Master Thesis

The Emotional Impact of mHealth applications on consumers

Master of Science in Business Administration

Specialization Innovation and Entrepreneurship

Supervisor: Olga Tsoumani, MSc
Second examiner: Dr. Ruud Wetzels

Kardelen Bayramusta

s1012208

kardelen.bayramusta@ru.nl

Radboud University

Nijmegen School of Management

Nijmegen, August 15th, 2022

Table of Contents

Abstract

The number and variety of mobile health applications have increased significantly in recent years. Although there has been extensive research regarding the high expectations and benefits offered by mobile health apps, little is known about what consumers experience when using these apps. This study sought to fill this gap by examining the paradoxical tensions generated by mHealth apps, as well as their emotional impact on consumers and their coping strategies to alleviate unpleasant emotions. An in-depth analysis of the paradoxical tensions, emotional reactions and coping strategies associated with the use of mHealth apps by users was conducted using a qualitative approach, including eleven semi-structured interviews. In line with Mick and Fournier's Paradoxes of Technology (1998), this study identified five paradoxes, ten emotional reactions, and four coping strategies. On the basis of these findings, several theoretical and practical contributions are made.

Keywords: *mHealth applications, paradoxes, emotions, coping strategies*

1. Introduction

1.1 Problem description

In the last few years, the social and economic costs of non-communicable diseases (NCDs), also called chronic diseases, have escalated and call for immediate action (Lakerveld et al., 2020). A non-communicable disease is characterized by a long duration and results from multiple factors, such as genetic, physiological, environmental, and behavioural. As per the World Health Organization (2021), NCDs are the leading cause of death worldwide, and cardiovascular diseases are responsible for most NCD fatalities - with an estimated 17.9 million deaths each year. Low physical activity and increased sedentary behaviour are the primary contributors to NCDs. Following a sedentary lifestyle not only increases the number of deaths by millions each year, but it also increases the cost of healthcare by billions of Euros. Inactivity and, specifically, sedentary behaviour cost the European Union healthcare system 80.4 billion Euros each year. This economic cost burden is expected to increase in the future,─and it is estimated to reach €125 billion in 2030 (Greier et al., 2021).

Sedentary behaviour is defined as "any waking behaviour characterised by an energy expenditure ≤1.5 metabolic equivalents (METs), while in a sitting, reclining, or lying posture" (Dempsey et al., 2020). It includes primarily desk-based work, driving a car and watching television (Tremblay, 2017). A study by Kristiansen et al. (2019) revealed that sitting for more than nine hours or more per day increases the hazard ratio of mortality and is linked with a wide range of health concerns. Cardiovascular disease (CVD), cancer, and type 2 diabetes are some of these concerns (Stephenson et al., 2021; Dempsey et al., 2020). To prevent the development of health disease, it is recommended to avoid a sedentary lifestyle by increasing one's physical activity level and by consuming a healthy diet (Tabish, 2017). Such changes, in turn, are expected to positively affect health (Biddle et al., 2016; Blair & Morris, 2009; Müller et al., 2018). Despite efforts by the World Health Organization and the United Nations to raise awareness about the benefits of physical activity and the need to avoid sedentary lifestyles, the public has largely ignored these efforts (World Health Organization, 2014). The majority of people do not adhere to healthy diet guidelines, ignore the importance of regular physical activity, and are overly passive. These behaviours and the difficulty to adopt a healthier lifestyle result in several consequences related to the individual's health, well-being, the health care system and economy, as described above (Ding et al., 2016; Lim et al., 2012; Müller et al., 2018).

A solution to this problem can be found in mobile health applications. In 1999, the term eHealth was first used to describe the use of information and telecommunication technologies

aimed at improving healthcare efficiency, accessibility, and cost-effectiveness (Oh et al., 2005). The use of mobile devices in healthcare has increased steadily over the last few years (Schweitzer & Simon, 2021). This specific type of eHealth has been named mHealth. Based on the definition provided by Akter et al. (2010), mHealth is defined as "a personalised and interactive health service platform whose main objective is to provide ubiquitous and universal access to medical advice and information to anyone using any mobile device". mHealth applications are available not only for health prevention but also for the treatment and monitoring of different diseases. Among the innovative new features in mobile technology are "wearables", such as Smartglasses and Smartwatches, including the well-known Apple Watch, Fitbit and Garmin Watch (Ometov et al., 2021). These digital health applications rely on self-tracking functions and self-qualifications that record physiological and psychological data via sensors, usually combined with personalised everyday information. Wearables and health apps not only help individuals monitor their movements using GPS and accelerometer but also measure their heart rate, physical activity, sleep and temperature since they are in direct contact with their skin (Rawassizadeh, Price & Petre, 2014).

Next, smartwatches and fitness trackers can motivate people to take an active lifestyle by encouraging a positive change in their behavior. Various fitness trackers include behavioural change techniques (BCT), including goal-setting, self-monitoring, and feedback on behaviour, proven to change and increase physical activity (Chia et al., 2019; O'Keeffe et al., 2020). An example of a behavior change strategy is to use a stimulus such as vibrations or push notifications to motivate the individual to become more physically active. An analysis in 2016 found significant behaviour changes when at least three BCT techniques were used simultaneously during a goal-setting intervention (Chia et al., 2019; O'Keeffe et al., 2020).

Mobi Health News reported that by the end of 2021, more than 350,000 digital health apps were on the market (Olsen, 2021). The IQVIA Institute for Human Data Science's 2021 trends report revealed that solely last year, more than 90,000 apps were released, with the main focus on general wellness and fitness (Mobi Health News, 2021). MyFitnessPal, Nike+ Run Club, and Fitbit are among the most popular mHealth apps. While the number of mHealth applications on the market is on the rise, its potential impact on consumer behavior is also becoming increasingly important. In the last years, these digital developments have launched an intense and polarised debate about the positive and negative impact of mHealth apps on consumers (Lupton, 2013; Whitson, 2013; Lupton 2014; Duus, 2015). Although the advantages of mHealth applications look promising, there is still contradictory evidence on the benefits and downsides of mHealth app usage on consumers. On the one hand, a number of studies on

adults have demonstrated that step counters and self-monitoring can lead to substantial improvements in health. Among these are increased physical activity levels, weight loss, reduction in fat percentage, and improvement in diabetes scores (Ganesan et al., 2016; Neil-Sztramko et al., 2017; Skogstad et al., 2016). In addition to positively influencing users' physical health, mHealth apps can also positively affect users' mental health. Greater need satisfaction, greater self-determined forms of motivation, and less demotivation are one of the psychological benefits. Further, positive mHealth experiences, as well as an increased level of activity, have been shown to improve both anxiety and depressive symptoms (Herring et al., 2011). Accordingly, it is argued that mHealth apps result in a reduced incidence of depression-like symptoms (Mumba et al., 2011). Moreover, when users achieve daily targets and expectations, mHealth apps have shown to induce positive emotions, including pride, self-fulfillment, satisfaction, and happiness (Duus et al., 2017). This encourages users to continue meeting their goals and promotes better physical and mental health.

However, there are also several disadvantages associated with mHealth apps. When daily goals, expectations, and provided data do not meet users' expectations, mHealth apps also evoke negative emotions such as: stress, anger, and frustration (Etkin, 2016). In accordance with this, researchers claim that mHealth apps have detrimental motivational effects and that short-term increases in motivation result from guilt, competition, and internal pressure (Kerner & Goodyear, 2017). Moreover, it is argued that most mHealth users only engage with these applications to avoid guilt and to gain social approval. The feeling of guilt associated with not exercising or meeting the daily physical activity goals ultimately results in pressure. Further, poor performance and getting reminded that one is not meeting their targets, results not only in feeling guilt but also, creates feelings of being exposed which in turn leads to emotional distress (Duus et al., 2017; Duus et al., 2018). According to participants of the study by Kerner and Goodyer (2017), most of the days, they felt motivated to reach their 10.000 steps p/day, but at the same time felt under pressure and stressed to do so.

It is therefore possible that positive and negative experiences with mHealth apps may be present at the same time. These self-contradictory consequences are defined as paradoxes (Quine 1966). Paradoxes were also found in a study by Blazevic and Klintwort (2018). Their study revealed that the positive and negative influences of technology sometimes seem to contradict each other and thus, result in a paradox such as motivating vs. demotivating. These tensions, in turn, give rise to emotions such as stress and anxiety. To address the tension and cope with the evoked negative emotions, such as stress, consumers react in a number of ways. This can be in the form of avoiding or confronting the source of the tension (Mick & Fournier,

1998). Following, a negative, contradictory experience may lead to discontinuation of app usage, resulting in the inability to achieve all the desired benefits.

It has already been mentioned that mHealth apps present a wide array of benefits, offering great potential to counteract sedentary behaviors. However, for mHealth apps to positively contribute to customer health, the effects of their use on consumer behavior, and in particular their emotional impact, must still be considered and addressed. A more in-depth analysis of mHealth users' experiences and emotional responses to paradoxical tensions may rectify and diminish this problem.

1.2 Objective of the research

This Master Thesis focuses on users experiences with mHealth apps, with a particular emphasis on paradoxes, emotions and coping strategies that might arise with these applications. As a result, the overarching objective of this study is to answer the following research questions:

A) *"What are the emotional consequences elicited by paradoxical tensions of using mHealth applications?"*
B) *"How do users cope with these emotional consequences?"*

To gain a deeper understanding of consumers' experiences and emotions with mobile health apps, this study takes a qualitative approach.

1.3 Relevance

The accelerated growth of technology, specifically mHealth technologies and its impact on billions of lives, makes this master thesis relevant for practice and theory. Despite the popularity of mHealth applications, the emotional impact of these applications on consumers has not been fully explored yet. It is important to emphasize that previous research has focused primarily on paradoxical tensions rather than evaluating and exploring the emotions in this context. This has resulted in a lack of understanding of how consumers feel, respond and react to paradoxical tensions. Accordingly, the literature suggests that more research should be conducted on emotional reactions and coping strategies affecting the user experience with mHealth applications (Duus et al., 2017; Duus et al., 2018; Etkin, 2016). Furthermore, Blazevic and Klintwort (2019) are the only researchers to have explored the paradoxical aspects of consumers' mHealth experiences, which leads to a need to further exploration. Thus, the absence of research on the experiences and emotional reactions associated with mHealth app usage indicates a clear need for an academic contribution to the field of science.

These findings can provide several suggestions and impulses to managers, app developers, and decision makers in the healthcare sector, which can be implemented for further implications. As a result of the research conducted in this thesis, insights can be derived that will help to provide a better understanding of the customer experience related to mobile health apps. This valuable information can be used by the developers to make improvements to the product and to the features so that customers continue to use the app in the long run and that the mHealth app can continue to deliver its intended benefits to the individual.

Consequently, this master's thesis will contribute to understanding the influence of mHealth applications on users' emotions as well as the paradoxes and coping strategies in this domain.

1.4 Outline of the thesis

In the following chapter, the literature is reviewed, and the theoretical background will be discussed, covering the key concepts and underlying theories used for this thesis. First, the positive consequences of mHealth apps on physical and mental health are discussed. Following the negative consequences are discussed with a particular emphasis on emotions. Then, the framework 'Technology of Paradoxes' by Mick and Fournier (1998) is presented and explained, in which paradoxes, emotional reactions and coping strategies concerning technology are discussed. Further, the paradoxical tensions, the evoked emotions and coping strategies in relation to mHealth apps are discussed. In the third chapter, the research methodology is presented. This section will elaborate on and explain the chosen research method, followed by the sample characteristics, the design, the data analysis process, and the ethical considerations. Next, the results are analyzed and compared with findings from academic literature. The findings are then incorporated into a broader context in the discussion section. Finally, the key findings are presented in the conclusion and contributions, limitations and recommendations for future research are presented based on this research.

2. Theoretical Background

2.1 Consequences of mHealth apps

The ever-increasing number of mHealth apps are focused on gathering and monitoring individuals' health-related data to enhance global health. Through the dissemination, collection, and analysis of health-related data, and the support of interventions, such apps can help shift attitudes and behaviours. In several studies, the benefits and downsides of mHealth have been emphasized (Liang et al., 2011; Rowland et al., 2020). In the following the positive and negative consequences of mHealth applications will be discussed.

2.1.2 Positive consequences

The research on physical activity promotion via mobile devices has increased significantly in recent years and revealed several behavioural benefits (Fujiki, 2010). Buckingham et al. (2019) studied the effectiveness of mHealth applications in workplace settings to reduce sedentary behaviour (SB) and promote physical activity (PA). According to their research, wearable activity monitoring and text messaging interventions significantly reduced employees' sitting time. In a study published by Gremaud et al. (2018), sedentary time was reduced by 26.6 minutes for participants wearing a Fitbit activity monitor. Neil-Sztramko et al. (2017) found a reduction of 405.5 minutes in both objective and self-reported sedentary times after 12 weeks of using the smartwatch Fitbit Flex. Ganesan et al. (2016) reported a mean reduction of 0.74 in self-reported daily sitting after using the smartphone app for 100 days. In addition to reducing sedentary time, mHealth apps also have many other health benefits for users. Among the positive health-related benefits of using mHealth applications are weight loss, BMI reduction and reduced-fat percentage (Ganesan et al., 2016; Neil-Sztramko et al., 2017). Moreover, it was found that the use of mHealth also resulted in reduced systolic blood pressure, reduced resting pulse rate, reduced total and low-density lipoprotein (LDL) cholesterol (Skogstad et al., 2016). Gilson et al. (2017) also found a positive effect on the Type 2 Diabetes Risk Score, improved diet and improved self-reported health or wellness. Moreover, greater self-reported energy and emotional wellbeing, reduced sleep disturbance, and improved self-efficacy for walking were reported (Neil-Sztramko et al., 2017) A further positive experience resulting from the mHealth application is the feeling of getting stronger. Users who check their analytics dashboard more frequently tend to have higher daily and weekly activity levels. This, in turn, has positive outcomes on the users' behavioural change and achieving their goals is also nearer (Duus & Cooray, 2015).

Besides the physical health benefits mHealth apps also have benefits on the mental health of users, which positively consumers psychological state. It has been proven that consumers experience various positive emotional effects, such as happiness, self-fulfillment and satisfaction when using mHealth applications (Duus et al., 2018). The researchers Mumba et al. (2021) found that participants who participated in more physical activity showed fewer depression-like symptoms. The positive emotions emerging from mHealth applications and the increase in activity lead to improvements in both anxiety and depressive symptomatology (Brenes et al., 2007; Herring et al., 2012). In addition, research conducted by Duus and Cooray (2015) also found that the usage of mHealth applications results in self-satisfaction. In this study, the engaged users reported feeling happier, proud, and more energetic once they reached their daily targets. This, in turn, resulted in a feeling of self-satisfaction. According to the participants, self-satisfaction led to the feeling of being less pressured to maintain the performance the next day.

The ability to engage in physical activities and self-monitoring is also reported to be an indication for independence and self-worth (Chastin et al., 2014; Kanejima et al., 2019). As part of their study, Chastin et al. (2014) examined the impact of self-monitoring on users. As a result, they revealed that self-monitoring is found to increase motivation, which results in a reduction in sedentary behavior. According to the participants in this study, using mHealth applications and monitoring one's activity led to the feeling of self-care. As a result, the sense of self-care and taking action to improve their well being positively influenced their motivation and subsequently affected their use of mHealth apps. Research also indicates that when users have positive experiences with mHealth apps, their motivation to continue using the app increases (Chastin et al., 2014).

2.1.3 Negative consequences

Despite the variety of positive aspects of mHealth apps, users may also encounter negative effects after using them for an extended period. However, these negative experiences do not directly refer to physical health or behavioural consequences but rather to psychological consequences. The use of mHealth applications is not detrimental to someone's physical health but rather their mental health (Duus et al., 2018; Callow et al., 20202). mHealth users experience negative emotions when they do not meet their target goals. Duus et al. (2018) reported that participants in their study took breaks from using mHealth apps due to not reaching the daily targets. The constant reminders that they were not getting close to their targets resulted in guilt. The participants, thus, had the impression that they were not able to

change their behaviour, and this, in turn, discouraged them from continuing. Moreover, due to the ability to monitor and measure one's activity level, it is possible to accurately identify traits, habits, and behavioural patterns that did not fit into some participants' ideal conceptions. This led participants to avoid using the apps and disregard them.

Ruckenstein (2014) argued that behaviour became salient through self-monitoring, since formerly unknown behavioural aspects were transferred into comprehensible information. In this regard, Wolf (2010b) mentioned that self-tracking tools can serve as a mirror for the consumer and support improving the self through gaining awareness, discovery and knowledge.

Furthermore, mHealth apps may create feelings of confrontation and explosion, leading to a state of emotional distress. Several participants reported feeling exposed and confronted with their perceived negative habits (e.g. eating excessively and not exercising enough). As a result, they experienced some emotional distress (Duus et al., 2017; Duus et al., 2018).

An additional negative psychological consequence of mHealth applications is “obsession”. In tracking and analyzing one's performance, it is possible to develop a dependency on the provided data. This would result in users feeling compelled and obsessed to always monitor their progress and thus, contributing to users feeling stressed. Moreover, participants stated that this obsession contributed to both self-blame and an obligation to improve the performance data, even if they did not feel motivated. Therefore, there might be a feeling of force and being obligated to perform better even if they are not willing to do so.
It is also important to note that users may experience feelings of anger and pressure when they do not achieve their targeted goals (Duus et al., 2018).

2.2 The Paradoxical Impact on Technology

2.2.1 The paradox concept

To understand how mHealth apps are perceived by users, this study will use Mick and Fournier's (1998) concept of paradox and theoretical framework of Paradoxes of Technology. The continuing discussions on the paradox concept in organizations keep arousing interest in the field (Schad et al., 2016; Smith & Lewis, 2011). Despite the high relevance of the paradox concept in many domains, there is still a lack in consumer behaviour literature (Mick and Fournier, 1998; Schad et al., 2016). However, as the paradox concept is often used in management and organization studies, numerous definitions are present (O'Driscoll, 2008; Smith & Lewis, 2011). According to Bar-Hillel and Quine (1968), a paradox is a "statement that appears self-contradictory". Mick and Fournier (1998) define the paradox concept as

opposite conditions that simultaneously exist. Vince and Broussine (1996) describe paradoxes as tensions between clarity and uncertainty of human emotions. In turn, Schad et al. (2016) state that paradoxes indicate constant contradictions between interdependent elements, meaning that these seemingly distinct and oppositional elements are tied in a so-called "web of eternal mutuality". The many definitions concerning the paradox concept have one thing in common: it always refers to "opposite conditions that can simultaneously exist" (Fonner & Roloff, 2012; Mick & Fournier, 1998).

Past studies on researching paradoxes have focused on both the collective approach (Schad et al., 2016; O'Reilly & Tushman, 2013; Raisch et al., 2009) and the individual approach (Schad et al., 2016). Whereas the collective approach studied how groups such as organizations and teams experience challenges of paradoxes, the individual approach studies examined how consumers encountered and responded to paradoxes on behavioural, cognitive and emotional levels (Smith & Lewis, 2011; Mick & Fournier, 1998). As Mick and Fournier's definition was offered in the context of consumer behaviour research, and thus refers to the individual rather than the collective approach, this research opts for their definition.

2.2.2 Paradoxes and Emotions

The first comprehensive conceptual framework on paradoxical tensions, consumer behaviour, and coping strategies within the domain of technological products was developed by Mick and Fournier (1998). Mick and Fournier (1998) applied the paradox concept to private consumer settings and household technologies. Their study proposed a theory of paradoxes of technology focused on consumer attitudes and behaviours after technology adoption. Mick and Fournier's study in 1998 revealed that technology users experience eight paradoxical tensions when using technology: control/chaos, freedom/enslavement, new/obsolete, competence/incompetence, efficiency/inefficiency, fulfils/creates needs, assimilation/isolation and engaging/disengaging. The paradoxical tensions mentioned above-created feelings of ambivalence and conflict, making users doubtful about their opinion of the technological device. In the following paragraph each paradox will be elaborated on.

The first paradox control/chaos were among the most salient across the data sets of Mick and Fournier (1998). According to this paradox, consumers evoke feelings of control when their activities are dictated, and feelings of chaos when it interferes with their activities leading to confusion. The second paradox is freedom/enslavement. In line with this, a feeling of freedom is experienced when technology provides an independent and minimal amount of restrictions. A feeling of enslavement, on the other hand, is experienced when technological

dependence restricts activity. The new/obsolete paradox results from new knowledge and innovations generated by science that constantly replaces existing knowledge. As a result of continuous technological innovation, existing technologies become obsolete over time. The fourth identified paradox is competence/incompetence. According to Mick and Fournier (1998), competence occurs when consumers understand how a particular technology works while incompetence occurs when they are unaware of how to use it. When a task can be completed in less time and with less effort, technology can be considered efficient. Conversely, when the same tasks require more time and effort, e.g. because of malfunctioning technology, then it is considered inefficient. Fulfills/creates needs is a further paradox identified. According to the informants, technology can fulfill some needs, yet it can also identify unrealised needs. This paradox appeared to be subtle and was discussed in relation to the ownership and use of computers. Several informants indicated that the computers they own meet various needs while others felt that they need computers in order to fulfill their needs or acquire the necessary knowledge to utilize them. Mick and Fournier (1998), also stated there is the possibility that technology can cause human separation and/or human togetherness. By watching sports and movies on television and communicating through telephones and computers, it facilitates assimilation. Contrary to this, isolation occurs when consumers spend more time watching television and playing video games than socializing. The last identified paradox by Mick and Fournier (1998) is the paradox of engaging/disengaging. When technology facilitates the flow of activities, it appears as engaging. In contrast, it becomes disengaging if it leads to disruption and passive behavior.

The Technology of Paradoxes framework of Mick and Fournier (1998), was also applied to other technologies. Jarvenpaa and Lang (2005) examine the paradoxical experiences of different users when using mobile technologies. The authors also identified eight paradoxes in mobile technology that significantly influence the behaviour of consumers and their experiences. There were many parallels with the earlier findings of Mick and Fournier (1998). Moreover, four more paradoxes were discovered; Planning/Improvisation, Public/Private, Illusion/Disillusion, and Independence/Dependence. A further analysis of paradoxical experiences using mobile technology was conducted by Chae et al. (2010). As discovered by Jarvenpaa & Lang (2005), paradoxes including Efficiency/Inefficiency, New/Obsolete, and Empowerment/ Enslavement had also significant positive relationships with stress about mobile technology in their study (Chae et al. (2010).

Mick and Fournier's (1998) research revealed that paradoxes create conflicts and ambivalence in users, which in turn, elicit negative emotions such as anxiety and stress. In this

regard, users are impacted not only on a functional level, but also emotionally when confronted with paradoxes as described earlier. In several cases, technology paradoxes have caused emotional distress, with feelings ranging from envy to foolishness to caution and frustration to fear and betrayal (Mick & Fournier, 1998). To cope with these conflicting paradoxes and emotions consumers undertake coping strategies.

2.2.3 Coping strategies

To manage these tensions coping mechanisms are applied. Several studies have pointed to coping strategies as a way to cope with paradoxical tensions and negative emotions (Mick & Fournier, 1998; Jarvenpaa & Lang, 2005; Johnson et al., 2008). In general coping strategies have been studied in literature extensively in relation to stress and other negative affective states. There are many ways in which people cope with stress; some consumers may choose to express their feelings in an outward manner, others may re-interpret the situation in a positive light to make it seem less stressful, and so on (Duhachek, 2005). In psychological literature, different categorisations of coping strategies have been proposed by several researchers (Lazarus & Folkman, 1987; Duhachek, 2005). According to Lazarus and Folkman (1987), there are two coping functions: problem-focused coping to deal with stressful, emotional experiences and emotion-focused coping to deal with the emotions evoked by a stressful situation by changing or regulating the emotions. Nambisan and Baron (2010) in turn, argue that confrontative and avoidance coping strategies are the most commonly employed by consumers to manage paradoxes. Several studies have pointed to coping strategies as a way to cope with paradoxical tensions and negative emotions (Mick & Fournier, 1998; Jarvenpaa & Lang, 2005; Johnson et al., 2008). Prior research suggested that technology paradoxes may create emotions of conflict and ambivalence, triggering anxiety and stress, prompting coping strategies (Bleuler, 1950). Coping involves regulating emotions to specific challenges with cognitive and behavioural efforts that meet the demand beyond an individual's control (Bridges et al., 2001). The typology of coping strategies proposed by Mick and Fournier (1998), will be further discussed in the following paragraph and will be used to guide this research.

Mick and Fournier (1998) classified coping strategies as either avoidance or confrontation and further subcategorized them as pre-acquisition or consumption stages (see below: Figure 1). A confrontational coping strategy uses strategies to accept and deal with technology, including accommodating, collaborating, and attempting to master the technology (Mick & Fournier, 1998). Due to the paradoxes of technology, the purpose of confrontational coping is to reduce tension and emotions (Yi & Baumgartner, 2014). Neglecting the

technology, abandoning the technology, and distancing oneself from the technology are, in turn, examples of avoidance coping strategies (Mick & Fournier, 1998; Nambisan & Baron, 2006; Jarvenpaa & Lang, 2005). According to Jarvenpaa and Lang (2005), whenever technology is highly demanding or confusing, avoidance coping strategies are more likely to be employed. Mick and Fourniers (1998) subcategorized pre-acquisition avoidance strategies, comprising three pre-acquisition practices: ignore, refuse, and delay. They represent a refinement of the more general notion of technology rejection associated with the diffusion of innovations paradigm (Rogers, 1995). On the other hand, the pre-acquisition confrontative strategy includes four sublevels: pretesting, buying heuristics, extended decision-making, and extended warranty/maintenance contract. These confrontative strategies reinterpret some conventional notions related to consumer behaviour that have a more profound and more complex role in everyday life. The third coping strategy is called: the consumption avoidance strategy. It comprises three behaviours: neglect (demonstrating temporary indifference to the technological possession), abandonment (i.e. declining to use the technological possession) and distance (i.e. developing a policy regarding the use and timing of the technological possession). Confrontation strategies include the following: accommodation (modifying tendencies, preferences, routines in response to perceived needs, abilities or limitations of a technological possession), partnering (establishing a close, committed relationship of heartfelt attachment with a technological possession), and mastering (dominating the technological possession by gaining a comprehensive understanding of its operation, strengths, and weaknesses) (Mick & Fournier, 1998).

BEHAVIORAL COPING STRATEGIES FOR MANAGING TECHNOLOGY PARADOXES AND THEIR EMOTIONAL EFFECTS

Coping strategies	Emotional effects
Pre-acquisition avoidance strategies:	
Ignore	Avoiding information about the characteristics or availability of certain technological products
Refuse	Declining the opportunity to own a specific technological product
Delay	Postponing but eventually owning a specific technological product
Pre-acquisition confrontative strategies:	
Pretest	(1) Using someone else's technological product temporarily or (2) purchasing a technological product but not assuming definitive ownership until the return policy or warranty expires
Buying heuristics	(1) The latest, cutting-edge model; (2) a basic, less sophisticated model; (3) an expensive model; (4) a familiar, widely known brand; and (5) a reliable brand
Extended decision making	Taking stock of one's needs, searching diligently for detailed product/brand information, and then purchasing the most appropriate alternative in a careful, calculating manner
Extended warranty/maintenance contract	(1) Buying additional insurance at the time of product purchase to cover service and repairs or (2) buying an ongoing contract for periodic preventive maintenance and emergency repairs
Consumption avoidance strategies:	
Neglect	Showing temporary indifference toward a technological possession
Abandonment	(1) Declining or discontinuing the use of a technological possession or (2) leaving a technological possession unrepaired if it has malfunctioned
Distancing	(1) Developing restrictive rules for when or how a technological possession will or will not be used or (2) physically placing a technological possession in an unobservable or remote site
Consumption confrontative strategies:	
Accommodation	Changing tendencies, preferences, routines, etc., according to the perceived requirements, abilities, or inabilities of a technological possession
Partnering	Establishing with a technological possession a close, committed relationship of heartfelt attachment
Mastering	Dominating a technological possession by thoroughly learning its operations, strengths, and weaknesses

Figure 1: Behavioural coping strategies for managing technology paradoxes and their emotional effects (Mick & Fournier, 1998).

This Master thesis is concerned with the paradoxical tensions that appear with the use of smart devices, namely mHealth apps. Consequently, it focuses on the paradoxes of technology (Mick & Fournier, 1998). Worth mentioning is that Mick & Fournier (1998), mainly focus on pre-acquisition strategies. This Master thesis in turn, will elaborate more on the post acquisition strategies.

2.3 The Paradoxical Impact on mHealth apps

2.3.1 Paradoxes and Emotions

The emotional impact and consequences of mHealth applications on consumers, in terms of paradoxes and coping strategies, were mainly found by Blazevic & Klintwort (2019). According to Blazevic and Klintwort's study (2019), five paradoxes were most prevalent among the respondents: integration/disintegration, self-control/ external control, confirmation/disconfirmation, individual/community, and motivating/demotivating. In the first paradox, integration/ disintegration, individuals are concerned with the ease they have adopted the mHealth app into their lives (Mick & Fournier, 1998; Blazevic & Klintwort, 2019). Disintegration refers to a mHealth app that has not been adopted or is not adopted at all, as opposed to integration, which means that the app has been adopted easily. When a mHealth app is not easily adapted into one's everyday life, it is more likely that the individual will abandon the app.

Further, the paradox of self-control versus external control examines the extent to which users are in control of themselves as they use a mHealth app and to what extent the app is controlling their life. When one receives push notifications from an app, one may experience a greater sense of external control (Bidargaddi et al., 2018). As a result, people may feel that the mHealth app is too controlling, which may cause them to stop using it.

Thirdly, Blazevic and Klintwort (2019) identified the paradox of confirmation/disconfirmation in the mHealth domain. The paradox is whether the mHealth app confirms our assumptions or shows something different than what we expected, whether in a good or a bad way. It is more likely that one will keep using an app when one is satisfied with the results that it displays. In contrast, a person may be more likely to stop using a mHealth app if it consistently gives negative results that they were not expecting. Sharing one's achievements through the mHealth app with family or friends or sharing them on social media vs keeping them to oneself is the fourth paradox of individual vs community. A positive feeling may result from sharing one's results (Blazevic & Klintwort, 2019). Getting compliments may be a positive side effect of sharing one's results. Nevertheless, it may also lead to negative

feelings, such as feeling rivalry with one's friends or family (Mick & Fournier, 1998; Jarvenpaa & Lang, 2005).

Finally, the paradox motivating/demotivating has been identified (Blazevic & Klintwort, 2019). Motivating the individual to use a mHealth app refers to how a mHealth app motivates one to continue using it. This may occur when the app reports either a negative or positive result. One may be motivated to achieve a positive outcome when a negative result is displayed. In contrast, when a positive result is presented in the mHealth app, one may be inclined to keep going since it was a successful day. On the other hand, a demotivating aspect may cause someone to stop using a mHealth app (Jarvenpaa & Lang, 2005), especially when users are more demotivated than motivated by a mHealth app.

2.3.2 Coping strategies

As mentioned above, Blazevic and Klintwort (2019) also discovered how mHealth users managed the paradoxes and tensions with coping strategies. They identified five coping strategies: discontinuing, adjusting, assuming responsibility, emotionally distancing and ignoring.

The coping strategy 'discontinuing' was the most applied one in their research and referred to respondents terminating the use of their apps or turning off all the functions that elicited negative emotions. Thus, when users experience compulsive behaviour, they tend to delete their apps or temporarily remove them from their devices. The frequent reminders and notifications often can annoy, pressure and stress the users. The users manage these feelings by distancing themselves from these apps.

The second coping strategy is adjusting. This means that users cope with adjusting and adapting their behaviours, mindsets or habits to the requirements of the app to relieve themselves of tensions. Consequently, they revealed trying to be more conscious about themselves, adjusted their eating behaviour and modified their sleeping patterns.

On the other hand, assuming responsibility was a means of coping with individual/community paradoxes or privacy concerns. Participants believe that the increased delegation of responsibility to mHealth applications is the cause of users no longer listening to themselves. In addition, respondents indicated that they sought to retain control over the app by refusing to allow it to take responsibility for their behaviour improvement or other accomplishments.

The fourth coping strategy observed is emotionally distancing. This means that users are reluctant to allow the app to get too close to them. As a result, they keep a distance from

the app. The last coping method mentioned was ignoring. The research finding indicated that ignoring is a coping strategy with multiple aspects.

Overall, respondents appear to be avoiding receiving information from the app or the app itself. This coping strategy includes denying, or denying aspects and attributes that have the potential to negatively affect the user, such as the seriousness of data privacy issues and the possible consequences arising from them. A second aspect of this coping strategy is doubt, which is particularly salient when viewed in relation to the paradox of confirmation/disconfirmation.

3. Methodology

3.1 Research Methods

The objective of this research is to answer the research questions, which were introduced in the beginning:

A) *"What are the emotional consequences elicited by paradoxical tensions of using mHealth applications?" and*

B) *"How do users cope with these emotional consequences?"*

The first research question examines the paradoxical tensions and emotional reactions that arise from the use of mobile health applications. More specifically, it aims to investigate how the paradoxical tensions and the negative feelings evoked by mHealth apps affect consumers. In this regard, it is important to examine how consumers perceive tensions and how these tensions influence them. Prior research has shown that digital technology evokes paradoxical tensions and emotions in users (Mick & Fournier, 1998; Jarvenpaa & Lang, 2005; Chae et al., 2010). Consequently, the objective of this study is to apply the framework of 'technology paradoxes' developed by Mick and Fournier (1998) to the domain of mobile health applications. The second research question aims to explore the coping strategies that arise in response to emotions. Thus, the goal is to investigate consumer behaviour regarding mHealth apps in light of coping strategies.

To explore and achieve a deeper understanding of social phenomena to understand the experiences, perceptions, and behaviours of those studied, a qualitative research method is adequate for this research (Agius, 2013; Dresing et al., 2013). As quantitative research is a means for testing objective theories by examining the relationship among variables, qualitative research is better suited for this study (Creswell, 2018). Furthermore, the lack of available literature on this topic (Blazevic & Klintwort, 2019) makes qualitative research an ideal choice as an explorative methodology (Gill et al., 2008; Hammersley, 2003). According to Myers (2013), the qualitative research method is appropriate for understanding and explaining social phenomena in a real-life context. Thus, qualitative research can provide more insight into how users interact with mHealth apps and the emotions they encounter during the process (Boyce & Neale, 2006). Consequently, this research method is the most suitable one for this thesis.

Additionally, this research follows abductive reasoning. As defined by Eriksson & Linström (1997), abductive reasoning refers to the process of forming plausible explanations by identifying underlying patterns. Furthermore, Żelechowska et al. (2020) define abductive reasoning as a form of intricate reasoning meant to explain unexpected or vague phenomena or to fill in the gaps in our knowledge. According to Reichertz (2013), *abduction* can be defined

as the process of determining expectations for conclusions based upon some knowledge or idea regarding the theme while maintaining agility for new results or concepts to emerge. Accordingly, abductive reasoning is well suited for inferring new ideas or extending existing ones. Since the starting point of this Master Thesis is the framework of Mick and Fournier (1998), it may provide some preliminary ideas regarding the topic and suggestions about topics that may arise during the interview process (Myers, 2013). In light of this, abductive reasoning is an appropriate approach for gaining insights into the experiences, emotions and coping strategies of mHealth users.

The data is collected through semi-structured interviews to comprehensively understand mHealth users' experiences. Semi-structured interviews are often conducted with one respondent at a time, and employ closed and open-ended questions, often followed by follow-up why- and how-questions (Adams, 2015). Following the preformulated questions and the new questions that might emerge during the interview will aid in receiving crucial insights that arise during the conversation. While the preformulated questions will aid in having focus (Myers, 2013). Consequently, with this approach, a dialogue can meander around the topics on the agenda and may delve into unforeseen topics in the domain of mHealth and thus contribute to novel insights and theories (Adams, 2015; Timmermanns & Tavory, 2012). Lastly, considering the qualitative nature of the research, data collection and data analysis are performed simultaneously, making the process iterative.

3.2 Sample characteristics

In order to provide answers to the research questions, students and employees with low physical activity levels and thus a less active lifestyle were interviewed. Based on the aspect of whether respondents used mHealth applications, the respondents were selected. Accordingly, this research aimed not to find respondents with a lot of expert knowledge but rather to find respondents who currently use the apps in their daily lives and possess some basic understanding of them. As a result, the sample for this study consisted of eleven active mobile health users who sought to improve their physical activity levels, ranging from increasing their daily steps to increasing the distances run. Moreover, the convenience sample criterion and snowball sampling procedure was used for selecting the respondents, meaning that the respondents were selected from the researcher's network. Herewith, respondents of this research further recommended mHealth users, which are suitable for this research.

Due to the purpose of this study, which aims to understand the experiences, emotions, and coping strategies of mHealth app users, analyzing information power, which refers to the

emotional responses and consequences, is more valuable than determining the sample size (Malterud, Siersma, Guassora, 2016). According to Deterding and Waters (2018), the sample size should target saturation in qualitative research. This refers to the point at which no new information is acquired in data collection (Boddy, 2016, Deterding & Walters, 2018). According to Boddy (2016), a sample size of twelve is the most appropriate when considering the time it takes to plan, conduct, transcribe, and analyze the interviews. Despite twelve interviews being conducted in this study, one had to be excluded due to its answers not aligning with the study's objectives.

Consequently, the user was unsuitable for this thesis due to a mutual misunderstanding. In order to achieve a homogeneous population, the interview was disregarded since it was too different from the other interviews. This resulted in a sample size of three men and eight women ranging from 22 to 33 years of age. The respondents came from various countries, including six from Germany, one from Belgium, one from the Netherlands, one from Luxembourg, one from Greece, and one from Turkey.

3.3 Research design

This study consists of a sample of ten current and one former user of mHealth applications. Thus, all the participants have either used mHealth apps or had experiences with them. Nevertheless, as the term mHealth has multiple definitions, the concept of mHealth apps may not be construed in the same way by all respondents. The concept of mHealth apps is therefore explained in advance of conducting the interviews so that there is a common understanding of the topic. In addition to explaining the definition, the respondents were informed about the objective of this research. To obtain honest answers and allow respondents to open up during the interview, it is stressed to the respondents that anonymity is guaranteed and that the responses are only intended for research purposes (Myers, 2013). Moreover, the interviewer requested permission to record the interview. As a follow-up to the introduction of the topic and the expression of consent by respondents, it was asked if there were any questions regarding the interview process or the topic that needed to be addressed (Solarino & Aguinus, 2021).

Once all questions had been answered, semi-structured interviews were conducted. The interview guide is developed using the theoretical framework provided by Mick and Fournier (1998) as well as the findings presented by Blazevic and Klintwort (2019) and contain questions related to mHealth users' experiences, emotions and coping strategies. There are primarily four sections in the questionnaire. Before starting with the initial questions regarding

users experiences with mHealth apps, demographic information about the respondents is collected. Next, the first set of questions focuses on the respondents' usage patterns and frequency. This section consists of questions about the respondent's experiences and feelings concerning mHealth apps. Therefore, this section is divided into two subsections. The respondents are first asked about their positive experiences, followed by questions regarding their negative experiences. In the following section, questions are asked regarding the respondents' strategies for coping with these feelings and emotions. In the fourth section, participants are asked about their overall experiences with mHealth applications from the beginning to the present and whether they intend to continue using them.

In this study, an English interview guide is provided. Although all respondents were not native English speakers, the interviews were conducted in English, as respondents came from various countries, and English seemed to be the most appropriate language, in which the respondents were also comfortable.

As requested by the respondents, semi-structured interviews were conducted online using the technology communication software, Zoom. As most of the respondents were geographically dispersed, online interviews were seen as the most convenient and preferred method. Interviews conducted online as well as interviews conducted in person have both their advantages and disadvantages.To begin with, online interviews are beneficial for several practical and logistical reasons. Adopting this approach reduces the geographical constraints associated with face-to-face interviews and geographically dispersed participants can be reached, as in this study. Also, video interviews are more flexible in scheduling and provide participants with more options to accommodate their busy schedules at work and home. In addition, the participants are more relaxed as they are interviewed in a familiar and comfortable environment (Irani, 2018). The disadvantage of this approach is that it limits the researcher's ability to assess the participant's environment, which can provide the researcher with valuable contextual information when conducting the data analysis. In addition, researchers cannot observe an individual's body language and nonverbal communication in full since they often view the participant from the waist up, which is not the case when a face-to-face interview is conducted (Irani, 2018).

3.4 Data analysis

Recordings of the semi-structured interviews are made with the respondents' consent to remain close to reality when analysing the data. The recorded audios were firstly transribed. As a part of ensuring easy readability, any empty words and nonverbal sounds were eliminated

from the transcript if the key message of the respondents was not anticipated to change (Oliver, Serovich, & Mason, 2005). Besides the recordings, notes were taken based on the respondent's responses and the way they behaved during the interview. Next, an analysis of the data was carried out after the transcription has been completed and the notes have been included. This was accomplished in abductive reasoning and through content analysis. While following an abductive approach, the categories are gathered from previous literature and the present research data. Content analysis, in turn, is a research method that relates data to context based on validated and reproducible inferences (Krippendorff, 2018). Accordingly, before using the content analysis technique for the interviews, a context mapping procedure has been carried out. Using this method, underlying structures in data were identified (Visser et al., 2005). Following, the data generated from the interviews and the made notes were examined as first to better understand the material. Then the data was analysed for structure and then grouped into categories based on overarching themes (Krippendorff, 2018). These categories were coded and structured through content mapping (Myers, 2013).

3.5 Research Ethics and Limitations

This research was conducted in accordance with several ethical considerations. In addition to informing the respondents about how the data is collected, the interviewee also informs them about how the data will be used. After obtaining permission from the interviewees, the interviewer records the interview, ensuring the anonymity of all parties involved. In order to maintain anonymity, respondents are referred to by numbers instead of their full names, such as Respondent 1. Furthermore, all the respondents in this study participated voluntarily and were free to withdraw from the study at any time. Furthermore, interviewees were free to ask any questions they desired concerning the study at any time. In the context of transparency, the research goal was not only stated at the beginning of the interview but was also announced from the beginning of contact with the respondent. Worth mentioning is also that the researcher and supervisor sign a Research Integrity Form. This form acknowledges that the researcher is responsible for providing original work, providing appropriate information, requesting and informing participants, and maintaining confidentiality.

4. Research Results

4.1 Introduction

This section presents the results of the analysis of the interview transcripts. The study examined which paradoxical feelings mHealth users experienced, what emotional reactions these have evoked and how users dealt with upcoming conflicts through the process. In light of this, it became apparent how the usage behaviour of mHealth apps developed over time and users' reactions changed with various stages of adoption.

To begin with, respondents explained their motivations and reasons for using their preferred apps (see Table 1). Then, paradoxes were examined to understand how users feel and behave when encountering several contradictory feelings while using mHealth apps. These opposing feelings have resulted in the identification of five substantial paradoxes, as indicated in Table 2. The paradoxes, in turn, evoke both positive and negative emotional reactions in the users, affecting them from various perspectives. This study revealed a total of seven emotions. Table 2 contain both positive and negative emotions. Lastly, it was examined how users cope with paradoxical tensions and evoked emotional reactions. As a result of this research, five coping strategies have been identified (see Table 3). The analysis of the collected data revealed that some paradoxes were prominently depicted and were acknowledged to varying degrees by users. Furthermore, certain paradoxes seemed to elicit more negative reactions than others. Also, some of these varied according to the type of mHealth app. Many paradoxes could be clearly distinguished from one another, but many also displayed overlaps and were closely linked to one another and the emerging tensions.

Looking closer at the types of mHealth apps used, most respondents indicated they used mostly the Apple Health app, which was pre-installed on their phones. As well as the Runtastic app from Nike, the Phoenix app, and Smartwatches such as the Apple Watch, Fitbit, and Garmin were used to track the participants' activity. A third category consisted of apps for calorie counting and nutrition assessment, such as MyFitnessPal. Trackers for sleep and breathing were also utilized. The process will be described in detail in the following section. In addition, this chapter discusses the prospective risk and rewards of mHealth apps as stated by the respondents.

4.2 Initial motivation

A description of the initial motivations for users to use mHealth apps can be found in Table 1. The mHealth apps were mainly used to serve as a guiding tool for setting and improving personal goals but also to track and monitor one's health, general well-being and athletic performance. Furthermore, receiving quantifiable information on performances, such as time and step tracking, was a further motivation to start using mHealth apps. The motivation for using mHealth apps was also driven by curiosity, alongside the desire for guidance and receiving insights. In some cases, it was after receiving a smartwatch as a gift, while in others, it was after their friends' positive experiences that persuaded them to get started using them.

4.2.1 Seeking guidance

According to the data collected, ten respondents started using mHealth apps to seek guidance on their fitness and health journeys. As per this study, seeking guidance is defined as setting goals and wanting to be guided in achieving those goals, receiving advice and being encouraged to become more active as a result. Weight loss, improved running performance, and tracking of daily activities were some of the goals mentioned by the respondents.

"The main reason why I bought my fitness watch is to track my steps and calories and with that hopefully to lose weight." (R6, 25, female)

A further facet of seeking guidance with the use of mHealth applications was the ability to track individual performance and understand how improvement can be achieved:

"I think if you are a beginner and you don't know how long you run or how fast you're running, then it's super nice to have a check and have a track on your run." (R4, 26, female)

4.2.2 Receiving insights

Another reason why respondents began using mHealth apps was to receive insights and gain access to factual information. Based on the collected data, it was revealed that respondents' awareness of the positive effects of increased physical activity on both their physical and mental health provided them with a motivation to begin using mHealth apps and gauge their actual state:

"I know it's good for my health, it's good for my body, and it's also good for my mind" (R7, 24, female)

Similarly another respondent stated:

"So I know it's good for my brain, body and I know it's good for my mental health." (R8, 22, female)

Furthermore, receiving insights for some respondents also indicated the desire to discover and understand their habits with the use of these apps, followed by an attempt to overcome and improve them:

"Before using the app, I wouldn't be able to notice if I had done less. But now, with the help of the app I literally know how many hours of sleep and how many steps I make, how many calories I burn, my heart rate and everything."(R1, 26, male)

As a result, respondents expressed a desire to adopt healthier lifestyles by receiving insights about their activities and performance levels:

"It's mainly because of health related reasons. At the moment I am trying to opt for a healthier lifestyle. This is actually the main reason why I am using my watch to track my steps." (R6, 25, female).

In addition, users were impressed with the app's ability to depict the user's behavior with factual information. Respondent 1 *(26, male)* mentioned that the application helped him become more aware of his poor physical activity and sleeping habits, and thus encouraged him to improve them.

"I: Have you observed any changes in your life by using this app?

R1 (27, male): Yeah, definitely. Because I walk a lot more nowadays. So in some ways it did help me. Going out basically has changed the way I look at life. Now I tend to wake up earlier and do all my work in the morning and then in the evening I tend to do things that I like and walking is part of it now. So I enjoy walks and it also clears my mind."

4.2.3 Curiosity

Curiousity is the last motive pertaining to the initial motivation of mHealth users. For some, curiosity arose after receiving a smartwatch as a gift, which then led to excitement to explore the features and experience the app. In contrast, for others, curiosity was elicited by positive experiences shared by friends and family. The positive opinions about mHealth apps inspired users to start using them.

"You know, like in the beginning, I was like, just curious. Okay, what is possible to track? And I was, like, playing around with the functions of the watch, and it was cool to see. Okay, you know, like, I'm running faster and my heart rate is going up." (R2, 33, male)

Concept	Definition	Quote
Seeking guidance	mHealth users perceive the app as a helping tool to achieve their personal goals.	*I'm doing an office job, so I'm sitting a lot and I do want to see how many steps I'm taking. (R7, 24, female).*
Receiving insights	mHealth users appreciate receiving information regarding their physical health and performance.	*I mainly used it for time tracking purposes, so to see mainly the improvement because I was using it for running. (R5, 24, female).*
Curiosity	mHealth users are curious about the features and functions the app provides.	*At the beginning it was a Christmas present for me. Then I thought it was nice and I used it for a couple of days then I was kind of interested and now I use it every day. (R10, 27, female)*

Table 1: Initial motivation

4.3 Paradoxes

As stated by the respondents, mHealth apps have both positive and negative aspects. However, it is important to note that sometimes positive and negative experiences can occur simultaneously, resulting in paradoxical tensions. In turn, these paradoxes evoke various emotional reactions within the users. This study identified a total of five paradoxes. A detailed description of the most critical paradoxes, their associated emotions, and their definitions can be found in Table 2. In the following, the paradoxes and the respective emotions of the users, both positive and negative, will be explained in detail.

4.3.1 Motivating vs. Demotivating

Motivating

Among respondents, the paradox of motivating versus demotivating was the most salient. Motivation in this study refers to how mHealth apps motivate users and how they stimulate physical activity, while demotivation refers to how the app causes users to become passive and demotivated. On the one hand, users often found the received insights of their performance and progress to be both motivating and helpful:

"The knowledge and the security that the watch gives me and also the insights motivate me to go out and get my steps in." (R1, 26, male)

"I think the positive thing really is that you can see what you are doing, like the data does not lie. You see how long you did something, what was your heart rate, what was your pace etc., so it's a positive thing and you can really see what is happening and that's really motivating." (R2, 33, male)

Furthermore, users found that the graphical summaries of their fitness activity and progress provided by their app were particularly helpful because they allowed them to uncover their habits. As a result, users became more active and changed bad habits into positive ones, which in turn encouraged them to become more active.

"I've been less lazier since I've been walking more." (R1, 26, male)

Aside from that, respondents reported that mHealth apps motivated them especially when they saw positive results. Reaching their daily goals and seeing improvements in their performances motivated users to continue using the app and increased their motivation for the next day to keep on performing well.

"When I was doing good on my runs, then I was more motivated to go on more runs." (R4, 26, female)

"I feel motivated for the next time." (R3, 23, male)

According to the respondents, the motivational aspect caused positive emotions such as happiness and joy.

"I do realize that I'm happy if I'm meeting my goals, and I do realize all the effects an app can have on you, especially of the push notifications, which I think are quite interesting." (R7, 24, female)

Similarly another respondent stated:

"I would say that it can motivate you to go out for a run which is then cool because you would feel joy, and you would be happy and satisfied." (R5, 25, female)

A further statement was: *"So somehow I feel happy because I achieved what I wanted." (R10, 27, female)*

The reasons for this emotional reaction were mostly explained by the achievement of the daily goals:

"*I guess it's like the satisfaction you get from reaching the goals." (R7, 24, female)*

Most respondents indicated that the motivation for using their apps came from the positive results they observed. Nevertheless, the study also revealed that not all of the participants felt happy simply because they had achieved their goals. Instead, they just feel happy because they have moved and gone out.

"So I think I enjoy the process of the running, you know, not achieving the goal but the process." (R4, 26, female)

Demotivating

On the contrary, respondents also emphasized the second paradoxical aspect, 'demotivating'. Several users revealed that their initial motivation disappeared throughout the course of their app usage. For the majority, the reason for this was not being able to reach their goal and the push notifications they received from their respective apps. Accordingly, several respondents revealed that the demotivating aspect created feelings of stress and guilt.

"Stress and I also feel guilty. For example if I see a push notification on my phone and it says you sat a lot today and you should walk more, I feel guilty." (R3, 24, male)

"*Yes in the beginning it was actually quite funny and motivating but after a while it started to stress me out a lot." (R6, 25, female)*

In addition to that, respondents mentioned that once they were not able to reach their goals they not only felt stressed but also anxious. In this case, not being able to reach 10.000 steps was the main reason causing these emotions.

(...) causing more stress and inner anxiety in me; it's the feeling that I get, when I cannot reach my steps." (R6, 25, female)

Whereas another reason causing the emotion of fear is to fold back to old patterns, because of not being active for several days, which respondents aimed to avoid.

"I do get stressed and anxious when I see habits showing up again."(R1, 26, male)

Also, users who were already experiencing stress due to external factors such as exams, work, etc., found the app to be ‘extra stressing and pressuring’ when they still had to complete their workouts or steps they targeted.

“Sometimes it does stress you a little more and then it adds up because it is already a stressful time and you shouldn't think about this stuff during exam periods or as I said before, maybe you should, so it's kind of like a paradox.” (R1, 27, male)

Worth mentioning is also that the changing motivations not only appeared after a period of time but also throughout the day:

"So during the day I look at the app demotivated because I see I'm not reaching my goals, but then during the day I somehow meet them again and it's the same day and at night I look at it and I realize, yeah, i made it. So it can happen both during the same day." (R7, 23, female)

Another negative aspect mentioned most often, and in specific by eight respondents, were push notifications, which had a detrimental impact on the motivation, wellbeing, and mental health of users after a while. One respondent stated:

"I started receiving all these pushing notifications so then my experience went from a positive or let's say, a satisfied experience towards a negative experience; towards an experience of, like, disinterest and stop of usage." (R5, 25, female)

Another respondent revealed that the push notifications on running apps were annoying and not desirable, which then resulted in an unenjoyable and pressuring experience.

“When I have my phone with me on a run, I check it like every 10 minutes or every five or 6 minutes because I get the notification: oh, you're now at two kilometers, now three, four kilometers etc. and it says how fast you're running on average, so even if you do not check your phone, you hear it, and it's really annoying because you can not enjoy the actual run and being outside.” (R4, 26, female).

4.3.2 Dependence vs. Independence

A further paradox which often appeared during the research is dependence/independence. According to this study, the concept of dependence refers to users' concerns regarding becoming too dependent on the app and, as a result, placing too much emphasis on its numbers. On the other hand, independence refers to the positive feeling users experience when they do not take the insights and information too seriously.

Dependence

The first aspect of the paradox 'dependence' entails the respondents' fear and concern of becoming dependent on the app. As a result, some statements were made concerning the app's use as being dangerous and even toxic for a person's health.

"I had a toxic relationship in that time where I was like, oh, I don't want to have my phone with me because I want to go for a walk without the phone but then I was like, the walk is not as useful, you know, because it's not tracked." (R4, 26, female)

The feeling of being dependent on the quantified information of the app, and in general, on the apps, strongly influenced the respondents' feelings and their behaviour of app usage. One respondent had a strong opinion towards this and said.

"I'm disgusted that I am still dependent on seeing the numbers on the app." (R4, 26, female)

"I enjoyed the run, but I think sometimes I enjoy it more when I see the numbers and I don't want to experience this, I want to be completely independent. My enjoyment or happiness level should be completely independent from the app." (R4, 26, female)

Following, several negative emotions were reported by users who felt dependent on the application and too attached to it, including fear and anxiety. Hereby, users described a general and potential risk for users to develop unhealthy behaviours due to using mHealth apps. A considerable amount of respondents also mentioned that mHealth apps should set an age limit, as they were concerned about younger individuals, who may misinterpret the information and insights provided by these apps and defined these as dangerous.

"And I think for that reason there needs to be age limits as in PlayStation games. So maybe some young people cannot identify this line between their virtual life and real life." (R3, 23, male)

With regard to the age limit respondents also revealed that they were concerned about the negative effects that mHealth apps can have on their mental health, especially for young individuals who are still 'naive'.

"It is sad, you know, if there are some young girls who are still triggered by the app or feel frustrated because they do not meet their goals or they compare themselves with friends and other people. It's kind of sad to see that this kind of health app can influence your mental health in a negative way. Especially if you're young and naive, as I was, you know, when I downloaded the app." (R4, 26, female)

In conclusion, some respondents found it easier to accept the provided information and insights just as facts than others, as not everyone can view them as facts without becoming emotionally attached to them. Nevertheless, there were a few respondents who achieved this goal.

"I see it like it's facts, it's not emotional because it's just a number. In my head I'm like, it's just a fact. It's nothing emotional." (R8, 22 female)

Independence

Another aspect of the paradox is independence, which most respondents mentioned frequently. This research has identified independence as a positive effect, defined in the context of being able to change behaviour without needing much support from the app in the long run. Several respondents noted that, especially during the later phases of using mHealth apps, they had already mastered the data and information the apps provided. In particular, respondents who used mHealth apps for running and tracking purposes reported that they had already acquired an understanding of their speed, the number of calories they were burning, and their heart rate. After several months of using their app consistently, they got to the point where they no longer needed to carry their watches or phones with them whenever they were exercising.

"This was actually the reason why I said, okay, I use it for some time, but not like every time I run.'' (R2, 33, Male)

Accordingly, a number of respondents noted that they were not using these apps as frequently as they were at the beginning. This is not due to negative experiences with the application but rather due to the fact that they were already familiar with what they were doing and no longer required it as a guide. Being independent of mHealth apps brought with it a feeling of satisfaction and happiness.

4.3.3 Achievement vs. Failure

Achievement

The third paradox, often experienced by users, was achievement/ failure. The results of this study revealed that several respondents used mHealth apps to confirm their expectations and achievements about their performances, such as the distance they walked or ran and how many calories they burned, and also to confirm behavioural changes. In regard to this, users mentioned that once they achieved their targeted goals and the app confirmed it, they felt proud and satisfied with themselves.

"Every time I have a good run and I see it on the screen, I love the run; It is actually being proud." (R4, 26, female)

"I felt satisfied." (M6, 26, female)

Getting active is not the key to user satisfaction but rather the fact that the app confirms the users' expectations. Some respondents even describe this process as ticking a box on to-do lists. As a result, they perceive it as completing a task. Positive emotions, such as motivation and satisfaction, arise when this task is confirmed.

" *(...)satisfaction because it's like ticking a box; I'm like, okay, cool that is done. (R8, 22, female)*

With regard to this another respondent said:

"I would say, yeah, very satisfactory. They motivate me to do more exercise than I usually would, and it just helps me with my day to day happiness and Mental health." (R8, 23, female)

Another emotion identified in regard to the paradox of 'achievement' is pride. This refers to the feeling of pride users feel after doing something positive for their body and mental health, achieving their goals, and maximizing their physical activity levels. Each respondent appeared to feel pride when they accomplished something. A good workout also contributed to the appearance of this feeling.

"I was proud and very happy but I am always happy after doing workout or after moving my body". (R4, 26, female)

Furthermore, another respondent stated:

"You feel proud and happy because of the hormones, you know, endorphins and stuff like that." (R4, 26, female)

Failure

In contrast, six respondents also mentioned that mHealth apps often can create a feeling of failure when users' expectations regarding their activity levels are not met according to the app. The feeling of failure results in negative emotional reactions, such as frustration and disappointment.

"It's the feeling that I get, when I cannot reach my steps, so I feel sad, pressured and disappointed at the same time.

Furthermore, some respondents reported feeling embarrassed when their expectations were not met or confirmed, and described this as feeling like they had failed.

"Yeah. It was like the feeling when your expectations are not met. It's like a failure." (R4, 26, female)

Most respondents reported that being disappointed with one's performance and not being able to meet their expectations led to feelings of anger and frustration.

"Frustration, definitely frustration, which then results in demotivation." (R4, 26, female)

Similarly, another respondent indicated that being frustrated with one's performance can lead to stress.

"The frustration then causes an inner stress and restlessness if I can say it like that." (R6, 26, female)

In line with this, when users knew beforehand that they would not be able to meet their daily goal for the day for various reasons, such as being in an exam week or having a long work day, they felt frustrated. As stated:

"Sometimes during periods, where I have to study or work a lot it is really demotivating as I know that I won't be able to reach my goals. Then I get frustrated a lot." (R6, 25, female)

The results of the study indicate that several users relied on the app's confirmation. Whenever the app does not confirm users' expected performance, negative emotions emerge and dominate the positive ones.

4.3.4 Self-comparison vs. Peer comparison

Self-comparison

Additionally, this study identified the paradox of using apps individually or in a community. In other words, the paradox relates to self-comparison vs peer comparison. In general, users preferred to use their apps for their own purposes and did not wish to share their results or information regarding their performance with their peers, friends, or family members:

"No, actually I never share it." (R4, 26, female)

Most users preferred to stay self-centred, so their performance or activity levels were kept private and only for themselves. Sharing their results with their community was instead considered pressuring. It was reported by almost all respondents that they felt pressured and stressed when hearing how active their friends and families were.

"You know, some friends I know there were like, oh, I did my 10,000 steps today, did you achieve it? So this can put a little bit of pressure on me." (R7, 23, female)

"Especially during Corona, everyone was starting to do the steps everyday, like walking in the park, for example, or just going outside for small walks. And you also hear from friends and family things like: "Did you already reached your steps today?", which also pressures you to be honest." R6, 26, female)

Interestingly, one respondent also highlighted the importance of personality traits in this context. When compared with others, people who are high in neuroticism may feel even more anxious and pressured, then people who are low in neuroticism.

"I think if you're someone who is really ambitious and has some neuroticism traits and you compare yourself with other people because they are sharing their results with you it can make you anxious, frustrated, demotivated."

Peer comparison

In contrast, some respondents highlighted the benefits of the second side of the paradox 'peer comparison'. Four respondents said they appreciate the app's features to connect with friends and families and enjoyed sharing their goals and achievements with friends with similar goals and interests. Thus, they also appreciated when friends and family members shared their performances, as this information seemed to motivate the respondents to also get active.

"*I started with my family and friends a challenge where we were constantly trying to outbeat each other with the amount of steps. By this I was to be honest more motivated to do my daily steps." (R6, 26, female)*

Similarly, another respondent stated that competition with friends motivates him, as well as competition with himself.

"So competition with you and with the others makes you more motivated." (R3, 23, male)

Worth mentioning is also that the participants made a distinction between the so-called "community". One respondent said that she only likes to compete and compare herself with people she knows and who have a similar job (e.g. office job). Comparing herself with others who are doing similar things and therefore are similarly active motivates her more than comparing herself with people with whom she is unfamiliar and does not know the type of job they perform.

"So if you are challenging yourself against friends , I would say you stay motivated because you can compare yourself a little bit and it's more on the easier side than compared to if you would challenge yourself against someone in the community worldwide where you are not knowing what they are doing in their daily lives." (R7, 24, female)

Although the majority of the respondents stressed that they were not willing to share their data online or with friends and families, some of them still did as they found it helpful and motivating at the same time. Seeing others' physical activities and performances encourages some users to become active. However, 7 out of 12 respondents still state that they solely use the apps to compare themselves with their previous performances.

4.3.4 Integration vs. Disintegration

Integration

A paradox of integration and disintegration was also frequently mentioned by respondents. The term ‘integration’ in this study refers to mHealth apps having the ability to be easily incorporated into a user's lifestyle. Most respondents claimed to carry their smartphone with them at all times, thus facilitating the incorporation of the application into their daily routines.

"So it's really easy to use." (R4, 26, female)

"For me, it was, like, easy to use, runs in the background, does not take a lot of battery from my phone because if you wanna go for a run, you still wanna listen to some music." (R4, 26, female)

Respondents also appreciated the fact that the app ran in the background while listening to music, enabling them to track their performance without interruption. A total of three respondents cited the Nike Run Club app as a favourite and expressed gratitude for this app:

"I'm also using the Nike Running App, and this app you can use together with your friends, which is really nice. It is also connected to Spotify, so in one app, you can track your performance and at the same time listen to some music, so you don't need to use two applications." (R3, 23, male)

In the research, respondents further indicated they considered reminders, often referred to as push messages, to be helpful, which explains the motivation for integration. In particular, the reminders were described as helpful during the initial phases of using the app.

"So I think a positive aspect is that it's like an incentive to actually go do something. Like if you know, this is your goal, this is how many kilometres or how many steps you want to do in a day, and you can actually see it happening on your watch, it's like a motivation, basically, to actually achieve that. So quite positive that it actually gets you out there walking or running." (R9, 23, female)

In general, the majority of respondents reported positive experiences with mHealth apps at the beginning of their use, but as their usage progressed, their experiences changed.

Disintegration

In contrast, several users complained that the app did not easily integrate into their daily lives. According to the majority of respondents who use workout applications, including weight lifting, they had difficulty tracking their progress and meeting the requirements of the apps. This, in turn, caused feelings of frustration.

"So yeah, when I when I go to the gym, for example, I don't really know what setting to press on because I am exercising, but most of the things that are available are more cardio related exercises." (R9, 23, female)

Additionally, while a few users found the app notifications helpful, the majority reported negative experiences with them. The majority of users described them as annoying and intrusive. Furthermore, a user reported feeling forced to squeeze in yet another workout:

"But then on the other side, it can also frustrate you if you had other activities planned and then you feel the urge to squeeze in this workout, even though, like, you don't feel like it at the moment, and you have a lot of things that you want to do that you fancy more." (R6, 25, female)

In addition, one of the major obstacles to integration was the lack of adequate personalization and inaccuracy of performance tracking.

(...) *"the problem is that it needs to be more personalized". (R3, 23, male)*

Similarly another respondent pointed out that personalization is missing in a sense, that the apps should be adjustable per person.

"So just putting that for me, it never made sense that just putting your height and your weight or your age already is enough for setting up a standard for you. So I think personalization would be better because, you know, not everybody's the same. We have different body shapes, different habits etc." (R1, 27, male).

Lastly, several respondents stated that they do not encounter mHealth apps as fully accurate and thus, find these unreliable and not properly trust in the numbers provided by the apps:

"I do think it's a bit silly to have calories burned on them because they're not accurate and I think it's quite misleading."(R8, 22, female).

"Because at the end these apps are not very accurate. They're not as accurate as, I don't know, another system because they ignore so many other things like your body and parameters, you know." (R5, 25, female)

Paradox / Emotion	**Definition**	**Quote**
Motivating ▪ Happiness ▪ Joy ▪ Satisfaction	The app motivates users to achieve their personal goal.	*"I'm very motivated to go out and I'm very motivated to do more steps." (Respondent 1, 26, male)*
Demotivating ▪ Stress ▪ Guilt ▪ Disappoint ment	The app demotivates the user to stay active.	*"During periods, where I have to study or work a lot it is really demotivating as I know that I won't be able to reach my goals." (Respondent 6, 25, female)*
Independence ▪ Satisfaction	Users have a stable and healthy relationship with the app.	*I feel better not to be tracked all the time. I mean, your life is anyways tracked a lot, you know, like I know your credit card, your clock in, clock out at work you anyways a lot of tracking happening in your life. So why should I do in my free time when I have a nice run or you know, when I sleep? Why should I continue that thing, you know, maybe, you know, I don't know. But it could be that it goes in that direction. (Respondent 2, 33, male)*
Dependence ▪ Fear ▪ Anxiety	Users have an unstable and unhealthy relationship with the app.	*"I think just dependency for me is the most striking one, you know, because I think if you overdo it and you, like, put too much meaning into the numbers. And then it's dangerous, you know, because then, you know, you run and you just control every time." (Respondent 2, 33, male)*
Achievement ▪ Happiness ▪ Pride	The app is used to confirm user's expectations by providing them insights on their performance.	*"Every time I have a good run and I see it on the screen, I love the run; It is actually being proud." (R4, 26, female)*
Failure ▪ Frustration ▪ Disappoint ment ▪ Anger ▪ Pressure	The app disconfirms the user's expectations, causing negative feelings.	*"It felt kind of like a burden, because if you didn't meet the expected goals from the app, you kind of saw your failures, you know, because you were like, oh, I didn't reach the 10,000 steps. I didn't exercise enough during the week. So, it's it was kind of like a lot of pressure at first." (7, 24, female)*
Self-comparision	Users do not share their results with others and use the app only for themselves. ▪ Self-focused	*"No, actually I never share it online." (R4, 26, female)*
Peer comparison ▪ Pressure ▪ Stress ▪ Motivation	Users appreciate being able to share their experiences and performances with friends, family, and peers.	*"Therefore, I started with my family and friends a challenge where we were constantly trying to out beat each other with the amount of steps. By this I was to be honest more motivated to do my daily steps." (R6, 25, female)*

		"Yes, in the beginning it was actually quite funny and motivating but after a while it started stress me out a lot. When I sometimes heard how many steps my friends already made during the day, it kind of put me into pressure." (R6, 25, female)
Integration ▪ Satisfaction	Users can easily integrate the app into their daily lives. ▪ Ease of use ▪ Convenient features	*"And for the like running app, I only use it when I go for a run. So, you push the start button and then it runs in the background and then you end it if you are finished with your run. So, it's really easy to use." (Respondent 4, 26, female).*
Disintegartion ▪ Frustation	Users cannot easily integrate the app into their daily lives. ▪ Lack of personalization ▪ Unreliability ▪ Technical incometence	*"Because, like, sometimes I wasn't sure if it was really accurate. Like, I had the impression that it was always kind of giving the same and that it was like a bit going into an unhealthy direction and relationship with the sport." (Respondent 5, 24, female).*

Table 2: Overview of the experiences paradxoes and emotions

4.4 Coping strategies

Coping strategies are methods for dealing with paradoxical tensions that arise when using mHealth apps. These strategies are designed to alleviate negative emotions such as stress, frustration, and anger. Table 3 shows the five significant coping strategies identified in the research targeting negative emotions.

4.4.1 Discontinuing

This study identified discontinuing as one of the most prevalent coping strategies. Discontinuation occurs when a user stops using mHealth applications that trigger paradoxical tensions and negative emotions. Most commonly, this was the case for the paradoxes of 'dependence/independence' and 'motivating/demotivating' that involved negative emotions, including stress, guilt, anxiety, frustration and fear. Several respondents reported that this coping strategy was mainly used to alleviate the negative emotions resulting from not achieving their desired goals as well as receiving bad push notifications and reminders. Two respondents highlighted that the extra pressure they felt was one of the reasons why they stopped using the app or no longer wanted to carry their smart devices, which were connected to their mHealth apps.

"I: Okay but how do you think these negative experiences actually affected your usage of these apps?

R5: Well I completely stopped using it.

R6: Sometimes I just don't want to carry my phone, because I feel like it stresses me."

To reduce feelings of pressure, stress, and frustration, one respondent first deactivated notifications and then deleted the app completely, as it was still negatively affecting her mental health.

"I had these notifications at the beginning of my usage of the apps, but then I deactivated them because I think it had a negative influence on my mental health, and it put more pressure on me." (R4, 26, female)

In addition, discontinuance resulted from a fear of becoming too dependent on the application. Often, it was described as a feeling of being overly focused on numbers and pushing oneself to an unhealthy degree. Thus, the majority of respondents believed that mHealth apps might become dangerous over time. As a result, they became more cautious with these apps and used them less and less.

Lastly, privacy concerns were another factor contributing to the discontinuation. Most respondents were aware of what app developers were doing with their data but were also anxious about what they were doing with it. To eliminate this feeling, they decided to delete the app:

"Like for me, because I use it for running so they kept track of the exact tours that I was running and everything and like the exact spots and everything was like recorded and I don't know where all this information went." (R5, 25, female)

4.4.2 Distancing

Another passive coping strategy used by the respondents was distancing, in which users emotionally or physically distant themselves from the app and its functions. This coping strategy targeted dependence/independence and integration/disintegration paradox.

It has been found that users who feel overly dependent on mHealth apps, experience several negative emotions, such as stress, fear, and frustration. As a means of reducing negative emotions, users distanced themselves and claimed that they learned not to become affected by the app's information. Users distanced themselves from the app by not recording workouts and leaving their smartwatches and smartphones at home, thereby preventing it from tracking their

activities. The reason cited by some respondents for not tracking their physical activities was that they felt less pressured when exercising without their apps.

"*I would enjoy running more if I don't use the tracking app or if I don't have my phone with me." (R4, 26, female)*

In addition to that, one respondent even said that mHealth apps can desensitize people from their emotions.

"So I think it sort of desensitizes us from our own emotions. Like, for example, I did a hike today that I've done before and today I had my watch on and the first time I didn't and I can say that it was much easier to do the hike the first time without the watch because you're not constantly checking how far you've hiked." (R9, 23, female)

Furthermore, respondents stated that they had distanced themselves from the apps once they had achieved their goals. Despite this, they do so when they feel they need to use it again. This was mostly the case for individuals seeking weight loss.

"So, I'm in a dieting phase at the moment, so I know that counting calories is important, but I know this only this will only last 10 to 12 weeks.nd I know I'm not going to be counting calories for the rest of my life every day. So yeah, I know it's only like a couple of weeks. So, yeah, I'll continue using them until I don't need them anymore and then I'll use them again when I do." (R8, 22, female)

Distancing also targeted the integration/disintegration paradox. However, it is important to note that this coping strategy focuses primarily on positive experiences rather than negative ones. In some cases, users felt they had acquired sufficient understanding of each feature, including their heart rate when running at a particular pace, how many calories they are burning, etc. As a result, they did not use the app as frequently as in the beginning and therefore kept distancing themselves from it. However, when there were days when they wanted to track their performance again, they did not hesitate to use it again.

4.4.3 Ignoring

Based on the study's results, ignoring was also a frequently mentioned coping strategy. Respondents have indicated that they avoid or ignore the information provided by mHealth apps or, in general, the app as a whole. This is often the case when users acknowledge the paradox of self vs peer comparison and goal accomplishment vs failure. Thus, ignoring mainly targets the emotion of pressure, frustration and disappointment. In order to decrease negative emotions, it has been reported that many users are simply ignoring the push notifications sent by their app once they are unable to meet their goals, as well as messages from peers and colleagues who share their activity data with them. As a result, the respondents accepted the information provided and did not allow it to affect them.

"It just doesn't matter. I just keep using it. And because even if you miss one day, that's fine. You just start again the next day." (R8, 22, female)

Some respondents even stated that once they started ignoring notifications, they were able to perceive their surroundings more than when they were not using their phones or smartwatches during their run or hike. Due to the absence of their respective apps, they could fully enjoy being outdoors and exercising without constantly having to be reminded of how well they were performing or how many kilometres they had covered.

"I've also experienced it with a lot of people, that they're not in the moment when they are doing a hike or run. They just care about what the watch says." (R9, 23, female)

Because of this, users tend to ignore these apps and do not use them every time they workout. The information provided and the progress are also not taken too seriously by them.

"Ignorance is bliss." (R9, 23, female)

4.4.3 Adjusting

Adjusting was another coping strategies mentioned by the respondent to deal with negative emotions, such as the fear of getting back to old patterns, because of not being active enough, which users aimed to avoid and also not being able to reach their goal. Several users stated that they wanted to improve their lives and well-being in every way. For some the usage of mHealth apps was one way to do so, as these apps allows users to discover their so-called poor habits and give insights regarding their physical activity levels. Although the majority of respondents stated that they wanted to become more aware of their overall well-being, they

also noted that the ability of the app to track bad habits was, for some, stressful and disappointing to witness.

"Okay so it's not the app's fault that I have these habits, but the fact that the app is showing me that is causing this stress. (R1, 27, male)

The negative emotions, as a result, demotivated some of the users, as they felt that the app had exposed them. As a result, respondents reported initially distancing themselves from the app to avoid being confronted with negative information. Although some participants reported feeling disappointed, pressured and stressed at first, they also felt motivated to improve their performance and lifestyles. As a result of adjusting their thinking patterns and viewing these discoveries as positive, they were able to lose negative evoked feelings and create positive ones, such as happiness and pride.

"I didn't expect that they would change my habits and make it more positive" (R1, 27, male)

Moreover, the self-tracking apps also increased respondents' physical activity. This was commonly found for step counting applications on smartwatches such as Apple Watch, Garmin and Fitbit:

"So what I did is because the app always reminds me that I did not take enough steps and I can see how many I took. I started walking everywhere." (R7, 23, female)

Concept	**Definition**	**Quote**
Discontinuing	Users stop using the app.	*"Well I completely stopped using it." (Respondent 5, 24, female)*
Distancing	Users distant themselves from the app and its functions.	*"I kind of at those times distanced myself from these apps. So I, for some time I didn't use it over the four or five years. I just stopped checking the numbers and yeah, that's the way I dealt with it." (Respondent 11, 26, female).*
Ignoring	Users received smartwatches as a gift and started using it out of curiosity.	*"I tend to ignore stuff like that because I don't get really bothered. So yeah, I don't really get bothered because there's other days that I do more. So, there might be a day that I don't make 10,000, which is my standard, then other days that I do 7000 or 5000 or even, and like maybe a week passes and I do 27,000." (R1, 26, male).*
Adjusting	Users adjust their behaviour and habits to the requirements of the app.	*"I think I changed my routine by going more outside in the morning. Before tracking my steps, I used to start studying directly after I woke up. Now I try to get my steps first in the morning, as I feel more energized and productive when I do my steps before studying. I think it's the feeling of pride and joy that pushes me to continue and also changing my habits in a good way." (Respondent 6, 25, female).*

Table 3: Coping strategies

4.6 Future Outlook

Eleven out of the twelve participants indicated that they would continue to use mHealth apps. Despite this, several users indicated that they were aware of the dangers and risks associated with these applications. Therefore, users made several suggestions for the development of future mHealth applications. A number of users argue that mHealth apps are great tools for assisting people with their physical health tracking and becoming more active. Several users have reported that the apps have helped them become more aware of their health and have further motivated them to take better care of themselves and exercise more. Despite this, most respondents reported that they would use these apps more cautiously because they found them toxic and dangerous. Thus, they stated that they would like to see some changes, so they will continue to use these applications in the long run. A few users also emphasized the importance of personality traits in this research. According to one respondent, users' willingness to continue using these apps could be influenced by their personality traits. As a general rule, people who are happy with their lives tend to deal with the negative emotions associated with mHealth apps better than people who are already experiencing difficulty with their lives.

Consequently, many respondents stated that these apps could potentially be hazardous, especially for young people who cannot distinguish between reality and virtual experiences. The following chapter will discuss and integrate these findings into a broader context.

"So, I think it depends on the personality. If you're an easygoing person, if you are happy and healthy in general, then this wouldn't affect you. But if you are in a depressed state of mind, or how do you say like in a more depressive phase in life, then I think this could have a big negative influence." (R4, 26, female)

5. Discussion

5.1 General Discussion

In the last few years, mHealth apps have rapidly grown in number and popularity (Olsen, 2021). Accordingly, the paradoxical feelings of tension that accompany positive or negative emotional reactions are also more present with the use of mHealth apps. Although there is already extensive literature on the topic of mobile mHealth apps, this research contributes to a topic that has not received extensive attention - the emotional impact of using mHealth apps. In this regard, the purpose of this study was to gain insights and explore more about the emotions that users experience when experiencing contradictory feelings and how they cope with them in practice. In this regard, this study aimed to answer the following questions:

A) *"What are the emotional consequences elicited by paradoxical tensions of using mHealth applications?"*

B) *"How do users cope with these emotional consequences?"*

In order to evaluate the effectiveness of mHealth apps, this study first identified the initial motivation of respondents. The three main motivations were seeking guidance, receiving insight and curiosity. As a second step in understanding why users behave as they do while using mobile health apps, users' positive and negative experiences were explored. As a result, five main paradoxical reactions have been observed in relation to the use of mHealth apps: Motivation/ Demotivation, Dependency/ Independency, Self-comparison/ Peer comparison, Goal accomplishment/ Failure and Integration/ Disintegration. In turn, these paradoxes evoked both positive and negative emotions from the users. This study found that Joy, Happiness, Pride, Satisfaction, and Motivation were the most prevalent positive emotions, while Anger, Frustration, Disappointment, Guilt, and Fear were the most prevalent negative emotions. In response to the tensions that were associated with mHealth apps, users developed coping strategies that were aimed at relieving stress-related feelings. This research identified four coping strategies: Discontinuing, Distancing, Ignoring and Adapting/Adjusting. Furthermore, respondents emphasized both the benefits and the dangers of mHealth apps, such as contributing to unhealthy standards that negatively affect physical and mental health and distort perception.

Several researchers have identified paradoxes, tensions, and coping strategies related to technology (e.g. Blazevic & Klintwort, 2029; Mick & Fournier, 1998; Jarvenpaa & Lang, 2005). Despite many similarities between this study and prior studies, some differences exist, such as identifying positive and negative emotions evoked by mHealth apps, which were often

not explored. This discussion is mainly based on Blazevic and Klintwort's (2019) and Mick and Fournier's (1998) research, which is the basis of most studies related to technology paradoxes.

A discussion and integration of the research results will follow in the below section. In addition, the practical implications and contribution to knowledge will be discussed. Furthermore, limitations of this study, ideas for further research and a conclusion will be presented.

5.1.1 Initial Motivation

In this research, respondents initially decided to use mHealth apps as a means to measure their actual state, track their individual performance, and acquire knowledge regarding how to do so. Accordingly, the basis of the original motivation was seeking guidance and receiving insights. There were also two respondents who began using mHealth apps only out of curiosity after receiving a smartwatch as a gift and hearing positive opinions from friends.

In this study, all respondents were aware of the benefits of mHealth apps, which were known to positively impact their mental and physical health. Consequently, consumers have been more motivated to use and engage with mHealth apps since their main goal was to improve their overall health and increase physical activity. Mummah et al. (2016) also identified awareness and self-monitoring as one of the most promising methods of changing sedentary behaviour and increasing physical activity. Similarly, Duttweiler (2016) asserts that self-tracking allows for behaviour modification, performance improvement, and behaviour control. Nearly all respondents to this study were positive about the self-tracking and self-control capabilities provided by mHealth apps. Among the main reasons that users chose to use mobile health applications were their curiosity about their performance and their desire to increase physical activity. The findings of Duttweiler (2016) and Mummah et al. (2016) were widely supported by respondents, who reported that mobile health apps and self-tracking had improved certain aspects of their lives. In particular, running and calorie counting applications were frequently used to accomplish specific objectives such as losing weight, increasing running distance and improving sedentary behaviour. In addition, respondents to this study particularly appreciated the factual information and insights provided by their mHealth applications. Providing factual information allowed respondents to better understand users' behaviours and habits, and respondents positively acknowledged it. Additionally, several users appreciated the gamification features within their apps, which incorporated gaming dynamics to make exercising enjoyable and entertaining. In accordance with that, Schmidt-Kraepelin et

al., (2022) found that gamification and attractive rewards in mHealth apps eliminate the monotony of day-to-day activities and motivate users to achieve their daily goals, thus enhancing their engagement.

5.1.2 Paradoxes

This study explores the experiences of users with mobile health apps by adapting the paradoxes of technology proposed by Mick and Fournier (1998) and Blazevic and Klintwort (2019). The paradoxes identified by this research correspond in their core with the paradox definition as "a statement that appears self-contradictory." (Bar-Hirrel & Quine, 1968). A total of eight paradoxes have been identified by Mick and Fournier (1998). However, this study identified only five paradoxes. Therefore, some of Mick and Fournier's (1998) findings do not apply to this study. The paradox of competence vs incompetence is one of them. Due to the fact that the respondents in this study are young adults with extensive experience with smartphones and smartwatches, this paradox is not applicable. The paradox of new/obsolete identified by Mick and Fournier (1998) cannot be found in this study as well. This is due to the frequent updates offered by mHealth apps, which makes them unlikely to be outperformed quickly by others. A further paradox identified by Mick and Fournier (1998), but not in this study, is the paradox of assimilation/isolation. There was no indication among the respondents that mHealth apps could lead to human separation. The difference in findings can be attributed to the fact that Mick and Fournier (1998) focused on household technologies twenty years ago, whereas this study focuses on mobile health applications.

Motivating/Demotivating

Blazevic and Klintwort (2019) also identified a paradox of motivating/demotivating, which resembles the paradox of engaging/disengaging identified by Mick and Fournier (1998) and Jarvenpaa and Lang (2005). In light of the paradox stated above, users perceive mHealth apps to be engaging and motivating in the sense that they aid them in achieving their goals and becoming more active. However, once these goals have not been achieved or users receive undesirable push notifications, they become disengaged and unmotivated. In line with Asimakopoulos et al. (2017), this research reveals that insights and visualizations regarding progress and performances enhance mHealth users' motivation and are seen as helpful. The motivational aspect arose mostly from the positive results the users saw. This, in turn, motivated users to continue using the app and be more motivated to achieve their daily goals and improve their performance for the following days. Positive emotions such as happiness

and joy were evoked in response to these factors. The main reason for this can be attributed to the accomplishment of their goals. Further, in accordance with Wong and Kwok (2016), this study found that gamification increases a user's motivation, enhancing physical activity. This is also in line with King et al. (2013), who argued that gamified mHealth apps show that "the physical activity participation in all subjects increases while sedentary behaviour decreases." The respondents in this study also claimed that they felt happier and more satisfied once they received vibrations after reaching their goals and visualizations such as a trophy or firework. These positive emotions were also found in the Duus et al. (2017) study, where a gamified design elicited positive emotions in users, such as pride and happiness.

Nevertheless, this study revealed that most respondents perceived the app as positive and motivating at first but shifted to negative perception, later demotivating the users. In most cases, this was due to the inability to reach their goals and push notifications, which induced stress and pressure within the users and negatively affected their mental health. Further, a feeling of guilt and disappointment was generated by the negative information displayed regarding their performance and being reminded that one is not meeting their goals. This has also been underlined in a statement by Duus et al. (2017) and Kerner and Goodyer (2017) that poor performances and negative push notifications cause feelings of guilt, pressure and stress among mHealth users.

Dependence/ Independence

Jarvenpaa and Lang (2005) also identified the paradox of dependence and independence. Similar to the paradox of freedom vs enslavement, the respondents indicated that using mHealth apps can result in dependency, such as enslavement (Mick & Fournier, 1998). In this instance, dependency is referred to the fear of overemphasizing what an app is saying and thus, allowing the app to control a respondent's emotions and experiences. Following, Duhachek's (2005) findings, the respondents in this study also aimed to control their emotions and make them not dependent on the application. As a result, when users recognized that their emotions and experiences were caused by the app, negative emotions such as fear and anxiety elicited in them, which they tried to avoid.

However, this was not the case for all respondents. Some respondents were better at maintaining a certain distance from the app than others. As a result of using mHealth apps for an extended period of time, some users became familiar with important key performance indicators. This resulted in no longer needing to use the app regularly. Consequently, users experienced positive emotions such as happiness and satisfaction. In addition, some users were

also able to put less emphasis on numbers. As a result, they did not allow these facts to affect their emotional state and simply accepted them as facts.

In conclusion, these findings indicate that different behaviors among users also result in different abilities and tendencies to become dependent or independent on the mHealth applications.

Self-comparison/ Peer comparison

This study identified a new paradox involving the conflict between self-comparison and peer comparison. According to most users, they do not wish to share their performances with other users in order to focus primarily on themselves. Several users have reported feeling pressured and stressed when they receive notifications regarding the activity levels of their friends and family members. Nevertheless, some respondents noted that sharing their information with their family members motivated them to become more active. The most frequent experience of this was reported by those who described themselves as competitive. Despite several studies showing that competition motivates people to exercise and become more active, this study does not support these findings (De Korte et al., 2018).

Users expressed a sense of pressure and embarrassment as a result of competition. It is common for users to feel frustrated and embarrassed, particularly when their performance falls short of that of others with whom they compare themselves. This is also consistent with the findings of Uphill and Jones (2007), who found that athletes and performers experienced feelings such as anger and anxiety when competition threatened their personal goals. These findings were also confirmed within this research as some users were afraid of the appraisals and opinions of others on their performances. In contrast, this was not the case for all respondents. A few respondents said they enjoyed competition, as they were competitive people. Accordingly, personality traits and characteristics may have a significant impact on mHealth adoption as well as provide alternative findings to the paradox of self-comparison and peer comparison when explored.

Achievement/ Failure

The paradox of achievement vs failure is closely related to the paradox of confirmation vs disconfirmation explored by Blazevik and Klintwort (2019). When the app confirms respondents' expectations regarding their performance, there is a sense of pride and satisfaction. In contrast, when they are not performing at their expected level, users feel frustrated and disappointed and sense a feeling of failure. As described at the beginning of this thesis, mHealth apps can elicit both positive and negative emotional reactions within users. It has been reported by Chastin et al. (2014) that when users have positive experiences with mHealth apps and their

expectations are met; they are more likely to continue to use them. More specifically, when the user experiences satisfaction, the app is more likely to be used in the future. The results of this study confirm this, as satisfaction was one of the most cited positive emotions among respondents when their expectations were confirmed. The respondents described the feeling as the result of knowing that they moved their bodies and are closer to achieving their goals. As a result, satisfaction in this research was primarily attributed to achieving goals, not the app itself, such as ease of use (Alanzi, 2022).

It can be concluded from these findings that technology and consumers can become increasingly integrated and reliant on one another. This is also consistent with the findings of Duus et al. (2018). According to this study, most consumers place greater trust in technology confirmations than in their own abilities. In addition, they place a great deal of importance on the confirmation of the app, and allow their emotions to be influenced by it. When the app does not confirm their anticipated performance, they feel frustrated, contrary to when it does confirm, they feel pleased and satisfied.

Integration/ Disintegration

As described by Blazevic and Klintwort (2019), this paradox results from the respondents' contradictory perceptions of how mHealth apps fit into their lives. In health-related areas, it has been shown that the intention to use is greater when mHealth apps have low effort expectancy (Lima et al., 2019; Sun et al., 2013). This is also evident in this research. As noted in other research (Blazevic & Klintwort, 2019; Jarvenpaa & Lang, 2005; Munson & Consolvo, 2012), ease of use contributed to integration, whereas inconvenience led to disintegration. Many users expressed their gratitude for step counting and running applications because of their ease of use since their steps were automatically tracked throughout the day without having to open the application. The fact that all respondents carry their phones with them wherever they go makes the integration of the mHealth apps also easier. Similarly, respondents stated that they liked features such as simultaneously tracking their performance and listening to music on Spotify, which would connect to their running app (Nike Run Club app).

Conversely, users complain about difficulties integrating their apps due to technical incompetence. Some users who were lifting weights complained that they could not track their progress and did not know which setting to select. Disintegration was also caused by the lack of personalization of mHealth apps and unreliability in data accuracy. A majority of respondents suggested that the apps should be customizable based on the individual. Meaning

that apps should not only focus on the weight and height of the users but also on their fat and muscle percentage to make the provided data as accurate as possible. Several researchers claim that smartwatches, such as the Fitbit, Garmin and Apple watches, are reliable and accurate. Thus, the participants trust the collected and presented data (Bender, 2012; Duus et al., 2018). This study, however, indicates otherwise. Respondents in this study mentioned facing technical difficulties, such as smartwatches tracking hand movements as steps while sitting. Accordingly, this made the integration of their respective mHealth applications difficult. Unlike respondents in other studies, mHealth users in this study have questioned the data provided and decided not to rely too heavily on the information and input the apps provided. Consequently, this study suggests that activity apps such as step counters and running apps are often perceived as easy to use and beneficial and, therefore, are easily integrated into users' daily lives. In contrast, workout apps are often not fully integrated.

The respondents in this study further discussed the contradicting feelings of reminders and push notifications. In one regard, users reported that reminders were helpful and motivating, making integration more likely to occur. Some of them, on the other hand, found it stressful and pressuring. Recent research supports these findings. A study by Hernandez et al. (2020) found that push notifications have effectively motivated people to lose weight and become more physically active. In contrast, Lentferink et al., (2022) shows mainly negative experiences with mHealth apps when the frequency of push notifications could not be adapted. Therefore, future interventions should examine the effect of different message contents and notifications frequency , as well as, to optimize notifications so that they will be perceived as helpful and encourage integration.

To conclude, users who experienced positive experiences with the application were satisfied, as demonstrated by Jarvenpaa and Lang's (2005) study. It was reported that users felt satisfied and motivated as a result of this positive experience. In contrast, when users' expectations of their apps were not met, and they faced difficulties, they experienced negative feelings such as frustration and pressure.

5.1.3 Coping strategies

When using mHealth applications, respondents often experience paradoxical tensions that lead to feelings of stress and pressure. As a means of dealing with these emotions, users employ coping strategies. This is in agreement with Mick and Fournier's (1998) study, which found that consumers often employ coping strategies when technology negatively impacts users daily lives. The same applies to this study. A total of thirteen coping strategies were identified by Mick and Fournier (1998) with regard to household technologies. This research, in turn, identified four coping strategies. The following paragraphs discuss and contextualize the four coping strategies found in this study.

Discontinuing

Discontinuing can be referred to the term ‘abandonment’ in Mick and Fournier’s (1998) research. In this strategy, the user stops using mHealth apps completely. It is mainly the tensions of dependence vs. independence and motivating vs. demotivating that trigger negative emotions in users and cause discontinuance. Many users reported experiencing feelings of stress, guilt, anxiety and frustration as a result of push notifications and not being able to reach their goals. As a result, they decided not to use them anymore.

Nevertheless, it is worth mentioning that users decided to discontinue their use of these apps due to their concern about becoming too reliant on the data and insights provided by these applications. By deleting the app, users were able to maintain control over themselves and their emotions, preventing over dependence on the app. In addition, privacy concerns also contributed to the development of fear and anxiety. It was mentioned by a few respondents that being unaware of the application developers' use of their personal information made them concerned.

Distancing

In this study, distancing was the most frequently used coping strategy. As described by Mick and Fournier (1998), 'distancing' is a consumption avoidance strategy in which consumers apply restrictive rules to technology use. Similarly, respondents in this study reported intentionally distancing themselves from the app to reduce feelings including: stress, fear, and frustration. In this sense, most respondents indicated that they used their respective apps less to record workouts, physical activities, etc. The users even left their smartphones and smartwatches at home, which were connected to their app, so that they would not even experience the negative emotions that these applications often elicited.

Conversely, users were also distancing themselves as a result of positive experiences. Several respondents indicated that after using mobile health apps for a longer period of time, they had developed a sense of understanding and did not require further guidance. In accordance with the findings by Duus et al. (2018), users reported gaining confidence as a result of learning from the tracker and acquiring their own, internalized capacity to manage their health and well-being. Accordingly, as in line with Duus et al., 2017) findings, the knowledge transfer enabled users to make health and fitness-related decisions on their own and not be reliant on the app any longer. Thus, users wanted to stay in control as a result, they distanced themselves from time to time (Blazevic & Klintwort).

Ignoring

This coping strategy was also acknowledged by Mick and Fournier (1998) and Blazevic and Klintwort (2019). The concept of ignoring is used in this study to address the paradoxes of self-comparison versus peer comparison, as well as achievement versus failure. Consequently, this coping startegy primarily targets the feelings of pressure, frustration, and disappointment. This study found that respondents considered ignoring to be one of the most effective strategies for overcoming, as well as preventing the emergence of negative emotions. Knowing beforehand that they would not reach their daily goals or that the app would not confirm their expectations, users anticipated that they would feel disappointed as a result. Thus, prior to the appearance of these emotions, they ignored their application. Ignorance was primarily attributed to the push notifications that were sent when goals were not met. Also, peers and colleagues were simply ignored when they sent messages about their activity status, to avoid the feeling of pressure. Accordingly, this coping mechanism can also be understood as a form of "self-defeating behaviour" (Trice et al., 2001). According to Blazevic and Klintwort (2019), this behavior may be described as mental abandonment. Based on this, the authors found that respondents often temporarily give up on their goals and desires when they assume they will not be able to improve their performance, and therefore ignore the application requirements. The results of this study also support this finding.

Adjusting

Adjusting, known as 'accommodation' in Mick and Fournier's study (1998), is a rather confrontative strategy, requiring users' action to diminish the tensions. As consumption avoidance strategies are more passive, this coping strategy indicates a positive one. This is in line with Blazevic & Klintwort's (2019) findings, in which users change their behaviour to

reduce tension and negative emotions. Among the respondents in this study, this strategy was applied to reduce negative feelings arising from bad habits, including stress and disappointment. In addition, respondents who were concerned about reverting to old unhealthy habits also aimed to reduce the feeling of fear. Accordingly, users were more aware of the habits and behaviour that they sought to improve. As a result, their levels of physical activity and sleep patterns were adjusted.

5.2 Theoretical Contributions

In response to the call from scholars, such as Duus et al. (2018) and Duhachek (2005), the purpose of this study is to provide an in-depth analysis of the emotional impact mHealth apps have on consumers. As well as the emotional impact of mHealth apps, this study examines the paradoxical tensions users experience and their coping strategies in detail. Further, in this study, information and insights have been obtained from active mHealth users from five different countries in order to address the limitations of several researchers. Accordingly, this research focused on the development of new knowledge on paradoxes with a particular focus on the emotional impact of mobile health applications on users.

First of all, this Master Thesis contributes to the research's theoretical lens and other literature on paradoxes of technology (Mick & Fournier, 1998; Jarvenpaa & Lang, 2005; Blazevic & Klintwort, 2019). This research not only identified paradoxes and coping strategies similar to former findings, but also identified a new paradox self-comparison/peer-comparison, which was not found yet in the existing literature on technology paradoxes. Furthermore, this thesis contributes to the literature gap that exists regarding the consequences of paradoxical tensions on mHealth users' emotions by shedding light on when negative emotions such as frustration, disappointment and guilt may occur.

Furthermore, the results of this study add significant value to the existing literature on mobile health. Despite the rise in the number of mHealth apps and its literature in recent years, the number of mHealth users has not remained consistent. Users stop using the apps. In addition to stopping using the app, the users also develop coping mechanisms to deal with it. Although coping strategies have been discussed in past literature, the users' experience of emotions has not been extensively examined and analyzed. Consequently, this research contributes to the growing literature on consumer behaviour theory and consumer emotions. By identifying ten emotions, this thesis provides a more comprehensive conceptualization of emotions with regard to mHealth than that presented in current literature (Blazevic & Klintwort).

Moreover, the findings of this study indicate that emotions have a significant impact

on the way users engage with mHealth apps. The more positive emotions users experience while using mHealth apps, the more likely they are to continue using them. In contrast, the more negative the emotions are, the more distance users establish with the apps. Additionally, this study found that emotions vary across consumers, as there appears to be a relationship between personality traits and emotional reactions. Future research will be required to analyze further the personality traits of users regarding Mhealth apps and examine their experiences.

5.3 Managerial Implications

In this study, positive and negative aspects of mHealth apps, their paradoxes, and the emotions associated with them were identified, as well as the coping strategies of users. Specifically, the identified emotional reactions related to paradoxical feelings indicate a number of managerial implications. In order to sustain a long-term usage of mHealth apps, the following aspects should be taken into consideration.

First, from a managerial perspective, the economic success of mHealth apps relies mainly on consumers' positive emotions. Consequently, managers and app developers should invest in research to eliminate negative emotions caused by mHealth apps. With regard to that, this research provides relevant insights which have not been researched in previous literature. Users of the Garmin watch were the only ones who did not experience negative emotions. The reason is that the Garmin watch reminds its user to take breaks to avoid over-exercising. As this result confirms the impact on users' mental health, managers and app developers have a highly responsible role. Managers and developers should pay more attention to different message contents and push notifications, as well as the frequency of these notifications.
Moreover, they should examine the possibility of optimizing these in order to make them perceived as helpful and encouraging. In fact, one user suggested that the app should use affirmations whenever a goal is not achieved. Instead of challenging the person to still reach the goal, these reminders could be made in a more understanding and forgiving way. These affirmations could positively affect users' feelings resulting in a more positive usage in frequency with the app. Additionally, one user even requested that the app encourages users not to use the app frequently in order to be able to listen to their own bodies and therefore avoid dependency.

Since five of eleven users experienced temporal distancing from the app as a response on negative feelings, managers and developers should try to track people’s emotions. Interestingly, a user of the Garmin watch stated that the app checks the user's emotions after a tracked exercise session. This should be implemented in all mHealth apps. Developers could

go further by integrating artificial intelligence into their apps' software. AI could analyze the relationship between the users' experienced emotions and the usage frequency. With each notification of the app and each reaction of the user, it would be possible for the app to continuously learn more about the user and, hence, improve in order to support a long-term use.

Furthermore, some users wished that mHealth apps would allow more personalization. More specifically, a user requested a more detailed and accurate assessment of their body's fitness, besides their height and weight. Additionally, users' personalities might be a factor to investigate since this study confirmed that users react differently to the same mHealth notifications. Developers and managers should examine which content and push notifications, as well as the app's structure, positively and negatively influence different personality types. Consequently, a personality test could be included in the account creation process. Once the user's personality has been determined, the entire app features and notifications should be customized and adapted accordingly.

A few respondents further highlighted the positive experience of gamification of the app. Getting trophies can improve the users' feelings, but gamification can blur the line between reality and virtuality. App developers and managers should recognize and investigate the risks associated with failing to distinguish between these two worlds. Therefore, a minimum age for the use of mHealth apps should be discussed. In addition, some respondents questioned the minimum age due to the fact that younger users may listen to their phones more than they do to their bodies.

The findings indicate that managers and developers need to pay closer attention to users' feelings since positive feelings and the avoidance of pressure and disappointment are driving factors for increased usage frequency of mHealth apps. From an economic point of view, it is not only managers and app developers who benefit, but above all the healthcare sector.

5.4 Limitations

Although the research was successful in achieving its objectives and producing relevant results, there are some limitations which could not be eliminated. As a first point, it should be noted that this study is not representative, and therefore, it cannot be generalized, as no more than eleven respondents were interviewed for this study. Further, although this research initially conducted twelve interviews, one had to be excluded, resulting in a sample size of eleven. In addition, the respondents of this study were selected based solely on the researcher's networks by a convenience sampling criterion and a snowball sampling procedure. The findings of this study are limited to individuals with specific demographic and socioeconomic characteristics, making generalizations difficult. Furthermore, the sample is not balanced by gender and age, as there are three men and eight women ranging in age from 22 to 33. Therefore, it might not be valid to generalize this study's results to individuals younger than 22 and older than 33 years. Even though this study examined respondents from five different countries rather than being restricted to one nationality, its findings may not be generalizable due to the uneven distribution of nationalities: 60% German, 10% Luxembourgish, 10% Belgian, 10% Turkish, 10% Greek, and 10% South African. It is even more challenging to generalize and transfer these findings to a broader context due to the unequal distribution of nationalities.

Also, since semi-structured interviews encompass a degree of freedom in formulation and questions, the interviews were not entirely consistent and, thus, differed in their thematic focus. Upon examining the apps investigated in this thesis, it should be noted that only a small number of mHealth apps are covered, such as Health and Nike Run Club.

5.5 Future Research and Recommendations

This study's objective was to explore the experiences of mHealth users, in particular, focusing on their emotional responses to using these apps. Through a qualitative approach, the research was able to gain a comprehensive understanding of how users feel when paradoxical tensions are experienced and what emotional reactions these cause while using the apps. Due to the limited number of respondents in this research, future research should examine the identified paradoxes, the positive and negative emotions, and the coping strategies to overcome them in greater depth. In addition, it would be beneficial to determine which types of mobile health applications elicit paradoxical tensions and negative feelings. Considering that there are a variety of mHealth apps available, including step counters, nutrition tracking apps, meditation apps, etc., it would be interesting to find out which type of mHealth application causes the most paradoxical tensions and negative emotions.

Additionally, although mobile health applications were initially developed to manage diseases and treatments, such as diabetes, hypertension, etc., there is a growing interest in these applications among individuals who are not chronically ill (Seiwert et al., 2013). The ever-increasing number of users downloading mHealth apps and its growing market value are evidence of this assertion (Al-Blooshi et al., 2020). Most research has been conducted in the health care sector, where chronic disease patients have been the focus. Therefore, future studies should focus on the experiences of mHealth users who are not in treatment for any disease yet are still interested in maintaining a healthy lifestyle.

Furthermore, this research revealed that some respondents rely more on the app and its provided information than others. As a result, several negative emotions such as fear, anxiety, disappointment, and stress were induced. In this regard, personality traits seem to play a significant role. The respondents who described themselves as competitive also experienced the most negative emotions due to their overreliance on numbers and data insights. In contrast, individuals who stated that they are more laid back were not overly concerned with the information provided by the app and could maintain a healthy relationship with it. Accordingly, it would be interesting first to investigate the participants' personality traits, group them, and then analyze whether they experienced paradoxical tensions and emotions similarly or differed from one another. Furthermore, the duration and intensity of emotions can also be examined. Consequently, one can determine which type of mHealth app most appeals to the respondents with similar personality characteristics.

Another limitation is that the respondents had difficulty distinguishing feelings from experiences. To be more precise, participants who had positive experiences in relation to

mHealth apps also interpreted these as positive emotions and vice versa, which does not have to be the case. Before conducting the interview, the interviewer should clarify the term emotions and explain what these entails.

Moreover, since respondents often discontinue using their mHealth apps early on, future research can assess what is needed to make these apps fully integrated into users' lives and what factors promote long-term use. A focus could be placed on push notifications since these appear to affect respondents the most and have a negative impact on their mental health. Participants in this study also cited push notifications as one of the main reasons they distanced themselves from mobile health apps.

6. Conclusion

This master thesis explores the emerging literature around mHealth apps and its effects on consumer behaviour by answering the following research questions:

A. *"What are the emotional consequences elicited by paradoxical tensions of using mHealth applications?"*
B. *"How do users cope with these emotional consequences?"*

To investigate the paradoxical tensions that exist within the domain of mHealth apps and to gain a deeper understanding of users' emotional reactions, experiences as well as their coping strategies, a qualitative research approach with semi-structured research questions was used.

As a result of this study five paradoxes have been identified, including Motivating/ Demotivating, Independence/ Dependence, Achievement/ Failure, Self-comparison/ Peer comparison and Integration/Disintegration. These paradoxes evoke several positive and negative emotions reactions in users. The most prevalent positive emotions discovered were as follows: Happiness, Joy, Satisfaction, Pride and Motivating. Whereas the most commonly occurring negative emotions were: Stress, Guilt, Disappointment, Fear, Anger, Pressure and Frustration. As a means of diminishing the negative feelings that arise as a result of paradoxical tensions, users employ coping strategies. A total of four coping strategies were identified in this study, namely Discontinuance, Distancing, Ignoring, and Adapting/Adjusting. Nevertheless, users also point out that mobile health apps have potential risks, such as promoting unhealthy and toxic behaviors that can negatively affect users' physical and mental health.

Respondents in this study recognized both the positive and negative aspects of mHealth apps and were able to draw a clear distinction between the app and the real world. While the positive experiences outweigh the negative ones, the negative experiences have been discussed the most. Although some of the respondents were able to cope with the paradoxical tensions and the negative emotions associated with mHealth apps, others were not able to do so. As a result, they deleted the application or distanced themselves from it. Thus, discontinuation was primarily attributed to negative feelings such as stress, anger, disappointment, and frustration created by the paradoxes encountered. Further reasons for users to distance themselves from these applications were their fear of becoming emotionally dependent upon them. In light of this, several actors, including app developers, managers, health institutions, and policy makers, should consider how potential risks, paradoxes, and negative emotions can be reduced and improved in the future.

References

Adams, W. C. (2015). Conducting Semi-Structured Interviews. In K. E. Newcomer, H. P. Hatry, & J. S. Wholey (Eds.), *Handbook of Practical Program Evaluation* (pp. 492–505). John Wiley & Sons, Inc. https://doi.org/10.1002/9781119171386.ch19

Agius, S. J. (2013). Qualitative research: Its value and applicability. *The Psychiatrist*, *37*(6), 204–206. https://doi.org/10.1192/pb.bp.113.042770

Akter, S., D'Ambra, J., & Ray, P. (2011). Trustworthiness in mHealth information services: An assessment of a hierarchical model with mediating and moderating effects using partial least squares (PLS). *Journal of the American Society for Information Science and Technology*, *62*(1), 100–116. https://doi.org/10.1002/asi.21442

Al-Blooshi, H., Al-Shami, S. A., & Sidek, S. (2020). Mobile health and users demographic characteristics and preferences. A case study from the UAE. *Systematic Reviews in Pharmacy*, *11*(12), 143-149.

Alanzi TM (2022) Users' satisfaction levels about mHealth applications in post-Covid-19 times in Saudi Arabia. PLoS ONE 17(5): e0267002. https://doi.org/10.1371/journal.pone.0267002

Arrogi, A., Bogaerts, A., Seghers, J., Devloo, K., Vanden Abeele, V., Geurts, L., Wauters, J., & Boen, F. (2019). Evaluation of stAPP: A smartphone-based intervention to reduce prolonged sitting among Belgian adults. *Health Promotion International*, *34*(1), 16–27. https://doi.org/10.1093/heapro/dax046

Asimakopoulos, S., Asimakopoulos, G., & Spillers, F. (2017, January). Motivation and user engagement in fitness tracking: Heuristics for mobile healthcare wearables. In *Informatics* (Vol. 4, No. 1, p. 5). MDPI.

Bar-Hillel, Y., & Quine, W. V. (1968). The Ways of Paradox and Other Essays. *Philosophy and Phenomenological Research*, *28*(4), 596. https://doi.org/10.2307/2105696

Bender, B. (2021). The impact of integration on application success and customer satisfaction in Mobile device platforms. In *Platform Coring on Digital Software Platforms* (pp. 79-118). Springer Gabler, Wiesbaden.

Biddle, S. J. H., Bennie, J. A., Bauman, A. E., Chau, J. Y., Dunstan, D., Owen, N., Stamatakis, E., & van Uffelen, J. G. Z. (2016). Too much sitting and all-cause mortality: Is there a causal link? *BMC Public Health*, *16*(1), 635. https://doi.org/10.1186/s12889-016-3307-3

Blair, S. N., & Morris, J. N. (2009). Healthy Hearts—and the Universal Benefits of Being Physically Active: Physical Activity and Health. *Annals of Epidemiology*, *19*(4), 253–256. https://doi.org/10.1016/j.annepidem.2009.01.019

Blazevic,V., & Klintwort, L. (2019), *Blessing or Curse: The Paradoxical Impact of Mobile Health Applications on the Consumer.* Proceedings of the European Marketing Academy, 48th, (10166)

Bleuler, E. (1950). *Dementia praecox or the group of schizophrenias.* International Universities Press.

Bort-Roig, J., Gilson, N. D., Puig-Ribera, A., Contreras, R. S., & Trost, S. G. (2014). Measuring and Influencing Physical Activity with Smartphone Technology: A Systematic Review. *Sports Medicine*, *44*(5), 671–686. https://doi.org/10.1007/s40279-014-0142-5

Boddy, C. R. (2016). Sample size for qualitative research. *Qualitative Market Research: An International Journal*, *19*(4), 426–432.

Boyce, C., & Neale, P. (2006). *CONDUCTING IN-DEPTH INTERVIEWS:* 16.

Brenes, G. A., Williamson, J. D., Messier, S. P., Rejeski, W. J., Pahor, M., Ip, E., & Penninx, B. W. J. H. (2007). Treatment of minor depression in older adults: A pilot study comparing sertraline and exercise. *Aging & Mental Health*, *11*(1), 61–68. https://doi.org/10.1080/13607860600736372

Bridges, D., Thompson, S. W. N., & Rice, A. S. C. (2001). Mechanisms of neuropathic pain. *British Journal of Anaesthesia*, *87*(1), 12–26. https://doi.org/10.1093/bja/87.1.12

Buckingham, S. A., Williams, A. J., Morrissey, K., Price, L., & Harrison, J. (2019). Mobile health interventions to promote physical activity and reduce sedentary behaviour in the workplace: A systematic review. *Digital Health*, *5*, 2055207619839883. https://doi.org/10.1177/2055207619839883

Callow, D. D., Arnold-Nedimala, N. A., Jordan, L. S., Pena, G. S., Won, J., Woodard, J. L., & Smith, J. C. (2020). The Mental Health Benefits of Physical Activity in Older Adults Survive the COVID-19 Pandemic. *The American Journal of Geriatric Psychiatry*, *28*(10), 1046–1057. https://doi.org/10.1016/j.jagp.2020.06.024

Chambliss, H. (2015). Motivating Physical Activity. In *Diet and Exercise in Cystic Fibrosis* (pp. 307–316). Elsevier. https://doi.org/10.1016/B978-0-12-800051-9.00035-3

Chae, M., Yeum, D., Myungsin, C., & Daesung, Y. (2010). The Impact of Mobile Technology Paradox Perception and Personal Risk-Taking Behaviors on Mobile Technology Adoption. *International Journal of Management Science*, *16*(2), 115–138. https://search.ebscohost.com/login.aspx?direct=true&db=bth&AN=56452932&site=eds-live

Chastin, S. F. M., Mandrichenko, O., Helbostadt, J. L., & Skelton, D. A. (2014). Associations between objectively-measured sedentary behaviour and physical activity with bone mineral density in adults and older adults, the NHANES study. *Bone*, *64*, 254–262. https://doi.org/10.1016/j.bone.2014.04.009

Chia, G. L. C., Anderson, A., & McLean, L. A. (2019). Behavior Change Techniques Incorporated in Fitness Trackers: Content Analysis. *JMIR MHealth and UHealth*, *7*(7), e12768. https://doi.org/10.2196/12768

Creswell, J.W., & Creswell, J. D. (2018). *Research design: qualitative, quantitative, and mixed methods approaches.* Fifth edition. Los Angeles: SAGE.

De Korte, E. M., Wiezer, N., Janssen, J. H., Vink, P., & Kraaij, W. (2018). Evaluating an mHealth app for health and well-being at work: Mixed-method qualitative study. *JMIR MHealth and UHealth*, *6*(3), 1–17. https://doi.org/10.2196/mhealth.6335

Dempsey, P. C., Biddle, S. J. H., Buman, M. P., Chastin, S., Ekelund, U., Friedenreich, C. M., Katzmarzyk, P. T., Leitzmann, M. F., Stamatakis, E., van der Ploeg, H. P., Willumsen, J., & Bull, F. (2020). New global guidelines on sedentary behaviour and health for adults: Broadening the behavioural targets. *International Journal of Behavioral Nutrition and Physical Activity*, *17*(1), 151. https://doi.org/10.1186/s12966-020-01044-0

Deterding, N. M., & Waters, M. C. (2018). Flexible Coding of In-depth Interviews. *Sociological Methods & Research*, 1–32.

Ding, D., Lawson, K. D., Kolbe-Alexander, T. L., Finkelstein, E. A., Katzmarzyk, P. T., van Mechelen, W., & Pratt, M. (2016). The economic burden of physical inactivity: A global analysis of major non-communicable diseases. *The Lancet*, *388*(10051), 1311–1324. https://doi.org/10.1016/S0140-6736(16)30383-X

Dubois, A., & Gadde, L. E. (2002). Systematic combining: an abductive approach to case research. *Journal of business research, 55*(7), 553-560.

Duhachek, A. (2005). Coping: A multidimensional, hierarchical framework of responses to stressful consumption episodes. *Journal of Consumer research*, *32*(1), 41-53.

Duus, R., Cooray, M., & Page, N. (2017). Agentic Technology: The Impact of Activity Trackers on User Behavior (An Extended Abstract). In M. Stieler (Ed.), *Creating Marketing Magic and Innovative Future Marketing Trends* (pp. 315–322). Springer International Publishing. https://doi.org/10.1007/978-3-319-45596-9_62

Duus, R., Cooray, M., & Page, N. C. (2018). Exploring Human-Tech Hybridity at the Intersection of Extended Cognition and Distributed Agency: A Focus on Self-Tracking Devices. *Frontiers in Psychology*, *9*, 1432. https://doi.org/10.3389/fpsyg.2018.01432

Duttweiler, S., & Passoth, J. H. (2016). Self-Tracking als Optimierungsprojekt. *Leben nach Zahlen. Self-Tracking als Optimierungsprojekt*, 9-42.

Duus, R., & Cooray, M. (2015). How we discovered the dark side of wearable fitness trackers. *The Conversation*, *19*.

Eriksson, K., & Lindström, U. Å. (1997). Abduction—a way to deeper understanding of the world of caring. *Scandinavian journal of caring sciences*, *11*(4), 195-198.

Etkin, J. (2016). The hidden cost of personal quantification. *Journal of consumer research*, *42*(6), 967-984.

European Observatory on Health Systems and Policies, Fahy, N., & Williams, G. A. (2021). *Use of digital health tools in Europe: Before, during and after COVID-19*. World Health Organization. Regional Office for Europe. https://apps.who.int/iris/handle/10665/345091

Fonner, K. L., & Roloff, M. E. (2012). Testing the connectivity paradox: Linking teleworkers' communication media use to social presence, stress from interruptions, and organizational identification. *Communication Monographs*, *79*, 205–231.

Foozonkhah, S., & Kalankesh, L. R. (2017). Depiction of global trends in publications on mobile health. *International Journal of One Health*, *3*, 42–45. https://doi.org/10.14202/IJOH.2017.42-45

Fujiki, Y. (2010). IPhone as a physical activity measurement platform. *CHI '10 Extended Abstracts on Human Factors in Computing Systems*, 4315–4320. https://doi.org/10.1145/1753846.1754146

Ganesan, A. N., Louise, J., Horsfall, M., Bilsborough, S. A., Hendriks, J., McGavigan, A. D., Selvanayagam, J. B., & Chew, D. P. (2016). International Mobile-Health Intervention on Physical Activity, Sitting, and Weight. *Journal of the American College of Cardiology*, *67*(21), 2453–2463. https://doi.org/10.1016/j.jacc.2016.03.472

Gill, P., Stewart, K., Treasure, E., & Chadwick, B. (2008). Methods of data collection in qualitative research: Interviews and focus groups. *British Dental Journal*, *204*(6), 291–295. https://doi.org/10.1038/bdj.2008.192

Gilson, N. D., Pavey, T. G., Wright, O. R., Vandelanotte, C., Duncan, M. J., Gomersall, S., Trost, S. G., & Brown, W. J. (2017). The impact of an m-Health financial incentives program on the physical activity and diet of Australian truck drivers. *BMC Public Health*, *17*(1), 467. https://doi.org/10.1186/s12889-017-4380-y

Grand Review Research. (2022*). mHealth Apps Market Size & Share Report, 2022-2030*. Retrieved 25 March 2022, from https://www.grandviewresearch.com/industry-analysis/mhealth-app-market.

Greier, C., Drenowatz, C., Riechelmann, H., & Greier, K. (2021). Objective and Subjective Physical Activity Levels in Austrian Middle School Students. *Advances in Physical Education*, *11*(04), 448–459. https://doi.org/10.4236/ape.2021.114037

Gremaud, A. L., Carr, L. J., Simmering, J. E., Evans, N. J., Cremer, J. F., Segre, A. M., Polgreen, L. A., & Polgreen, P. M. (2018). Gamifying Accelerometer Use Increases Physical Activity Levels of Sedentary Office Workers. *Journal of the American Heart Association*, *7*(13). https://doi.org/10.1161/JAHA.117.007735

Hammersley, M. (2003). *Dilemma Qualitative Method*. Taylor & Francis.

Hernández-Reyes, A., Cámara-Martos, F., Recio, G. M., Molina-Luque, R., Romero-Saldaña, M., & Rojas, R. M. (2020). Push notifications from a mobile app to improve the body composition of overweight or obese women: randomized controlled trial. *JMIR mHealth and uHealth*, *8*(2), e13747.

Herring, M. P., Jacob, M. L., Suveg, C., Dishman, R. K., & O'Connor, P. J. (2012). Feasibility of Exercise Training for the Short-Term Treatment of Generalized Anxiety Disorder: A Randomized Controlled Trial. *Psychotherapy and Psychosomatics*, *81*(1), 21–28. https://doi.org/10.1159/000327898

Irani, E. (2019). The use of videoconferencing for qualitative interviewing: Opportunities, challenges, and considerations. *Clinical Nursing Research*, *28*(1), 3-8.

Jarvenpaa, S. L., & Lang, K. R. (2005). Managing the Paradoxes of Mobile Technology. *Information Systems Management*, *22*(4), 7–23. https://doi.org/10.1201/1078.10580530/45520.22.4.20050901/90026.2

Johnson, D. S., Bardhi, F., & Dunn, D. T. (2008). Understanding how technology paradoxes affect customer satisfaction with self-service technology: The role of performance ambiguity and trust in technology. *Psychology and Marketing*, *25*(5), 416–443. https://doi.org/10.1002/mar.20218

Kanejima, Y., Kitamura, M., & Izawa, K. P. (2019). Self-monitoring to increase physical activity in patients with cardiovascular disease: A systematic review and meta-analysis. *Aging Clinical and Experimental Research*, *31*(2), 163–173. https://doi.org/10.1007/s40520-018-0960-7

Kerner, C., & Goodyear, V. A. (2017). The Motivational Impact of Wearable Healthy Lifestyle Technologies: A Self-determination Perspective on Fitbits With Adolescents. *American Journal of Health Education*, *48*(5), 287–297. https://doi.org/10.1080/19325037.2017.1343161

King, D., Greaves, F., Exeter, C., & Darzi, A. (2013). 'Gamification': Influencing health behaviours with games. *Journal of the Royal Society of Medicine*, *106*(3), 76-78.

Krippendorff, K. (2018). *Content analysis: An introduction to its methodology.* Sage publications.

Kuckartz, Udo & Dresing, Thorsten & Rädiker, Stefan & Stefer, Claus. (2008). Qualitative Evaluation: Der Einstieg in die Praxis. 10.1007/978-3-531-91083-3.

Kristiansen, F., Mikalsen, H., & Lagestad, P. (2021). School-time's contribution to the physical activity level of children and fulfilment of national health recommendations for physical activity in Norway. *Journal for Research in Arts and Sports Education*, *5*(1), 16–28. https://doi.org/10.23865/jased.v5.2429

Labrique, A., Vasudevan, L., Chang, L. W., & Mehl, G. (2013). H_pe for mHealth: More "y" or "o" on the horizon? *International Journal of Medical Informatics*, *82*(5), 467–469. https://doi.org/10.1016/j.ijmedinf.2012.11.016

Lakerveld, J., Woods, C., Hebestreit, A., Brenner, H., Flechtner-Mors, M., Harrington, J. M.,

Kamphuis, C. B. M., Laxy, M., Luszczynska, A., Mazzocchi, M., Murrin, C., Poelman, M., Steenhuis, I., Roos, G., Steinacker, J. M., Stock, C. C., van Lenthe, F., Zeeb, H., Zukowska, J., & Ahrens, W. (2020). Advancing the evidence base for public policies impacting on dietary behaviour, physical activity and sedentary behaviour in Europe: The Policy Evaluation Network promoting a multidisciplinary approach. *Food Policy*, *96*, 101873. https://doi.org/10.1016/j.foodpol.2020.101873

Lazarus, R. S., & Folkman, S. (1987). Transactional theory and research on emotions and coping. *European Journal of Personality, 1*(3, Spec Issue), 141–169. https://doi.org/10.1002/per.2410010304

Lentferink, A., Noordzij, M. L., Burgler, A., Klaassen, R., Derks, Y., Oldenhuis, H., ... & van Gemert-Pijnen, L. (2022). On the receptivity of employees to just-in-time self-tracking and eCoaching for stress management: a mixed-methods approach. *Behaviour & information technology*, *41*(7), 1398-1424.

Liang, X., Wang, Q., Yang, X., Cao, J., Chen, J., Mo, X., Huang, J., Wang, L., & Gu, D. (2011). Effect of mobile phone intervention for diabetes on glycaemic control: A meta-analysis. *Diabetic Medicine*, *28*(4), 455–463. https://doi.org/10.1111/j.1464-5491.2010.03180.x

Lim, S. S., Vos, T., Flaxman, A. D., Danaei, G., Shibuya, K., Adair-Rohani, H., AlMazroa, M. A., Amann, M., Anderson, H. R., Andrews, K. G., Aryee, M., Atkinson, C., Bacchus, L. J., Bahalim, A. N., Balakrishnan, K., Balmes, J., Barker-Collo, S., Baxter, A., Bell, M. L., Ezzati, M. (2012). A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990–2010: A systematic analysis for the Global Burden of Disease Study 2010. *The Lancet*, *380*(9859), 2224–2260. https://doi.org/10.1016/S0140-6736(12)61766-8

Lima, C. K. T., de Medeiros Carvalho, P. M., Lima, I. D. A. A. S., de Oliveira Nunes, J. V. A., Saraiva, J. S., de Souza, R. I., ... & Neto, M. L. R. (2020). The emotional impact of Coronavirus 2019-nCoV (new Coronavirus disease). *Psychiatry research*, *287*, 112915.

Lupton, D. (2014). Self-tracking cultures: towards a sociology of personal informatics. In Proceedings of the 26th Australian computer-human interaction conference on designing futures: The future of design (pp. 77-86).

Lupton, D. (2015). Quantified sex: a critical analysis of sexual and reproductive self-tracking using apps. *Culture, Health and Sexuality, 17(4)*, 1–14.

Malterud, K., Siersma, V. D., & Guassora, A. D. (2016). Sample Size in Qualitative Interview Studies. *Qualitative Health Research*, *26*(13), 1753–1760.

Mick, D. G., & Fournier, S. (1998). Paradoxes of Technology: Consumer Cognizance, Emotions, and Coping Strategies. *Journal of Consumer Research*, *25*(2), 123–143. https://doi.org/10.1086/209531

Mieg, D. H. A. (n.d.). *Experteninterviews in den Umwelt- und Planungswissenschaften. Eine Einführung und Anleitung*. 51.

MobiHealthNews. (2022). *MobiHealthNews*. Retrieved 25 March 2022, from https://www.mobihealthnews.com/.

Müller, A. M., Maher, C. A., Vandelanotte, C., Hingle, M., Middelweerd, A., Lopez, M. L., DeSmet, A., Short, C. E., Nathan, N., Hutchesson, M. J., Poppe, L., Woods, C. B., Williams, S. L., & Wark, P. A. (2018). Physical Activity, Sedentary Behavior, and Diet-Related eHealth and mHealth Research: Bibliometric Analysis. *Journal of Medical Internet Research*, *20*(4), e122. https://doi.org/10.2196/jmir.8954

Mummah, S. A., King, A. C., Gardner, C. D., & Sutton, S. (2016). Iterative development of Vegethon: a theory-based mobile app intervention to increase vegetable consumption. *International Journal of Behavioral Nutrition and Physical Activity*, *13*(1), 1-12.

Mumba, M. N., Nacarrow, A. F., Cody, S., Key, B. A., Wang, H., Robb, M., Jurczyk, A., Ford, C., Kelley, M. A., & Allen, R. S. (2021). Intensity and type of physical activity predicts depression in older adults. *Aging & Mental Health*, *25*(4), 664–671. https://doi.org/10.1080/13607863.2020.1711861

Munene, C. W., Pettigrew, S., & Mizerski, K. (2002). Paradoxes and technology adoption: a retail banking analysis. *Asia Pacific Advances in Consumer Research*, *5*, 331-335.

Munson, S. A., & Consolvo, S. (2012, May). Exploring goal-setting, rewards, self-monitoring, and sharing to motivate physical activity. In *2012 6th international conference on pervasive computing technologies for healthcare (pervasivehealth) and workshops* (pp. 25-32). IEEE.

Nambisan, S., & Baron, R. A. (2010). Different Roles, Different Strokes: Organizing Virtual Customer Environments to Promote Two Types of Customer Contributions. *Organization Science*, *21*(2), 554–572. https://doi.org/10.1287/orsc.1090.0460

Neil-Sztramko, S. E., Gotay, C. C., Sabiston, C. M., Demers, P. A., & Campbell, K. C. (2017). Feasibility of a telephone and web-based physical activity intervention for women shift workers. *Translational Behavioral Medicine*, *7*(2), 268–276. https://doi.org/10.1007/s13142-017-0471-7

Nilsen, P., Roback, K., Broström, A., & Ellström, P.-E. (2012). Creatures of habit: Accounting for the role of habit in implementation research on clinical behaviour change. *Implementation Science*, *7*(1), 53. https://doi.org/10.1186/1748-5908-7-53

O'Driscoll, A. (2008). Exploring paradox in marketing: Managing ambiguity towards synthesis. *Journal of Business & Industrial Marketing*, *23*(2), 95–104. https://doi.org/10.1108/08858620810850209

Oh, H., Rizo, C., Enkin, M., & Jadad, A. (2005). What is eHealth (3): a systematic review of published definitions. *Journal of medical Internet research*, *7*(1), e1. https://doi.org/10.2196/jmir.7.1.e1

O'Keeffe, N., Scheid, J. L., & West, S. L. (2020). Sedentary Behavior and the Use of Wearable Technology: An Editorial. *International Journal of Environmental Research and Public Health*, *17*(12), 4181. https://doi.org/10.3390/ijerph17124181

Oliver, D. G., Serovich, J. M., & Mason, T. L. (2005). Constraints and Opportunities with Interview Transcription: Towards Reflection in Qualitative Research. *Social Forces, 84*(2), 1273-1289.

Ometov, A., Shubina, V., Klus, L., Skibińska, J., Saafi, S., Pascacio, P., ... & Lohan, E. S. (2021). A survey on wearable technology: History, state-of-the-art and current challenges. *Computer Networks*, *193*, 108074.

on behalf of SBRN Terminology Consensus Project Participants, Tremblay, M. S., Aubert, S., Barnes, J. D., Saunders, T. J., Carson, V., Latimer-Cheung, A. E., Chastin, S. F. M., Altenburg, T. M., & Chinapaw, M. J. M. (2017). Sedentary Behavior Research Network (SBRN) – Terminology Consensus Project process and outcome. *International Journal of Behavioral Nutrition and Physical Activity*, *14*(1), 75. https://doi.org/10.1186/s12966-017-0525-8

O'Reilly, C. A., & Tushman, M. L. (2013). ORGANIZATIONAL AMBIDEXTERITY: PAST, PRESENT, AND FUTURE. *Academy of Management Perspectives*, *27*(4), 324–338.

Ortas, E., Burritt, R. L., & Moneva, J. M. (2013). Socially Responsible Investment and cleaner production in the Asia Pacific: Does it pay to be good? *Journal of Cleaner Production*, *52*, 272–280. https://doi.org/10.1016/j.jclepro.2013.02.024

Oulasvirta, A., Rattenbury, T., Ma, L., & Raita, E. (2011). Habits make smartphone use more pervasive. *Personal and Ubiquitous Computing*, *16*(1), 105–114.

Quine, W. (1976). *The ways of paradox*. Harvard University Press.

Raisch, S., Birkinshaw, J., Probst, G., & Tushman, M. L. (2009). Organizational Ambidexterity: Balancing Exploitation and Exploration for Sustained Performance. *Organization Science*, *20*(4), 685–695. https://doi.org/10.1287/orsc.1090.0428

Rawassizadeh, R., Price, B.A. and Petre, M. (2014) Wearables: Has the Age of Smart Watches Finally Arrived? Communications of the ACM, 58, 45-47. http://dx.doi.org/10.1145/2629633

Reed, J. L., Cole, C. A., Ziss, M. C., Tulloch, H. E., Brunet, J., Sherrard, H., Reid, R. D., & Pipe, A. L. (2018). The Impact of Web-Based Feedback on Physical Activity and Cardiovascular Health of Nurses Working in a Cardiovascular Setting: A Randomized Trial. *Frontiers in Physiology*, *9*, 142. https://doi.org/10.3389/fphys.2018.00142

Reichertz, J. (2013). *Die Abduktion in der qualitativen Sozialforschung: über die Entdeckung des Neuen*. Springer-Verlag.

Roberts, J., Yaya, L., & Manolis, C. (2014). The invisible addiction: Cell-phone activities and addiction among male and female college students. *Journal of Behavioral Addictions, 3*(4), 254-265.

Rogers, E.M. (1995). Diffusion of Innovations: Modifications of a Model for Telecommunications. In: Stoetzer, MW., Mahler, A. (eds) Die Diffusion von Innovationen in der Telekommunikation. Schriftenreihe des Wissenschaftlichen Instituts für Kommunikationsdienste, vol 17. Springer, Berlin, Heidelberg. https://doi-org.ru.idm.oclc.org/10.1007/978-3-642-79868-9_2

Rowland, S. P., Fitzgerald, J. E., Holme, T., Powell, J., & McGregor, A. (2020). What is the clinical value of mHealth for patients? *Npj Digital Medicine*, *3*(1), 4. https://doi.org/10.1038/s41746-019-0206-x

Schad, J., Lewis, M. W., Raisch, S., & Smith, W. K. (2016). Paradox Research in Management Science: Looking Back to Move Forward. *Academy of Management Annals*, *10*(1), 5–64. https://doi.org/10.5465/19416520.2016.1162422

Schmidt-Kraepelin, M., Toussaint, P. A., Thiebes, S., Hamari, J., & Sunyaev, A. (2020). Archetypes of gamification: analysis of mHealth apps. *JMIR mHealth and uHealth*, *8*(10), e19280.

Schweitzer, V., & Simon, F. (2021). Self-construals as the locus of paradoxical consumer empowerment in self-service retail technology environments. *Journal of Business Research*, *126*, 291–306. https://doi.org/10.1016/j.jbusres.2020.11.027

Seiwert, T., Sarantopoulos, J., Kallender, H., McCallum, S., Keer, H. N., & Blumenschein, G. (2013). Phase II trial of single-agent foretinib (GSK1363089) in patients with recurrent or metastatic squamous cell carcinoma of the head and neck. *Investigational new drugs*, *31*(2), 417-424.

Skogstad, M., Lunde, L.-K., Skare, Ø., Mamen, A., Alfonso, J. H., Øvstebø, R., & Ulvestad, B. (2016). Physical activity initiated by employer and its health effects; an eight week follow-up study. *BMC Public Health*, *16*(1), 377. https://doi.org/10.1186/s12889-016-3035-8

Smith, W. K., & Lewis, M. W. (2011). Toward a Theory of Paradox: A Dynamic Equilibrium Model of Organizing. *Academy of Management Review*, *36*(2), 381–403. https://doi.org/10.5465/amr.2009.0223

Solarino, A. M., & Aguinis, H. (2021). Challenges and Best-practice Recommendations for Designing and Conducting Interviews with Elite Informants. *Journal of Management Studies, 58*(3), 649-672.

Soliño-Fernandez, D., Ding, A., Bayro-Kaiser, E., & Ding, E. L. (2019). Willingness to adopt wearable devices with behavioral and economic incentives by health insurance wellness programs: Results of a US cross-sectional survey with multiple consumer health vignettes. *BMC Public Health*, *19*(1), 1649. https://doi.org/10.1186/s12889-019-7920-9

Spradley, J. P. (2016). *The ethnographic interview.* Waveland Press.

Statista. (2022). *Digital Health - Worldwide | Statista Market Forecast*. Retrieved 25 March 2022, from https://www.statista.com/outlook/dmo/digital-health/worldwide.

Stephenson, A., Garcia-Constantino, M., Murphy, M. H., McDonough, S. M., Nugent, C. D., & Mair, J. L. (2021). The "Worktivity" mHealth intervention to reduce sedentary behaviour in the workplace: A feasibility cluster randomised controlled pilot study. *BMC Public Health*, *21*(1), 1416. https://doi.org/10.1186/s12889-021-11473-6

Sun, Y., Wang, N., Guo, X., & Peng, Z. (2013). Understanding the acceptance of mobile health services: a comparison and integration of alternative models. *Journal of electronic commerce research*, *14*(2), 183.

Suver, C., & Kuwana, E. (2021). mHealth wearables and smartphone health tracking apps: A changing privacy landscape. *Information Services & Use*, *41*(1–2), 71–79. https://doi.org/10.3233/ISU-210114

Tabish, S A. (2017). Lifestyle diseases: consequences, characteristics, causes and control. Journal of Cardiology & Current Research. 9.

Timmermans, S., & Tavory, I. (2012). Theory Construction in Qualitative Research: From Grounded Theory to Abductive Analysis. *Sociological Theory*, *30*(3), 167–186. https://doi.org/10.1177/0735275112457914

Tushman, M. (n.d.). *Stanford University—Graduate School of Business*. 33.

Uphill, M. A., & Jones, M. V. (2007). Antecedents of emotions in elite athletes: A cognitive motivational relational theory perspective. *Research quarterly for exercise and sport*, *78*(2), 79-89.

Vince, R., & Broussine, M. (1996). Paradox, Defense and Attachment: Accessing and Working with Emotions and Relations Underlying Organizational Change. *Organization Studies*, *17*(1), 1–21. https://doi.org/10.1177/017084069601700101

Visser, F. S., Stappers, P. J., Van der Lugt, R., & Sanders, E. B. (2005). Contextmapping: experiences from practice. *CoDesign, 1*(2), 119-149.

Whitson, J. (2013). Gaming the quantified self. *Surveillance & Society, 11*(1/2), 163–176.

Wong, C. C. K., & Kwok, R. C. W. (2016). The effect of gamified mHealth app on exercise motivation and physical activity.

World Health Organization. (2014). *Global status report on noncommunicable diseases 2014*. World Health Organization. https://apps.who.int/iris/handle/10665/148114

World Health Organization. (2022). *Non communicable diseases*. Who.int. Retrieved 25 March 2022, from https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases.

Yi, Sunghwan & Baumgartner, Hans. (2004). Coping With Negative Emotions in Purchase-Related Situations. Journal of Consumer Psychology. 14. 303-317. 10.1207/s15327663jcp1403_11.

Żelechowska, D., Żyluk, N., & Urbański, M. (2020). Find Out A New Method to Study Abductive Reasoning in Empirical Research. *International Journal of Qualitative Methods, 19,* 1609406920909674. https://doi.org/10.1177/1609406920909674

Appendix

Appendix A: Interview questionnaire

Before we start with the interview, I would like to thank you in advance for participating in my research for my Master Thesis.

As discussed, beforehand, this research is about exploring the experience of users with mHealth applications.

When answering the questions, please keep in mind that there are no right or wrong answers. Furthermore, I would like to inform you that I will treat your answers with confidentiality and all your responses will be pseudonymized. Further, it is essential to point out that you are free to withdraw at any time during the interview and that you may also later request the removal of your data from the analysis. Please also note that your data will be used only for this Master's thesis project.

The interview will start with some general questions and then we will work towards the core of the interview. In total this interview will approx. last 45 min. I ‘d also like to let you know that during the interview I may be taking some notes on things we discuss.

Before we start, do you have any questions upfront that you would like to ask? Do you agree to participate? If so, do you mind the interview being recorded?

Introduction

Let's start with some first questions about you. How old are you? Where are you currently living? Would you like to share your level of education and profession?

Usage

Now, I would like to ask you some general questions regarding the use of mHealth applications/apps.

1) Which mHealth app(s) do you use at the moment?
2) How does this app work exactly? / What exactly do you do with it?
3) When you use this mHealth app, how often do you interact with it (or, how often do you use it)?
4) For how long now have you been using it?
5a) Did you use other mHealth apps previously?
5b) Which ones?
6) For what purpose did you use it/them?
7) Why did you stop using it/them

Getting back to the app you now use:

8a) Why did you decide to use this app (or, for what purpose did you download this app)?
8b) What were your expectations from the use of this app?
9) Have your expectations been met? / Have you observed any changes in your life by using this app?

Experience, Emotions & Coping strategies

Positive Experiences

10) What are the positive aspects of using this mHealth app? / What positive experiences have you had so far with using it?
11) Were these experiences expected or not?
12) To what would you attribute these experiences?

13a) When experiencing these positive aspects from using this app, how did you feel exactly?
13b) Which emotions did you experience more frequently and in what moments?
13c) What do you think caused this emotion?

14a) How do you think these positive experiences affected your usage of the app?
14b) How do you think these positive experiences affected your health-related behavior?

Negative Experiences

15) What are the negative aspects of using this mHealth app? / What negative experiences have you had so far with using it?
16) Were these experiences expected or not?

17) To what would you attribute these experiences?

18a) When experiencing these negative aspects from using this app, how did you feel exactly?
18b) Which emotions did you experience more frequently and in what moments?
18c) What do you think caused this emotion?

19a) How do you think these negative experiences affected your usage of the app?
19b) How do you think these negative experiences affected your health-related behavior?
20) Have you ever felt that some of the negative experiences you just mentioned were in conflict with some of the positive ones you mentioned earlier?
21a) If yes, how did that make you feel?
21b) How did that affect your usage of the app or your behavior?

Closing questions

22) How would you describe your overall experience with mHealth apps from the beginning until now?
23) Do you intend to continue using this app in the future?
24a) If yes, why? / Does this have something to do with the positive experiences you have had so far with it?
24b) *What changes would you like to see in this app, so you can have similar or more positive experiences with it in the future?*

25a) If you do not intend to continue using it, why? / Does this have to do with the negative experiences you have had so far with it?
25b) What changes would you like to see in this app, so that it can help avoid negative experiences in the future?

Do you want to add anything else?

Suggestion: after closing the interview, you can ask them what they thought of the interview, how they felt during it (comfortable etc).