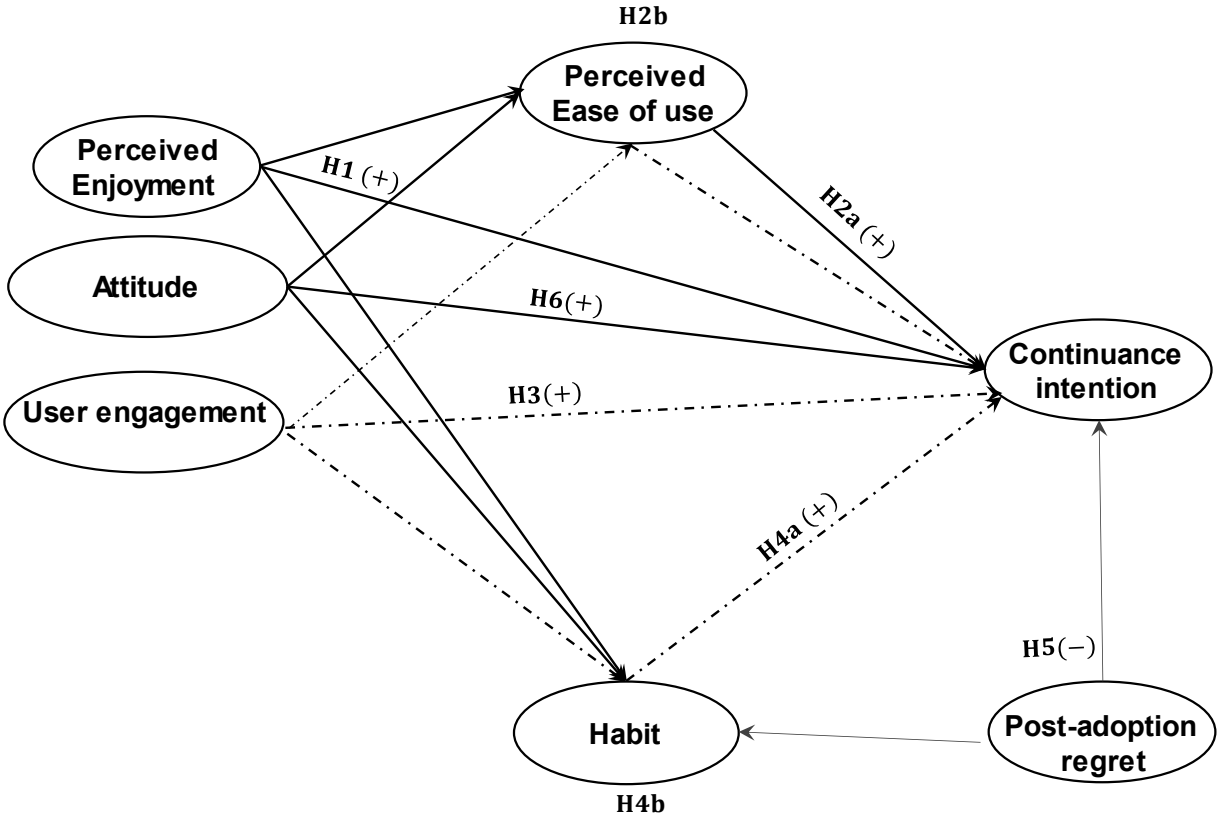

Figure 3.1: Theoretical framework
Source: Own elaboration

4 Methodology

To prove the appropriateness of the research and detect limitations, the methodology of this research will be presented in the following chapter. First, the decisions about the nature of the data, the research approach and the data collection will be discussed. Then, the questionnaire design, the sampling strategy and finally the operationalization of constructs will be undertaken.

4.1 Research approach

The goal of this research is to find answers to the formulated research problem. An explanatory research aims to answer why phenomena occur (Sue & Ritter, 2012). So, based on a profound literature review, hypotheses are built that specify relationships between variables. In this case the relationships between PE, PEOU, user engagement, habit, (post-adoption) regret, attitude and continuance intention are examined. Furthermore, quantitative data is gathered to be statistically tested to establish the validity of the relationships. To check the reliability and validity of data, the next chapter describes the data collection process.

4.2 Data Collection

For the present work, the research method of an online survey is chosen to collect data.

The access to unique populations, in this case communities of fitness app users, would be difficult through other channels since they mainly exist in cyberspaces.

Besides the access, the time factor is crucial for the choice of method. In a short amount of time a high number of individuals can be reached. In the same vein, the advantage of costs influences the decision to choose an online survey to gather primary data. Besides the advantages, disadvantages for applying online surveys exist. Especially sampling issues are oftentimes mentioned. Since the data is self-reported, the researcher cannot guarantee that participants provide accurate demographic or characteristic information. Moreover, a self-selection bias can occur. Some individuals ignore survey requests because they might be desensitized by advertisement in the online communities. That is, a tendency can exist that some individuals are more likely to respond, which can lead to a systematic bias (Wright, 2005).

Finally, the author chooses the online survey method, mainly because it allows access to the unique populations of fitness app users. The users can be directly contacted through

communities in the app and groups in other social media platforms, like Instagram and Facebook.

4.3 Design of questionnaire

The questionnaire consists of one filter question, three questions regarding the usage behaviour in terms of frequency, the main body with the questions concerning the constructs and finally three demographic questions.

The first question serves as a filter question, where participants are asked if they user fitness apps in general. Afterwards, the participants are asked to answer three questions that are mainly concerning the fitness apps they are using and their usage behaviour in terms of frequency. Afterwards the main body of the questionnaire contains the usage behaviour, in which the participants should agree or disagree with statements about the app usage on a 7-point Likert scale from strongly agree to strongly disagree. 32 statements are presented to the participants. To prevent participants to cancel the questionnaire before completion, the demographic questions are in the end of the survey. The questionnaire can be studied in Appendix C of this work.

4.4 Sampling

A non-probability convenience sampling approach is implemented. To understand which people are relevant to participate in this study, a target population is formulated. A target population is defined as “the collection of elements or objects that possess the information sought by the researcher and about which inferences are made” (Malhotra & Birks, 2006, p. 140). Consequently, the target population of this study includes all people that are working out with a fitness app that contains gamification elements. Since no exact numbers of the population exist, the worldwide downloads of fitness apps serve as a benchmark of the size of this market. Statista researched that fitness apps have been downloaded 636 million times worldwide in the second quarter of 2020 (Statista, 2020). Another source claims that in 2019 822.42 million fitness app users worldwide existed (Yu et al., 2021). The focus of this study is to investigate the continuance intention of gamified fitness app users, so the participants must be utilizing a fitness app, which contains gamification elements. To ensure this, the respondents are filtered with the first question to understand if they are part of the population. If a participant does not respond “Yes” when asked “Do you currently use any mobile fitness App/s when exercising?”, the respondent is thanked for participating in the survey and the survey is ended. Also, it must be assured that the participant uses a fitness app which is

gamified. So, the second question suggests some of these gamified fitness apps for the participants to choose from. The choice of apps for the questionnaire followed a systematic approach: First, the fitness apps are filtered for gamification elements. By reviewing the study of Cotton and Patel (2019) who looked at the 50 best ranked free fitness and health apps in 2019 and evaluated the apps for presence of game elements, a first selection is made. By looking at the data of Similiarweb for the most popular health & fitness apps worldwide (Similiarweb, 2021) the relevant fitness apps are chosen and checked for gamification elements. Multiple apps were excluded because no game elements were present. Appendix D shows the findings of this analysis. Besides these apps, the participants are given the option in question 2 to fill in another app (Answer: “Other” in Question 2). The mentioned fitness apps will be checked for the presence of game elements after the survey was conducted and in case game elements are present, the apps are included in the study. The results can be found in Appendix D. The strategy of distribution for the questionnaire is developed by seeking suitable networks where users of fitness apps would be reachable, amongst them:

- Instagram,
- In-app communities of the fitness apps,
- Facebook groups of fitness app brands/users,
- Posting the questionnaire on brand channels of the fitness apps,
- Asking participants to share with their fellow app users.

Pre-tests with 10 participants are conducted under similar circumstances to test if the respondents understand the questionnaire structure and items. In case of confusion, questions will be adapted and modified. The results of the pre-tests are the following: Participants of the pre-tests mentioned issues, which were translated into solutions and modifications. Question 2 was adjusted in the way that only the app should be selected which was used the most in the last 30 days. That is, the questions setting was also adapted and only one answer could be chosen. Question 4, regarding the weekly hours of exercise with the fitness app, was modified. The words “on average” were added since fluctuations in hours of exercise can occur according to job, health, or other personal reasons. Moreover, two answer options were added, namely 1-2 hours and 8+ hours to ensure all types of frequencies are included. Language barriers were mentioned since the study was distributed in countries where English is not the official language. The participant suggested to point out a dictionary, which is accurate and easy to use, when distributing the survey. Some participants indicated related topics that they find interesting to research in the area of gamification and fitness apps. The suggestions will be brought forward in the Chapter 6.3 “limitations and suggestions for future research”. Finally, the time of all pre-tests were measured to give an accurate idea of the time frame for the participants.

The next chapter discusses how the constructs under investigation were transformed into relevant questions to be implemented in the questionnaire.

4.5 Operationalization of the constructs

The variables of the framework need to be operationalised, so they can be applied to the online survey. The scales of the variables were predominately adapted from the literature contributions in gamified fitness apps and continuance intention, to ensure validity. Some of the scale items were slightly adapted to fit the theme of this work: continuance intention of gamified fitness apps. Appendix E shows how the author adapted the relevant scales. The following paragraphs discuss the source of each scale that was implemented.

First, a scale for the dependent variable, continuance intention, was identified. The scale was adapted from Bhattacherjee (2001), because it was the dominant scale applied in gamification and social media apps for measuring continuance intention (Hamari & Koivisto, 2015; Hsiao et al., 2016).

Then, PE was operationalized into several items, to enable measurement of PE. In a gamification context, it was used by Koivisto & Hamari (Koivisto & Hamari, 2014) which considered the scale from van der Heijden (2004). Consequently, the author takes this contribution as a suitable source to measure PE.

To enable the measurement of PEOU, the scale was chosen from studies of gamification continuance intention (Hamari & Koivisto, 2015).

The measurement of user engagement will be based on the scale of O´Brien (2018) since the scale is especially suitable for measuring engagement with technology. Also, a short form of the user engagement scale was developed and can be applied in the same sufficient way as the longer scale according to the author. He also suggests applying the shorter version in questionnaires, where other questions are asked (which is the case for this study) and at the same time fatigue and repetition of the participants should be considered. Due to these advices, the following work will apply the short form of the user engagement scale (O'Brien et al., 2018).

To assure reliability and validity, Limayem et al. (2007) developed the scale for habit with three items in a seven-step process. All three items showed high degrees of reliability and validity. The scale was already used in a gamification environment, hence the scale was also applied in this work (Huang et al., 2019).

To measure the level of (post-adoption) regret that users might experience with the app, the following items were adopted from Liao et al. (2017) who measured regret in an online store environment. This scale was utilized to measure the effects of regret on discontinuance intention in a gamified fitness app (Huang et al., 2019).

Lastly, the same attitude scale that was implemented in the work of Hamari and Koivisto in 2015 is applied in this investigation, since the gamification background is similar.

To summarize these analyses, the table in Appendix E shows the source and original as well as adapted items for each scale.

In the following chapter the data obtained from the questionnaire will be analysed, the results presented and discussed.

5 Data analysis and results

The online survey was released on the 16th of July and closed on the 2nd of August. In this time 342 responses were obtained and finally 265 were assumed valid, though still including participants who do not use fitness apps.

The tool used for deploying the online survey was lime survey. The factor analysis, multiple linear regression, with mediating effects and the regression for mediating effects were conducted with SPSS IBM Version 26. First, the data was qualified by applying the filter question. The aim was to exclude any responses from respondents who do not use any fitness apps. After applying the filter, 110 valid responses remained. After looking at the valid responses a sociodemographic profile of the respondents was established.

Moreover, the adequacy of the instruments was tested. For that, an exploratory factor analysis in principal components with varimax rotation was performed to reduce the dimensionality of the data.

The next part of the data analysis concerns the validation of the conceptual framework. To validate the hypotheses, which were formulated in Chapter 3.1, a multiple regression was performed, as well as the mediating effects detected, and the identified results will be presented.

Finally, the findings are discussed and compared related to the research question and the literature which was introduced in the literature review.

5.1 Characteristics and User Behaviour

In total 110 responses were considered for the analysis of the demographic factors. The following table shows the demographic profile for the 110 participants. Only the last question, concerning the use of mobile fitness apps, was derived from all valid 265 answers.

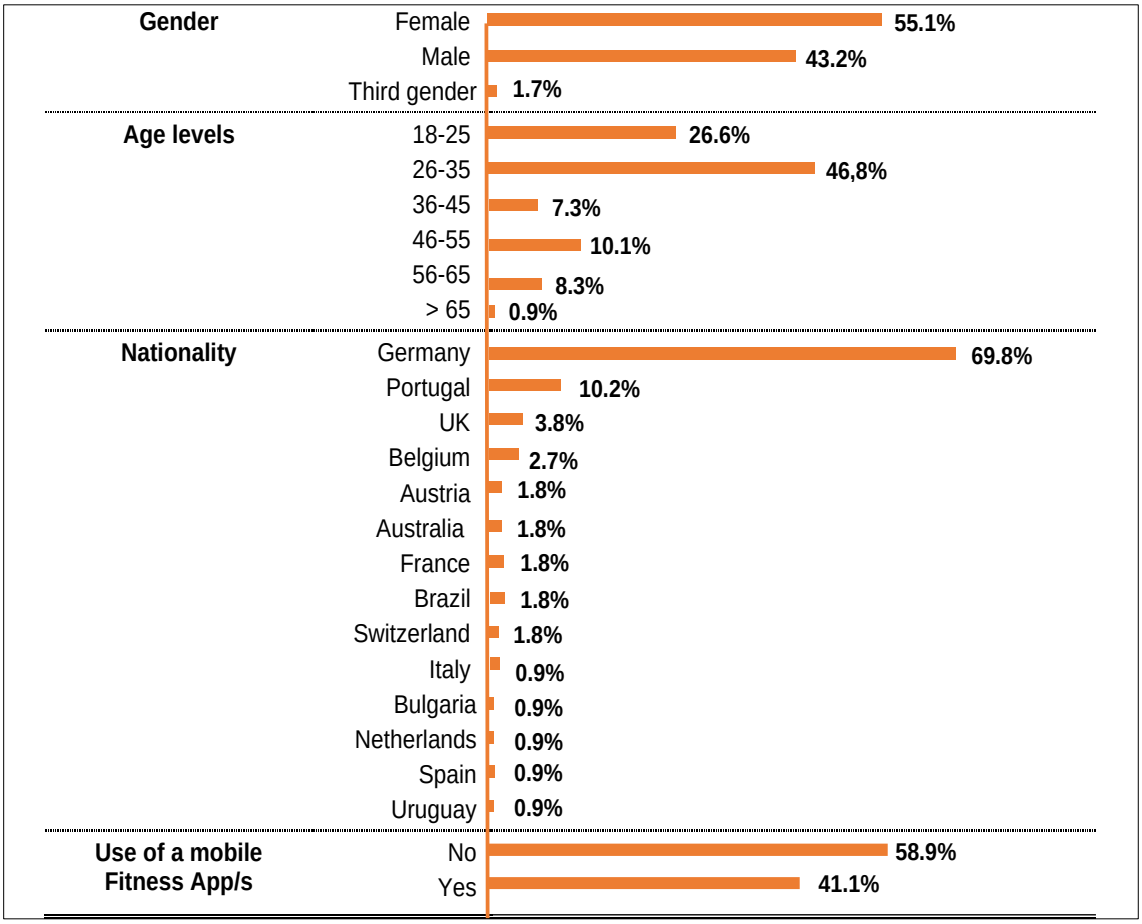

Table 5.1: Profile of respondents
Source: Own elaboration from SPSS

The questionnaire contained questions considering the duration and weekly average of usage, both questions were transformed into the following two graphs to visualize the results.

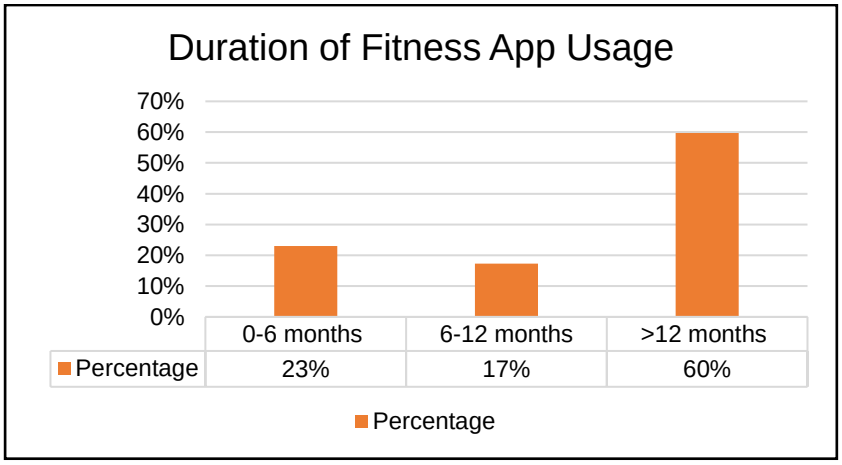

Table 5.2: Duration of fitness app usage
Source: Own elaboration from SPSS

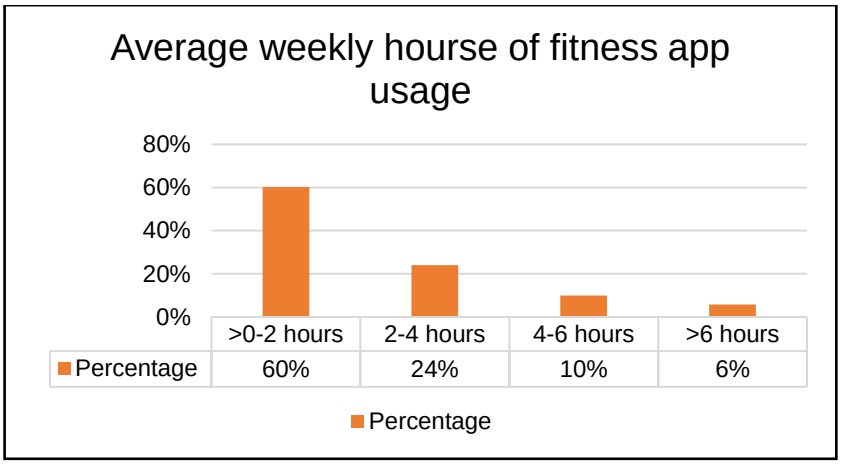

Table 5.3: Average weekly hours of fitness app usage
Source: Own elaboration from SPSS

5.2 Factor analysis

The exploratory factor analyses are conducted to reduce the dimension of the seven instruments. The extracted components for each instrument will serve as the predictors and outcome for the multiple regression model in Chapter 5.3. All relevant results of the factor analysis can be found in Appendix F.

5.2.1 Perceived Enjoyment

The exploratory factor analysis for the instrument PE was conducted and according to the Keyser-Meyer-Olkin (KMO) coefficient (0.783) the input variables are correlated in the sample (Hutcheson, 1999). Also, the Bartlett's test of sphericity suggests that the null hypothesis is rejected, meaning that the input variables are correlated in the population ($p - value <$ 0.001). Finally, the following component matrix shows that there is a one-dimensionality to the instrument, hence only one component is extracted. The component name adopts the instrument name PE.

	Component
	1
[I find the experience of the exercise and the fitness app use interesting.]	.854
[I find the experience of the exercise and the related fitness app use pleasant.]	.841
[I find the experience of the exercise and the related fitness app use enjoyable.]	.820
[I find the experience of the exercise and the related fitness app use exciting.]	.777
Explained variance (%): 67.78	

Table 5.4: Extracted component for the instrument PE
Source: Own elaboration from SPSS

5.2.2 Perceived Ease of Use

For the instrument Perceived Ease of use (PEOU) the exploratory factor analysis showed low communalities (0.449) for the item “Interacting with the fitness app does not require a lot of mental effort.” MacCallum, Widaman, Zhang, and Hong (1999) stated that communalities <0.5 are too low, thus the item was removed from the analysis and the remaining items were used for the factor analysis (MacCallum et al., 1999). The adequacy of the instrument PEOU for this statistical procedure was proved through the KMO coefficient (0.696), which can be interpreted as a mediocre but acceptable result (Hutcheson, 1999).The null hypothesis of the Bartlett test of sphericity, which indicates if the correlation matrix in the population is an identity matrix, is rejected ($p-value$ < 0.001). Finally, one component was identified, which explains the total variance of 69.06 % present in the input data. The following component matrix shows the results. The name of the component will remain PEOU.

	Component
	1
[I find the fitness app easy to use.]	.851
[My interaction with the fitness app is clear and understandable.]	.831
[I find it easy to get the fitness app to do what I want it to do.]	.810
Explained variance (%): 69.06	

Table 5.5:Extracted component for the instrument PEOU
Source: Own elaboration from SPSS

5.2.3 User engagement

After conducting the first exploratory factor analysis for the instrument user engagement, the variable "I lost myself in this experience" was removed due to its low communality (0.381). Kaiser recommends a minimum of 0.5 for the communalities (Kaiser, 1974). After eliminating this item, the KMO coefficient (0.817) shows that the input variables are correlated in the sample, and the Bartlett's test of sphericity dictated that the null hypothesis is rejected ($p - value$ < 0.001). In total 3 components were extracted, which explain 67.21 % of the total variance. The results are presented in Table 5.6.

	Component		
	1	2	3
[I felt interested in this experience.]	**.853**	-.079	.034
[Using the fitness app was worthwhile.]	**.828**	-.126	-.015
[My experience was rewarding.]	**.766**	.029	.218
[The fitness app appealed to my senses.]	**.730**	-.062	.244
[The fitness app was attractive.]	**.714**	.087	.439
[The fitness app was aesthetically appealing.]	**.640**	.190	.456
[I found the fitness app confusing to use]	.004	**.866**	-.047
[I felt frustrated while using the fitness app]	.034	**.849**	-.068
[Using the fitness app was taxing]	-.134	**.572**	-.387
[The time I spent using the fitness app just slipped away.]	.125	-.185	**.856**
[I was absorbed in this experience.]	.250	-.168	**.717**
Explained variance (%): 67.21			

Table 5.6: Extracted components for the instrument user engagement
Source: Own elaboration from SPSS

The components are named in the following way: Component 1 – Attraction; Component 2 – Frustration; Component 3 – Immersion.

5.2.4 Regret

For the instrument regret the correlation between the input variable in the sample is mediocre, concluding from the coefficient KMO (0.656). The Bartlett's test of sphericity suggests that the null hypothesis should be rejected ($p - value$ < 0.001), showing that the variables of this instrument are correlated in the population. One component was extracted, which will be shown in Figure 5.7 and the name will be adopted from the instrument.

	Component
	1
[I should have chosen another fitness app.]	.804
[I feel sorry for choosing the fitness app.]	.773
[I regret choosing the fitness app.]	.749
Explained variance: 60.18 %	

Table 5.7: Extracted component for the instrument regret
Source: Own elaboration from SPSS

5.2.5 Habit

In the exploratory factor analysis of this instrument, the result for the KMO coefficient (0.724) shows a good correlation between the input variables in the sample. Besides, the Bartlett's test of sphericity suggests rejecting the null hypothesis ($p - value < 0.001$). One component was extracted, as shown in the following Figure 11. The name habit will remain the same for the component.

	Component
	1
[Using the fitness app has become automatic to me.]	,902
[Using the fitness app is natural to me.]	,889
[When exercising, using the fitness app is an obvious choice for me.]	,856
Explained variance: 77.92%	

Table 5.8: Extracted component for the instrument Habit
Source: Own elaboration from SPSS

5.2.6 Attitude

Regarding the instrument attitude, the KMO coefficient was computed to be equal to 0.817, which shows a good correlation between the variables in sample. In Bartlett's test of sphericity, the null hypothesis is rejected ($p - value < 0.001$). The results show one-dimensionality, and one component, called Attitude, was extracted as can be seen in Figure 12. The percentage of total variance explained by one component is 68.56 %.

	Component
	1
[All thing considered, I find using the fitness app a wise thing to do.]	,830
[All things considered, I find using the fitness app to be a good idea.]	,808
[All things considered, I find using the fitness app to be a positive thing.]	,849
[All things considered, I find using the fitness app to be favorable.]	,824
Explained variance: 68.56%	

Table 5.9: Extracted component for the instrument attitude
Source: Own elaboration from SPSS

5.2.7 Continuance Intention

The instrument continuance intention was analysed for exploratory factor analysis. First, the item “If I could, I would rather discontinue my use of the fitness app” was deleted due to low communalities (<0.500). But, with the elimination of this item, this instrument with only two items has a Cronbach’s Alpha coefficient equal to 0.664, showing some reliability between them which allows to compute its average. The name “Continuance Intention” was adopted from the instrument.

Finally, the extracted components are the following:

- Component: 1 PE
- Component 2: PEOU
- Component 3: Attraction
- Component 4: Frustration
- Component 5: Immersion
- Component 6: Regret
- Component 7: Habit
- Component 8: Attitude
- Construct 9: Continuance Intention

5.3 Multiple linear regression models

Now, the empirical model is adjusted to the new components and is presented below.

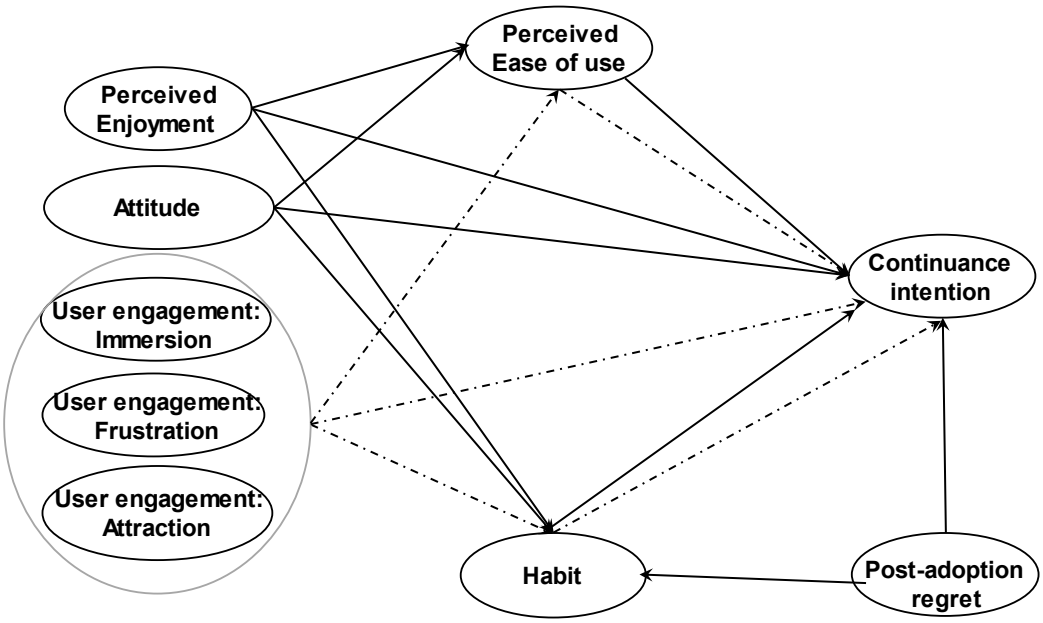

Figure 5.1: Empirical model
Source: Own elaboration

5.4 Multiple linear regression model to detect mediating effects

In order to detect mediation effects between the independent variable X on the dependent variable Y, a third-step regression method was used. This approach was introduced by Baron and Kenny (1986) and improved by Andrew F. Hayes who developed a PROCESS that simplifies the calculations of this method (Hayes, 2018). This approach was followed for all mediations in the conceptual framework.

Therefore, the multiple regression models are specified as the following:

$$M_i = \alpha_0 + \alpha_1 X_{1i} + v_i$$

$$Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 M_{ki} + \beta_3 X_{2ki} + \varepsilon_i$$

$$Y_i = \beta'_0 + \beta'_1 X_{1i} + \beta'_3 x_{2ki} + \tau_i$$

where the dependent variable is Y, continuance intention to use the fitness app; X_{1i} $(i = 1, 2)$ are the independent variables; M_k $(k = 1, 2)$ are the potential mediating variables that may mediate the relationship between X_{1i} and Y_i; X_{2ki} are a set of covariates such as regret that can explain the dependent variable; and $v_i, \varepsilon_i, and\ \tau_i$ are the error terms (random variables) for each regression. The total effect of X_1 on Y is $\hat{\beta}'_1$ and the direct effect of X_1 on Y is $\hat{\beta}_1$.

Since the independent variables are the components extracted from the exploratory factor analysis, they have a mean equal to zero and thus there is no need to center the variables $(x_i - \bar{x})$. The sample size is equal to 110 observations.

To estimate each model, the linear multiple regression model is the statistical approach to be used to estimate the detailed empirical model with the PROCESS v3.5 by Andrew Hayes, Model 4. A bootstrap approach with 5000 samples; and a heteroscedasticity-consistent standard error as well as a covariance matrix estimator were utilized.

Only the models which showed a significant mediation effect will be presented in the following sections.

5.4.1 Model 1

When the independent variable is the construct PE and the mediator is the construct PEOU, the results are the following:

Mediators (outcomes)	Coefficients	Estimated coefficients	p values	R^2
Perceived ease of use	constant	-0.013	0.840	0.482
	Perceived enjoyment	0.264	**0.093**	
Covariates	Attractiveness	0.060	0.653	
	Frustration	0.286	0.020	
	Immersion	-0.047	0.578	
	Regret	0.130	0.268	
	Attitude	0.404	0.002	

Table 5.10: Estimations when the independent variable is the construct PE
Source: Own elaboration from SPSS

From table 5.10, it can be said that PE significantly explains the mediator if the level of significance is 0.1.

From table 5.11 it can be said that the PEOU (the mediator) significantly explains the dependent variable (continuance intention) if the other independent variables are held constant (for a level of significance equal to 0.1). Therefore, the direct effect of PE (X_{11}) is equal to 0.300.

	Estimated coefficients	**p values**	R^2
Constant	5.618	0.000	0.532
Perceived enjoyment	0.300	0.071	
Perceived ease of use	0.262	**0.010**	
User engagement attraction	0.136	0.449	
User engagement frustration	-0.141	0.191	
User engagement immersion	0.022	0.800	
Post-adoption regret	-0.163	0.139	
Attitude	0.297	0.103	

Table 5.11: Estimations when the outcome variable is continuance intention to use the App (Y) and the independent variable is the PE
Source: Own elaboration from SPSS

	Estimated coefficients	**p values**	R^2
Constant	5.615	0.000	0.511
Perceived enjoyment	0.369	0.021	
User engagement attraction	0.152	0.380	
User engagement frustration	-0.067	0.532	
User engagement immersion	0.009	0.914	
Post-adoption regret	-0.130	0.264	
Attitude	0.403	0.011	

Table 5.12: Estimations when the outcome variable is continuance intention to use the App (Y) and the independent variable is the PE, without the mediator
Source: Own elaboration from SPSS

From Table 5.12, it can be inferred that the total effect of PE (X_{11}) on Y is equal to 0.369, meaning that the indirect effect of X_{11} on Y is 0.069 due to the presence of the mediator.

5.4.2 Model 2

When the independent variable is the construct attitude and the mediator is the construct PEOU, the results are the following:

Mediators (outcomes)	**Coefficients**	**Estimated coefficients**	**p values**	R^2
Perceived ease of use	constant	-0.013	0.840	0.482
	Attitude	0.404	**0.002**	
Covariates	Perceived enjoyment	0.264	0.093	
	User engagement attraction	0.060	0.653	
	User engagement frustration	0.286	0.020	
	User engagement immersion	-0.047	0.578	
	Regret	0.130	0.269	

Table 5.13: Estimations when the independent variable is attitude
Source: Own elaboration from SPSS

From Table 5.13, it can be said that attitude significantly explains the mediator.

From Table 5.14, it can be said that the PEOU (the mediator) significantly explains the dependent variable (continuance intention) if the other independent variables are hold constant (for a level of significance equal to 0.05 or 0.1). Therefore, the direct effect of attitude (X_{12}) is equal to 0.297.

	Estimated coefficients	**p values**	R^2
Constant	5.618	0.000	0.532
Attitude	0.297	0.104	
Perceived ease of use	0.262	0.010	
Perceived enjoyment	0,300	0,071	
User engagement attraction	0.136	0.449	
User engagement frustration	-0.141	0.191	
User engagement immersion	0.022	0.800	
Post-adoption regret	-0.164	0.139	

Table 5.14: Estimations when the outcome variable is continuance intention to use the App (Y) and the independent variable is attitude
Source: Own elaboration from SPSS

	Estimated coefficients	**p values**	R^2
Constant	5.615	0.000	0.511
Attitude	0.403	0.021	
Perceived enjoyment	0.369	0.0210	
User engagement attraction	0.152	0.380	
User engagement frustration	-0.067	0.532	
User engagement immersion	0.009	0.914	
Post-adoption regret	-0.130	0.264	

Table 5.15: Estimations when the outcome variable is continuance intention to use the App (Y) and the independent variable is attitude, without the mediator
Source: Own elaboration from SPSS

From Table 5.15, it can be referred that the total effect of the attitude (X_{12}) on Y is equal to 0.403, meaning that the indirect effect of X_{12} on Y is 0.106 due to the presence of the mediator.

5.4.3 Model 3

When the independent variable is the construct attitude and the mediator is the construct habit, the results are the following:

Mediators (outcomes)	Coefficients	Estimated coefficients	p values	R^2
Habit	constant	0.032	0.573	0.656
	Attitude	0.406	**0.003**	
Covariates	Perceived enjoyment	0.092	0.491	
	User engagement Attraction	0.346	0.001	
	User engagement Frustration	0.076	0.344	
	User engagement Immersion	0.125	0.030	
	Regret	0.052	0.485	

Table 5.16: Estimations when the independent variable is the construct attitude
Source: Own elaboration from SPSS

From Table 5.16, it can be said that attitude significantly explains the mediator habit if the other independent variables are hold constant.

From Table 5.17, it can be said that the mediator habit significantly explains the dependent variable (continuance intention) if the other independent variables are hold constant and for a level of significance equal to 0.1. Also, the direct effect of attitude (X_{13}) on Y is equal to 0.295.

	Estimated coefficients	**p values**	R^2
Constant	5.606	0.000	0.526
Attitude	0.295	0.117	
Habit	0.268	**0.059**	
Perceived enjoyment	0.345	0.034	
User engagement attraction	0.059	0.724	
User engagement frustration	-0.087	0.404	
User engagement immersion	-0.024	0.778	
Post-adoption regret	-0.144	0.207	

Table 5.17: Estimations when the outcome variable is continuance intention to use the App (Y) and the independent variable is attitude
Source: Own elaboration from SPSS

	Estimated coefficients	**p values**	R^2
Constant	5.615	0.000	0.511
Attitude	0.403	0.021	
Perceived enjoyment	0.369	0.021	
User engagement attraction	0.152	0.380	
User engagement frustration	-0.067	0.532	
User engagement immersion	0.009	0.914	
Post-adoption regret	-0.130	0.264	

Table 5.18: Estimations when the outcome variable is continuance intention to use the App (Y) and the independent variable is attitude, without the mediator
Source: Own elaboration from SPSS

From Table 5.18, it can be concluded that the total effect of attitude (X_{13}) on Y is equal to 0.403, meaning that the indirect effect of X_{13} on Y is 0.109 due to the presence of the mediator.

In conclusion, three mediating effects were detected:

- Two mediating effects were identified when the mediator is the 'PEOU', and the independent variables are 'PE' and 'attitude'
- One mediating effect was found when the mediator is 'habit', and the independent variables is 'attitude'.

  The signs of the independent variables on the mediators are presented in the Tables 5.19 and 5.20 below.

Model	Mediators	Independent variables	Signs
Model 1	Perceived ease of use	Perceived enjoyment	+
Model 2		Attitude	+
Model 3	Habit	Attitude	+

Table 5.19: Signs of independent variables on mediators
Source: Own elaboration from SPSS

Model	Dependent variable	Mediators	Signs
Model 1	Continuance Intention	Perceived ease of use	+
Model 2			+
Model 3		Habit	+

Table 5.20: Signs of mediators on dependent variable
Source: Own elaboration from SPSS

In sum, three mediation models were identified: two of them are related with the mediator PEOU and one related to the mediator habit. The corresponding estimated mediating effects are visualized in the following Figure 5.2:

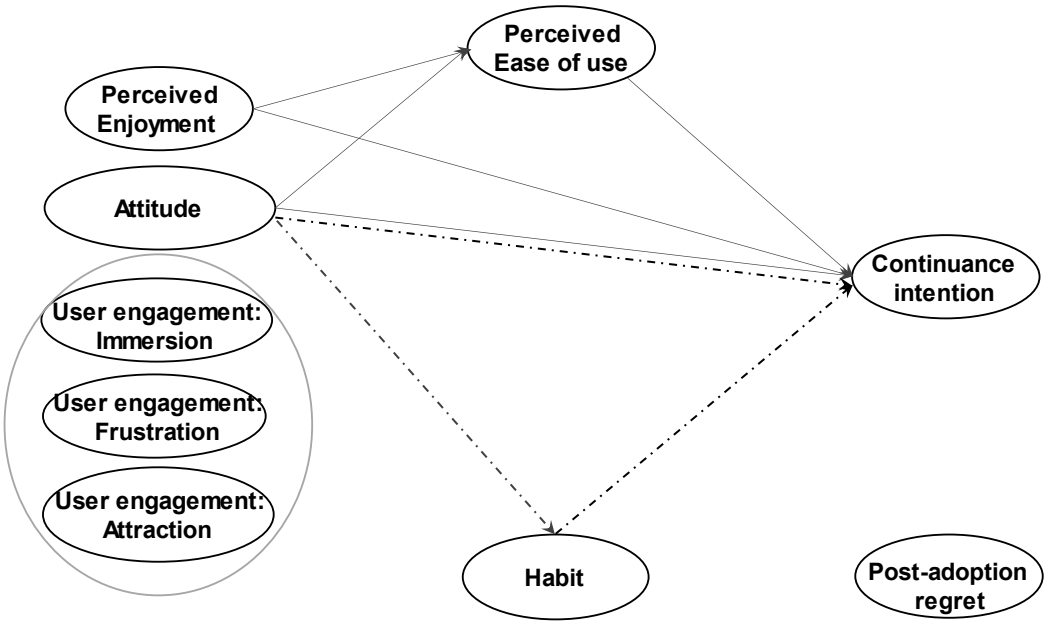

Figure 5.2: Estimated empirical model with mediating effects
Source: Own elaboration

Finally, four direct effects were identified. PEOU, PE, Attitude and Habit have a direct positive influence on Continuance intention. The following figure shows the estimated empirical model with direct effects.

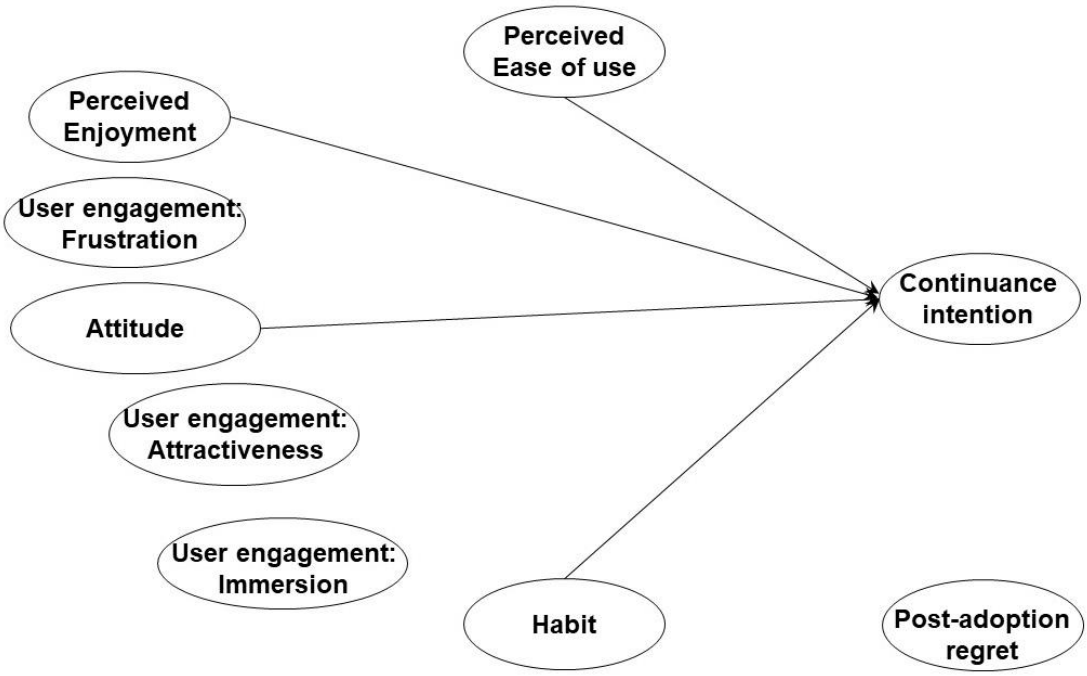

Figure 5.3: Estimated empirical model with direct effects
Source: Own elaboration

5.5 Hypotheses validation

Finally, as discussed in Chapter 3.1, six potential determinants which explain continuance intention were examined and two mediators were checked for mediating effects. By looking at the regression models presented in the chapter 5.4, the hypotheses can be validated or rejected. The eight research hypotheses that were brought forward are listd in Table 5.21. After analyzing the data, in this chapter all hypotheses are finally accepted or rejected. The following table summarizes these findings.

Hypotheses	Validation
H1: PE positively explains continuance intention.	Accepted
H2a: PEOU positively explains the continuance intention.	Accepted
H2b: PEOU is a potential mediator in this model.	Partially accepted when the independent variables are PE and attitude
H3: User engagement positively explains continuance intention.	Rejected
H4a: Habit positively explains the continuance use intention.	Accepted
H4b: Habit is a potential mediator in this model.	Partially accepted when the independent variable is attitude
H5: Post-adoption regret negatively explains the continuance intention.	Partially accepted but not significant
H6: Attitude explains the continuance intention.	Accepted

Table 5.21: Hypothesis validation
Source: Own elaboration

5.6 Discussion

In this chapter the findings of the study will be discussed, independently addressing all predictors which have an explanation power for the outcome, continuance intention. Moreover, the validated mediating effects will be discussed.

As a theoretical contribution and to gain a holistic view of continuance intention in gamified fitness apps, user engagement was implemented into the model. Also, the mediating effects, with habit and PEOU as mediators, between the independent and the dependent variables were tested. These results correspond with previous research in some terms but contradict in other terms.

First, PE was found to positively explain continuance intention and is mediated by PEOU. Hamari and Koivisto (2015) as well as Huang et al. (2019) found that PE can directly influence how much people are willing to continue using the app. Gamified systems, like the fitness apps, try to implement game elements to embed playful and fun elements in non-game

contexts (Werbach & Hunter, 2020). Through these implemented systems, the PE could be increased and affect the intentions to continue using the app.

Second, PEOU can positively explain the continuance intention of fitness app users. This result is according to the findings of Hamari and Koivisto (2015). This finding also goes further back in time to the contributions of Davis et al (1989). In their TAM they found that PEOU positively influences the intention to continue using the technology. Even though their research was conducted in an organizational environment, still PEOU can contribute to the continuance use intention in a non-organizational environment, like the fitness app environment.

The mediation of PEOU between PE and continuance intention is an insight that contradicts previous studies like the study of van Heijden (van der Heijden, 2004). The mediation effect found in van Heijden's study is reversed. He found that PEOU is mediated by PE. In the paper of van Heijden (2004) it was discussed that PEOU can contribute to the enjoyment value of hedonic technological systems. However, the results from this study can be interpreted that people who enjoy using the fitness app also find it easier to use it. Both findings - PE can explain continuance intention and PEOU can mediate this relationship - could be crucial in understanding what can retain gamified fitness app users.

Another mediation was detected - PEOU mediates the relationship between attitude and continuance intention. Attitude is oftentimes referred to as a summary evaluation of an object (Buil et al., 2013). By evaluating the fitness app and gaining a favourable attitude, the PEOU will increase. Hence, if a user forms a positive attitude, the use might become easier because the user thinks the fitness app offers value. That in turn will lead to the intention to continue using the app.

Furthermore, attitude positively explains continuance intention. A favourable attitude towards fitness apps could therefore increase the continuance intentions. This was also found in Hamari and Koivisto's (2015) studies in a gamification app environment. In a gamified app the accomplishment of orchestrated tasks and other gamification elements could lead to positive attitudes. Positive attitudes in turn might convince the user to take on future challenges and he continues using the app.

Habit can likewise predict the outcome variable. The results show that 60.21 % of all fitness app users of the sample use the app on average 0-2 hours per week and 24.08 % 2-4 hours (Tables 5.2 and 5.3). Moreover, 59.69 % of users already utilize the app more than 12 months. This could indicate that the use of the app has been habituated. Thus, it could hint that the users are less prone to neither quit the usage, nor to switch to another app. This finding is consistent with the findings of other studies (Huang et al., 2019; Nascimento et al., 2018). Habit furthermore mediates the relationship in between attitude and continuance in-

tention. So, if a user develops a favourable attitude by a positive overall evaluation of the fitness app, the user is more likely to form a habit to use the app regularly.

A surprising finding was that contrary to the study from Bitrián et al. (2021) user engagement could not explain the continuance intention of fitness apps. Though, only few numbers of studies have examined the relationship between user engagement and continuance intention of gamified fitness apps, the research in this area can still be seen as scarce.

Lastly, regret was not detected to negatively explain continuance intention in fitness apps, even though it was the strongest indicator in positively explaining discontinuance intention in the study of Huang et al. (2019). Since competition is high in the fitness app industry and many alternatives exist, it is easy for a user to compare apps. The explanation why regret might not be an important determinant of continuance intention could be, that many fitness apps are free or have a freemium version, that is, initial costs are low or zero. So, this could mean regret is less likely to occur since switching costs are low or zero. This might be different for apps which require a subscription. Another reason could be that since 2019 the awareness and information about fitness apps have increased, so that people are basing their decision to start using a fitness app on more information and less uncertainty.

As a conclusion to this work, the determinants of continuance intention in gamified fitness apps that were detected are: PE, PEOU, Attitude and Habit.

6 Conclusion

6.1 Theoretical contributions

The goal of this work was to detect the determinants of continuance intention in gamified fitness apps.

The literature, which this work is focused on, does not include the construct user engagement in the continuance intention model of gamified fitness apps. Bitrián et al. (2021) only tested the relation between user engagement and continuance intention, but not with mediating effects. In conclusion, in this study, no significant effects were found between user engagement constructs on the continuance intention to use the app. Thus, more studies need to be done to clarify this issue.

An important finding that contributes to the research field is habit as a mediating variable. Habit proved to have a predictive power on the outcome continuance intention. Moreover, habit also mediates the relationship between attitude and continuance intention. Since this study is limited in some ways, more attention should be paid to the construct habit in continuance intention of mobile apps.

A relevant mediation effect that was found, was the mediation of PEOU between PE and continuance intention. It also invites researchers to examine this relationship further and try to apply this finding to other app industries which implement gamification.

Whereas user engagement does not seem to be a suitable instrument to be included in theoretical models, the findings reveal that researchers could adopt the significant constructs and mediations into their continuance intention of technology.

6.2 Managerial Implications

The research findings provide ‘food’ for thought for practitioners, for example in the areas of gamification app design, marketing as well as product management. Besides the fitness industry, also other app industries could draw their conclusions and implement suitable measures. This chapter is structured like Chapter 5.6. The constructs that influence continuance intention of gamified fitness app will be discussed one by one from a practical perspective.

The fun in a fitness app is key. PE is a factor that needs to be considered when designing a fitness app. More resources should be devoted to injecting enjoyment in apps, even though it could appeal that a fitness app needs more utilitarian value, the findings show that hedonic value is very relevant for the user (Hamari & Koivisto, 2015). Thus, implementing game elements which are fun, could result in screen time. Rewards, performance ranking and in-app bonuses could be striking game elements that lead to more continuance use intentions. Mobile app providers should explore the triggers that lead to mobile app enjoyment for their target group. But not only does the enjoyment mean continuance intention, but also the user could perceive the system as easier to use. By implementing simple interfaces and supporting the user intensely in initial phase of usage, it could be easier to operate the app and in turn retain the user. If new entrants on the market find a way to make the system more accessible and comprehensible, the competitive advantage of established technologies can be eroded. This was found in technologies of the travel industry (Filieri et al., 2021). In a fitness app environment, the customer journey could help understand the PEOU and which struggles the user might face. For example, for some fitness apps, they are usually used on the go, so signal strength and a well-developed GPS integration could be crucial. The Nielsen Norman Group has developed the PURE (Pragmatic Usability Rating by Experts) method which quantifies difficulties of technology use and gives insides how to fix it. Their approach is based on a quantitative rating of usability experts. These experts should be chosen based on the target user types. Then, a score will be computed by measuring the frictions the system causes the user on a pre-defined task. A panel discussion afterwards can also

support the findings and give insights how to overcome the frictions and improve the ease of use (Rohrer, 2017).

Habit was detected as explaining the continuance intention of gamified fitness users. According to Nir Eyal, the co-author of the book "How to build habit-forming products", companies that form strong user habits will have a competitive advantage (Eyal & Hoover, 2014). The authors state that especially internal triggers attached to the product, can lead to the user operating the app without any external call. The product should be aligned with the daily routines and emotions of the user. The hook model, invented by Nir Eyal, expresses how the manifestation of a habit works: first there is a trigger, which can be an external trigger also, e.g., an app icon for the fitness app. Then, the behaviour follows in anticipation of the reward. For a fitness app this could be the fitness activity that is performed. Rewards are the next step. Variable rewards are the most relevant tools to implement hooks. Here, game elements could play an important role since rewards are a dominant strategy of strengthening the reward feelings for users, besides a good feeling of having accomplished a workout. The last step in the hook model is the investment. This is when the user needs to re-enter the cycle and perform another workout with utilizing the app. The investment can be time, data, or the effort. Along these 4 steps – trigger, action, variable reward, and investment – fitness app providers can improve their performance. This can be done by for example conducting user behaviour analysis. Understanding who is a devoted user and how often this user practices with the fitness app is the first step here. This can be based on company data. When the habitual user was found it is important to understand the journey of this users and how the app became a habit. This so-called *habit path* can help to understand what made the user become a habitual user. It consists of similar actions shared by the most loyal users. When these actions are discovered, they can be modified in the next step. In a gamified fitness app, it could be that users have a certain number of bike rides they need to accomplish with the app or by reaching the next level they enable a new product feature. By facilitating all actions until the user reaches this tipping point could leverage loyalty.

Lastly, a positive attitude can enhance use intentions which needs to be the focus of UX design and marketeers. Attitudes are created by beliefs and excitements. If people have a favourable attitude towards embedding information technology in their life in general, it could lead them to be more open towards performing fitness apps. App providers should try to plan how to create positive attitudes for the user. Educating users about the use of fitness apps and how they can gain information from the usage and improve their skills, could be a suitable measure to improve attitudes. It is also crucial to understand what forms a favourable attitude of the target group. In fitness apps it was found that the social influence had an effect on the attitude (Hamari & Koivisto, 2015). It could be that users look up to peers or identify with the fitness app, hence, try to promote their self-image with it. Also, game elements could

support the ability to connect with a community and share their challenges. By considering the social influence that affects the attitude towards a fitness apps, features should be promoted that enable the exchange between users. Moreover, influencers in the area, e.g., professional athletes, could be a suitable way to put emphasis on the social influence.

Attitudes also increase the PEOU and the habit forming. So, it is a very crucial concept in the model of continuance intention of fitness apps and resources need to be focused on examining what can form positive attitude for the specific target.

6.3 Limitations and suggestions for future research

Despite the efforts to prevent bias and include all relevant information, every study has limitations. The following chapter will explain the limitations this study has to face; however, these limitations might reveal future paths for research and help other researchers to consider and overcome these difficulties in their work.

First, the construct was chosen, because continuance intention of mobile apps, in this case fitness apps, can drive app providers to improve their apps, and by that prevent churn. However, an intention does not necessarily result in the behaviour. It is easier to measure and might disclose a certain tendency but does not guarantee continuance usage.

Another limitation was to implement all determinants into the construct. As Figure 2.5 depicts, continuance intention of fitness apps is a rather complex construct and still there might be many determinants missing. To continuously improve this model, relevant aspects need to be added; existing and tested determinants questioned. A special intention should be drawn to the construct of “satisfaction” which plays an essential role in the continuance intention model by Bhattacherjee. Contradictive results were shown regarding the predictive power of this construct on continuance intention. Since one of the key studies which this work is based on, found no predictive power on continuance intention, it was excluded from the concept. Though, this is a construct that was found relevant in other studies to explain continuance intention.

The influence on precise gamification features was not considered in this study. It is not clear which gamification features could influence the continuance intention or the motivation of the fitness app users.

Besides, one instrumental limitation that appeared was the language barrier. Most literature exists in English and the master was studied in English. Since the constructs are operationalized in English and the common language for most stakeholders of this work is English, it was considered the most suitable language for the questionnaire. Finally, as can be seen in Table 1, most participants of the study (≈70 %) were Germans. Many of these people have

expressed difficulties with the language, thus, to translate the study could have helped the participants and less participants would have aborted the study before finalizing it.

Finally, probability sampling could not be applied. To ensure all individuals from a population have the same probability to be included in the sample, it is a requirement for probability sampling (Vehovar et al., 2016). To conduct a probability testing was not possible for this work, because the access to all units of the population is not possible. This could be improved by formulating a more specific target group.

For the future these limitations can serve as solid ground for conducting more studies in the field. Various ideas for future research are discussed in the next paragraphs.

First, data could be collected from the usage of fitness app users and compliment the study's findings. Since the study focused on the intentions instead of actual behaviours, this could validate if the determinants that were found influence not only the intention, but also reflect in actual usage. In the same vein, it is crucial to underline that, if the bootstrap approach was not used, not only influent outliers had to be excluded, but also the filter question, which excluded participants who do not use fitness apps, decreased the number of the valid responses and, thus, a bigger sample size would be needed. Hence, I suggest exploring a better access to the users of fitness apps for future studies, by, for example, cooperating with fitness app. Also, considering other app categories, which oftentimes have gamification features implemented, could lead to new insights.

Moreover, new determinants for continuous intention can be explored. The construct satisfaction should be included in a future study to validate the results found in the studies this work is based on.

Besides, the most relevant gamification features for positively influencing continuance intention in fitness apps could be added to the model.

Another future research path could be to include new technologies in the study, like augmented reality or IOT. How can gamification features support these technologies in continuance intention?

All these limitations and suggestions show that the discussed topics are a rising trend, and more research is needed to explain the topics continuance intention in new technologies, gamification, and fitness apps. It remains interesting in what way these research strings will evolve in the future.

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8 Appendix

A. Frequency of game elements in fitness and health apps.

Game element	Frequency of use (%)
Goals	78,1 %
Social influences	78,1 %
Challenges	62,5 %
Collaboration	46,9 %
Competition	40,6 %
High Scores	21,9 %
Badges	18,8 %
Narrative	12,53 %
Streaks	9,4 %
Points	6,3 %

Figure 8.1: Frequency of game elements in fitness and health apps

B. Studies of continuance intention in gamified fitness apps

Work	Context	Variables directly influencing continuance/discontinuance intentions	Results
(Huang et al., 2019)	Discontinuance Intention of Gamified fitness App	Regret PU Satisfaction Habit Gamification App Value Discontinuance intention	Regret, Habit and Gamification App Value had a significant influence on discontinuance intention.
(Hamari & Koivisto, 2015)	Continuance intention and attitude towards Gamified fitness App	Usefulness Enjoyment Playfulness Recognition, Ease of use Attitude Continuance intention	PEOU, PE, and attitude had a significant influence on continued use intentions.
(Bitrián et al., 2021)	User Engagement of Gamified fitness Apps	User engagement Continued Use Intention	User engagement had a significant influence on continued use intention.
(Hsiao et al., 2016)	Continuance Intention of Mobile Social App	Satisfaction PE Habit Social Ties Continued Use intention	Users' satisfaction, connection with others, and hedonic motivation to use the apps had direct and significant influence on continuance intention.
(Nascimento et al., 2018)	Continuance Intentions in smartwatches	Habit PU Satisfaction PE Continuance intention	PU, satisfaction, habit, and perceived usability can enhance the continuance intention.

Table 8.1: Studies on gamification and continuance intention

C. Questionnaire

Background Questions:

Do you currently use any mobile Fitness App/s when exercising? (Examples: Komoot, Strava, Nike Run Club, Fitbit etc.)	Yes No
Please select the Fitness App you have used the most in the last 30 days. (If you use another Fitness App than the examples, please choose the option "Other" and write your answer in the empty text box.)	(Please choose only one of the following) Komoot Adidas Runtastic Steps App Pedomenter Fitbit Nike Run Club Strava Sweat Zepp Other (Please specify in the empty text box)
How long have you been using the Fitness App? (In case you are using several apps, please answer the following question regarding the most used one)	(Please choose only one of the following) Less than 1 month 2-6 months 7-12 months 13-18 months More than 18 months
How many hours do you exercise on average per week with the Fitness App?	(Please choose only one of the following) Less than 1 hour 1-2 3-4 5-6 7-8 8+

Regarding the use of your Fitness App please answer on a scale, from strongly agree to strongly disagree, which statements apply to you.	
PE	**1 "Strongly disagree" …"7 "Strongly agree**
Regarding the use of your Fitness App please answer on a scale, from strongly agree to strongly disagree, which statements apply to you.	**1 2 3 4 5 6 7**
I find the experience of the exercise and the related fitness app use pleasant.	**1 2 3 4 5 6 7**
I find the experience of the exercise and the related fitness app use exciting.	**1 2 3 4 5 6 7**
I find the experience of the exercise and the fitness app use interesting.	**1 2 3 4 5 6 7**
PEOU	
Interacting with the fitness app does not require a lot of mental effort.	**1 2 3 4 5 6 7**
My interaction with the fitness app is clear and understandable.	**1 2 3 4 5 6 7**
I find the fitness app easy to use.	**1 2 3 4 5 6 7**
I find it easy to get the fitness app to do what I	**1 2 3 4 5 6 7**

want it to do.	
User engagement	
I find it easy to get the fitness app to do what I want it to do.	**1 2 3 4 5 6 7**
I lost myself in this experience.	**1 2 3 4 5 6 7**
The time I spent using the fitness app just slipped away.	**1 2 3 4 5 6 7**
I was absorbed in this experience.	**1 2 3 4 5 6 7**
I felt frustrated while using the fitness app.	**1 2 3 4 5 6 7**
I found the fitness app confusing to use.	**1 2 3 4 5 6 7**
Using the fitness app was taxing.	**1 2 3 4 5 6 7**
The fitness app was attractive.	**1 2 3 4 5 6 7**
The fitness app was aesthetically appealing.	**1 2 3 4 5 6 7**
The fitness app appealed to my senses.	**1 2 3 4 5 6 7**
Using the fitness app was worthwhile.	**1 2 3 4 5 6 7**
My experience was rewarding.	**1 2 3 4 5 6 7**
I felt interested in this experience.	**1 2 3 4 5 6 7**
Continuance Intention	
I intent to continue using the fitness app rather than discontinue its use.	**1 2 3 4 5 6 7**
My intentions are to continue using the fitness app than use any alternative fitness apps.	**1 2 3 4 5 6 7**
If I could, I would like to discontinue my use of the fitness app.	**1 2 3 4 5 6 7**
Habit	
Using the fitness app has become automatic to me.	**1 2 3 4 5 6 7**
Using the fitness app is natural to me.	**1 2 3 4 5 6 7**
When exercising, using the fitness app is an obvious choice for me.	**1 2 3 4 5 6 7**
Regret	
I feel sorry for choosing the fitness app.	**1 2 3 4 5 6 7**
I regret choosing the fitness app.	**1 2 3 4 5 6 7**
I should have chosen another fitness app.	**1 2 3 4 5 6 7**
Attitude	
All things considered; I find using the fitness app a wise thing to do.	**1 2 3 4 5 6 7**
All things considered; I find using the fitness app to be a good idea.	**1 2 3 4 5 6 7**
All things considered; I find using the fitness app to be a positive thing.	**1 2 3 4 5 6 7**
All things considered; I find using the fitness app to be favourable.	**1 2 3 4 5 6 7**

Demographics:

Please choose your gender	Male Female Non-binary/ Third Gender No answer
Please fill in your country of residence	(Please write your answer here:)

Choose your age please	(Please choose only one of the following) 18-25 26-35 36-45 46-55 56-65 >65

D. Gamification elements in the Fitness Apps of Participants

Fitness App	Game elements	Rating in App Store
Komoot	Collect points and badges for communication your rides, exploration	4.7
Strava	virtual racecourse to compete for leader board, medals, challenges, progress bars, community interaction, “Kudos” (likes)	4.8
Nike Run Club	Challenges, Badges, achievements, sharing achievements	4.7
Fitbit	Challenges, races, points, Competition, community, reminder (nudges), achievements	4.1
StepsApp pedometer	Awards, progress bars,	4.8
Adidas Runtastic	Feedback during the runs, Push messages, community, challenges, cheering button, story runs	4.7
Sweat: Fitness app for Woman	Progress bars, prizes, Badges, social sharing possible, community	4.5
Zepp	In-app challenges, earn achievements, compete on leader boards, and win prizes, PAI (Personalized Activity Intelligence) points	4.5
Garmin connect	In-app Challenges, Goals, progress bars, social sharing, leader boards, community	3.7
Polar App	Heart rate challenges, social sharing, in updated version: targets and goals	4.4
Google Fit	Points collecting for cardio activity, progress bars, Challenges	3.7
Equilab	Progress bars, Community	4.7
Peloton	Achievements, Challenges, Community, sharing	4.8
Runkeeper	Challenges, Goals, Leader board, sharing with community	4.6
Tom	Goals, Rewards, Challenges, sharing on social media possible	4.2
Samsung Health App	Goals, Achievement, Rankings, Community, Game like interface, Holiday challenge, progress bars	4.3
Sports Tracker	Sharing, Community, stars, Goals, progress bars, diary	4.3
Freeletics	Daily recaps, progress bars, sharing, goals	4.6
Gymondo	Goals, progress bars, Levels	4.7

TK Fit Challenge	Goals, rewards, levels, progress bars	4.8
Body Move App	Sharing, Levels	-
30 days challenge	Badges, Progress bars	4.4
Down Dog	Goals, Levels	4.8
Fitnessblender (excluded)	Community to share	-
Mi Fit (excluded)	-	4.2
All trails (excluded)	-	4.9
Centr (excluded)	Social	4.5
Pamela Reif App (excluded)	-	4.8
Apple Fitness (excluded)	Progress bars	-
Tabata (excluded)	Sharing	4.9

E. Scales for operationalization of concepts

Variable	Source	Scale Items modified for questionnaire	Scale Type	Origin
1. Continuance Intention	(Bhattacherjee, 2001)	CI1. I intent to continue. using the OBD fitness app rather than discontinue. its use. CI2. My intentions are to continue using OBD the fitness app than use any alternative fitness apps. CI3. If I could, I would like to discontinue my use of OBD the fitness app. (reverse coded)	7-point Likert scales anchored between "strongly disagree" and "strongly agree"	First two items were adopted from Mathieson's (1991) behavioural intention (to accept IS) scale. The third item was added to meet Nunnally's (1978) suggested norm of at least three items per construct. The two initial items measured respondent's intention to continue OBD use as opposed to discontinuing its use or using any alternate services such as traditional banking. The third item assessed respondents' overall discontinuance intention (worded negatively to control for potential common-method bias)
2. PE	(Hamari & Koivisto, 2015)	E1. I find the experience of the exercise and the related Fitocracy fitness app use enjoyable. E2. I find the experience of the exercise and the related Fitocracy fitness app use pleasant. E3. I find the experience of the exercise and the related Fitocracy fitness app use exciting. E4. I find the experience of the exercise and the related Fitocracy fitness app use interesting.	7-point Likert scale (strongly disagree – strongly agree)	Van der Heijden (2004) tested enjoyment on a 7-point sematic differentials scale: Enjoyable disgusting Exciting-dull Pleasant-unpleasant Interesting-boring
3. PEOU	(F. D. Davis et al., 1989; Hamari & Koivisto, 2015; Venkatesh & Davis, 1996)	EOU1: Interacting with a computer the fitness app does not require a lot of mental effort. EOU2: My interaction with a computer the fitness app is clear and	7-point Likert scale (highly disagree – highly agree)	

		understandable. EOU3: I find a computer the fitness app easy to use. EOU4: I find it easy to get the computer the fitness app to do what I want it to do.		
4. User Engagement	(O'Brien et al., 2018)	UE1. I lost myself in this experience. UE2. The time I spent using Application x the fitness app just slipped away. UE3. I was absorbed in this experience. UE4. I felt frustrated while using this Application x fitness app. UE5. I found this Application x fitness app confusing to use. UE6. Using this Application x fitness app was taxing. UE7. This Application x fitness app was attractive. UE8. The Application x fitness app was aesthetically appealing. UE9. The Application x fitness app appealed to my senses. UE10. Using the Application x fitness app was worthwhile. UE11. My experience was rewarding. UE12. I felt interested in this experience.	5-point Likert scale (Strongly disagree-strongly agree)	
5. Habit	(Limayem et al., 2007)	H1. Using the WWW fitness app has become automatic to me. H2. Using the WWW fitness app	7-point Likert scale (strongly disagree-strongly agree)	Self-developed by Limayem.

		is natural to me. H3. When exercising, using the WWW fitness app is an obvious choice for me.		
6. Post-adoption regret	(Liao et al., 2017)	REG1: I feel sorry for choosing to shop at the e-store the fitness app. REG2: I regret choosing to shop at the e-store the fitness app. REG3: I should have chosen to shop at another e-store another fitness app.	7-point Likert scale from strongly disagree to strongly agree	Not specified, they only say that they definition of regret comes from (Zeelenberg, 1999)
7. Attitude	(Ajzen, 1991)	A1: All things considered; I find using Fitocracy the fitness app a wise thing to do. A2: All things considered; I find using Fitocracy the fitness app to be a good idea. A3: All things considered; I find using Fitocracy the fitness app to be a positive thing. A4: All things considered; I find using Fitocracy the fitness app to be favourable.	(Hamari & Koivisto, 2015)	Ajzen (1991)

F. Factor Analysis

PE Instrument

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.783
Bartlett's Test of Sphericity	Approx. Chi-Square	227.299
	df	6
	Sig.	.000

Communalities

	Initial	Extraction
[I find the experience of the exercise and the related fitness app use enjoyable.]	1.000	.672
[I find the experience of the exercise and the related fitness app use pleasant.]	1.000	.708
[I find the experience of the exercise and the related fitness app use exciting.]	1.000	.603
[I find the experience of the exercise and the fitness app use interesting.]	1.000	.729

Extraction Method: Principal Component Analysis.

Total Variance Explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.711	67.780	67.780	2.711	67.780	67.780
2	.557	13.914	81.694			
3	.426	10.656	92.350			
4	.306	7.650	100.000			

Extraction Method: Principal Component Analysis.

Component 1 – PE

PEOU instrument

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.696
Bartlett's Test of Sphericity	Approx. Chi-Square	111.229
	df	3
	Sig.	.000

Communalities

	Initial	Extraction
[My interaction with the fitness app is clear and understandable.]	1.000	.691
[I find the fitness app easy to use.]	1.000	.725
[I find it easy to get the fitness app to do what I want it to do.]	1.000	.656

Extraction Method: Principal Component Analysis.

Total Variance Explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.072	69.057	69.057	2.072	69.057	69.057
2	.511	17.023	86.080			
3	.418	13.920	100.000			

Extraction Method: Principal Component Analysis.

Component 1 – PEOU

User Engagement instrument

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.817
Bartlett's Test of Sphericity	Approx. Chi-Square	549.521
	df	55
	Sig.	.000

Communalities

	Initial	Extraction
[The time I spent using the fitness app just slipped away.]	1.000	.783
[I was absorbed in this experience	1.000	.606
I felt frustrated while using the fitness app	1.000	.726
I found the fitness app confusing to use	1.000	.753
Using the fitness app was taxing	1.000	.495
[The fitness app was attractive.]	1.000	.709
[The fitness app was aesthetically appealing.]	1.000	.654
[The fitness app appealed to my senses.]	1.000	.596
[Using the fitness app was worthwhile.]	1.000	.702
[My experience was rewarding.]	1.000	.635
[I felt interested in this experience.]	1.000	.734

Extraction Method: Principal Component Analysis.

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.317	39.245	39.245	4.317	39.245	39.245	3.549	32.261	32.261
2	2.038	18.527	57.772	2.038	18.527	57.772	1.932	17.560	49.821
3	1.039	9.441	67.213	1.039	9.441	67.213	1.913	17.392	67.213
4	.879	7.990	75.203						
5	.573	5.209	80.413						
6	.474	4.305	84.717						
7	.434	3.950	88.667						
8	.409	3.718	92.385						
9	.315	2.862	95.247						
10	.289	2.628	97.876						
11	.234	2.124	100.000						

Extraction Method: Principal Component Analysis.

Component 1 – Attraction
Component 2 – Frustration
Component 3 – Immersion

Regret Instrument

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.656
Bartlett's Test of Sphericity	Approx. Chi-Square	62.694
	df	3
	Sig.	.000

Communalities

	Initial	Extraction
[I feel sorry for choosing the fitness app.]	1.000	.597
[I regret choosing the fitness app.]	1.000	.562
[I should have chosen another fitness app.]	1.000	.647

Extraction Method: Principal Component Analysis.

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1.806	60.188	60.188	1.806	60.188	60.188
2	.648	21.584	81.771			
3	.547	18.229	100.000			

Extraction Method: Principal Component Analysis.

Component 1 – Regret

Habit Instrument

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		,724
Bartlett's Test of Sphericity	Approx. Chi-Square	201,053
	df	3
	Sig.	,000

Total Variance Explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2,337	77,916	77,916	2,337	77,916	77,916
2	,392	13,059	90,975			
3	,271	9,025	100,000			

Extraction Method: Principal Component Analysis.

Communalities

	Initial	Extraction
[Using the fitness app has become automatic to me.]	1,000	,814
[Using the fitness app is natural to me.]	1,000	,791
[When exercising, using the fitness app is an obvious choice for me.]	1,000	,733

Extraction Method: Principal Component Analysis.

Component 1 – Habit

Attitude Instrument

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		,817
Bartlett's Test of Sphericity	Approx. Chi-Square	218,219
	df	6
	Sig.	,000

Total Variance Explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2,742	68,556	68,556	2,742	68,556	68,556
2	,474	11,851	80,407			
3	,425	10,616	91,023			
4	,359	8,977	100,000			

Extraction Method: Principal Component Analysis.

Communalities

	Initial	Extraction
[All thing considered, I find using the fitness app a wise thing to do.]	1,000	,689
[All things considered, I find using the fitness app to be a good idea.]	1,000	,653
[All things considered, I find using the fitness app to be a positive thing.]	1,000	,721
[All things considered, I find using the fitness app to be favorable.]	1,000	,679

Extraction Method: Principal Component Analysis.

Component 1 – Attitude