Blessing or Curse: The Paradoxical Impact of Mobile Health Applications on the Consumer

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Abstract
This Master thesis explores consumer behaviour after technology adoption and applies the concept of paradoxes of technology, introduced by Mick and Fournier (1998), to the novel domain of mobile health apps (mHealth apps). The aim of this thesis is to identify the paradoxical tensions elicited by mHealth apps and how they affect the consumer. The evaluation of relevant and current literature represents the theoretical foundation of this research. The research question is answered based on insights from qualitative research in form of a diary study, the Sentence Completion Method and semi-structured interviews. The sample consists of thirteen interview respondents and five diary study participants. As a result, three different stages of mHealth use are identified. These consist of the users' initial motivation for using these apps, the occurrence of paradoxes and tensions and finally, coping strategies. First, respondents use mHealth apps to receive support in order to improve certain aspects of their lives, which is facilitated by receiving factual self-tracking information. Second, five predominant paradoxes are identified in the collected data, namely Integration/ Disintegration, Self-control/ External control, Confirmation/ Disconfirmation, Individual/ Community and Motivating/ Demotivating. Moreover, three noteworthy tensions are detected, which are Privacy concerns, Obsession and Ambivalence. Finally, it is found that paradoxical tensions often elicit negative, conflicting emotions in the consumer. Thus, users apply coping strategies in order to manage these tensions. The five most apparent strategies are Discontinuing, Adjusting, Assuming responsibility, Emotionally distancing and Ignoring. It is found that many paradoxes, tensions and coping strategies are related and often contain several, subordinated facets.
1. Introduction

1.1 Problem description

“The world is being transformed by new technologies, which are redefining customer expectations (...) and changing the way people live and work.” (Martin et al., 2017, p.2).

Digital technologies are changing the way industries operate and are impacting society’s functioning at large. Moreover, they are shaping the future and will be relevant in almost every aspect of life (Martin et al., 2017). An important aspect of this development is the Internet of Things which denotes a complex and highly distributed network of devices communicating with each other and with human beings (Xia et al., 2012). However, while these developments offer great potential, they simultaneously create challenges, that can be described as bright and dark sides of technology (Zolfagharian & Yazdanparast, 2017).

With a rising number of smartphone owners and growing penetration rates, the smartphone, as a multi-purpose device, has significantly changed the way people interact and lead their lives (Deloitte, 2017). Rotondi et al. even called smartphone users “homo smartphoniens” (Rotondi et al., 2017, p. 25). On the one hand, the smartphone is associated with freedom, mobility and empowerment since it enables connectedness, convenience and flexibility (Jarvenpaa & Lang, 2005; Borges & Joia, 2015). On the other hand, it can make people feel distant from each other and even create feelings of dependency and addiction (Mihailidis, 2014; Twenge, 2017; Roberts et al., 2014). In consequence, Trub and Barbot (2016) argue that smartphone usage generates a paradoxical experience and creates contradictory emotions.

Past studies have pointed out that technology has multiple ways of impacting the consumer, both in a positive and negative manner. Linking to this, research has shown that contrasting consequences of technology use can emerge simultaneously in the form of paradoxes (e.g. Mick & Fournier, 1998; Jarvenpaa & Lang, 2005; Borges & Joia, 2013; Mazmanian et al., 2006; 2013). Especially the study by Mick and Fournier (1998) has shown the way forward in terms of detecting paradoxes that occur in connection with technology usage, such as the possibility to elicit both, feelings of freedom and enslavement as well as efficiency and inefficiency through a single technological device.

Furthermore, digital innovations have a substantial impact on the healthcare industry. The field of mobile health is characterised by various ongoing innovations and it is still exploring its breadth and boundaries (Albrecht, 2016). One aspect is the new possibility for the consumer to continuously monitor himself¹ with the help of intelligent and personal analytics through smart devices, which is termed “self-tracking” (Lupton, 2017; Ruckenstein, 2014).

¹ In order to ensure better readability, gender-specific person names are not differentiated in this work.
In this context, Wolf (2010a) names three technological factors that drive the change in self-tracking: diffusion of mobile devices, substantial improvements in data storage and improvements of biometric sensors.

Self-tracking devices can be used either for healthy people as a means for self-optimisation or for people suffering from diseases in order to improve their quality of life (Mitteldeutscher Rundfunk, 2018). Self-optimisation is the underlying idea of the concept of the “Quantified Self”, which focuses intensively on self-monitoring (Quantified Self Labs, 2015). Moreover, through mobile health applications (mHealth apps), the smartphone can be used as a smart device as well (Singh et al., 2016). Embedded with sensors, smartphones allow a new generation of mHealth apps to constantly monitor, measure and promote well-being (Lane et al., 2011). Numerous versions of mHealth apps, ranging from simple fitness trackers to sophisticated diagnostic tools are offered to the target audience, which includes healthcare professionals, health insurance companies and the consumer or patient (Albrecht, 2016). However, with the growing relevance and interest in person-generated data, privacy concerns become more apparent, especially because health is a sensitive topic (Sharon, 2016; Lupton, 2017).

Overall, previous research has primarily focused on the antecedents of technology adoption and little research has been conducted about the consequences and consumers’ experiences after technology adoption (Gill & Saad, 2010). Lupton (2017) stated in this context, that it has to be understood how people engage with personal data produced through self-tracking. Thus, this Master thesis aims at exploring the impact of mHealth apps on the consumer, the occurring paradoxical tensions and how they affect the consumer. Since the paradox concept is still relevant today, applying this concept to the modern and innovative domain of mHealth with insights from qualitative research, allows for a realistic, explorative and comprehensive understanding.

1.2 Relevance of the topic

There are several reasons why this Master thesis is relevant for theory and practice. First, as the quote in the introduction implies, the digital transformation has an impact on almost every aspect of people’s lives on a yet unprecedented scale. Therefore, it represents a highly relevant topic for further exploration (Martin et al., 2017). Since smart devices and mHealth apps are part of this development, there is a great importance attached to these topics. Bort-Roig et al. (2014) found an increase of publications on smartphone use for physical activity measurement. They assume that this trend is likely to continue, as smartphone technologies are becoming more accessible and increasingly accepted as tools for physical activity measurement.
Moreover, in an era characterised by technological changes and developments, the concept of technological paradoxes is as important as ever. This becomes obvious in the amount of literature still referring to Mick and Fournier’s study about paradoxes of technology from 1998 (e.g. Jarvenpaa & Lang, 2005; O'Driscoll, 2008; Mazmanian, 2013). Mick and Fournier (1998) mentioned in their study that further research should discuss the predominant paradoxes in different domains and whether the paradox concept can be used to extent, modify or develop new theories in this field of research. This will be achieved by this Master thesis.

Additionally, this thesis has practical importance and contributes to knowledge. The Deloitte survey argued that “as smartphone ownership and usage increases, it will be important to have measured, balanced responses to the negative aspects of technology.” (Deloitte, 2017, p. 9). Therefore, this thesis aims at identifying the different negative and positive aspects of technology in the form of paradoxes and tensions in the domain of mHealth apps. Subsequently, these findings can be used for further implications by giving suggestions and impulses to companies and decision makers in the healthcare industry. Insights from this thesis’ research can be used to initiate improvements to the product and changes in its design in order to alleviate the occurring tensions. Moreover, researching the topic from a consumer point of view is important. Lupton (2017) claimed that privacy concerns influence the usage and enjoyment of smart devices. This is especially relevant for the sensitive topic of mobile health.

Overall, since mHealth apps can still be described as novel, there is only little academic literature and research available regarding this topic, especially on the consequences of technology use. Thus, this Master thesis contributes to theory by applying and expanding the concept of paradoxes of technology to the modern domain of mHealth apps.

1.3 Objective of the thesis

This thesis explores the consequences of the use of mHealth apps and their impact on the consumer. The research by Mick and Fournier (1998) about paradoxes of technology has been conducted twenty years ago. Therefore, this thesis aims at transferring the paradox concept into the present age, by expanding it to the domain of mHealth apps. Hence, a purpose of this thesis is to contribute to the growing body of research.

In short, the overarching objective is to answer the research question, which reads as follows: What are the paradoxical tensions in the domain of mHealth apps and how do they affect the consumer?

With this research question in mind, it will be investigated which opinions consumers hold about mHealth apps and which of the apps’ aspects are perceived as positive or negative. Linking to this, paradoxes and tensions will be identified that are experienced by users. Moreover, to fully
answer the research question, the effects of mHealth apps on the consumer as well as users’ emotional reactions will be examined. Mick and Fournier (1998) also focus on the coping strategies, which consumers apply to manage the paradoxical tensions. These strategies and mechanisms will be also taken into account when answering the research question.

Finally, after an assessment of the impact of mHealth apps on the consumer, this thesis aims to integrate the findings into a broader context with the final objective to propose practical implications for multiple actors, such as companies and decision makers in the healthcare industry.

1.4 Outline of the thesis

In the following, the theoretical background of this thesis will be discussed. The second chapter is divided into subchapters that cover the paradox concept, contrasting aspects of digital technology and the ambiguous role of the smartphone. Moreover, the role of self-tracking devices for self-control purposes and an introduction to the domain of mHealth apps will be presented.

In the third chapter, the methodological approach will be explained. The research question will be answered through generating in-depth information, which is derived through qualitative research methods described in this chapter. Moreover, the sample characteristics, research design and data analysis procedure will be described in the methodology part of the thesis.

In the following fourth chapter, the results of the research will be presented. By means of a phase model, different stages of mHealth app usage will be visualised. Moreover, paradoxes and tensions, or in other words, simultaneously occurring and contradicting aspects of mHealth apps will be depicted. To illustrate this, statements in the form of quotations from the interviews and diary entries will be presented and further explained.

The final chapter interlinks the thesis’ results with findings from literature and prior studies and transfers the results into practical and theoretical implications. In addition to that, limitations of the research are presented, possibilities for further research indicated, and finally, a conclusion of the key findings of this Master thesis is given.
2. Theoretical background

2.1 The paradox concept

The idea of the paradox is not novel and has been discussed by various philosophers and psychologists (Schad et al., 2016; Smith & Lewis, 2011). Paradox is a central concept in philosophy but has only received limited attention in consumer behaviour, although it is perceived as a highly relevant concept (Mick & Fournier, 1998).

The concept of paradox has been of strong interest in the context of strategic management and organisation studies (O’Driscoll, 2008). One of the leading researchers in this field is Marianne Lewis. She described paradox and ambiguity as the two new and powerful themes in the study of organisations (Lewis & Dehler, 2000). A paradox represents contradictory yet interrelated elements, which can simultaneously exist and are credible at the same time (O’Driscoll, 2008; Smith & Lewis, 2011). Moreover, a paradox is defined as “situation, act or behaviour that seems to have contradictory or inconsistent qualities” (Jarvenpaa and Lang, 2005, p.7). These seemingly distinct and contrary elements are tied in a “web of eternal mutuality” (Schad et al., 2016, p.6).

Furthermore, the paradox concept can be used for recognising the diversity, complexity and ambiguity that occur in organisational life (Cameron & Quinn, 1988). Consistent with this view, the psychiatrist Carl G. Jung mentioned that “…only the paradox comes anywhere near to comprehending the fullness of life” (Jung, 1968, p. 16). Moreover, Jung called „non-ambiguity and non-contradiction (...) one-sided” (Jung, 1968, p. 16). The quotes by Jung are still applicable to many of today’s issues as the body of paradox studies continues to diversify and grow (Schad et al., 2016).

Mick and Fournier (1998) were the first to apply the paradox concept to the field of household technology. These authors interpreted paradox as “polar opposite conditions (that) can simultaneously exist, or at least can be potentiated, in the same thing” (Mick & Fournier, 1998, p. 124). Their study still leads the way today and has been taken into account by many researchers for further studies about technology (e.g. Munene 2002a; 2002b; Jarvenpaa & Lang, 2005; Mazmanian, 2006; Roberts, 2014).

In the domain of organisations, Smith and Lewis (2011) pointed out differences between tensions. The paradox can be depicted by the symbol of yin yang (figure 1), where elements A and B exist in a unified whole, simultaneously over time. A dilemma, however, can be visualised by a scale (figure 1) and describes competing choices where both options, A and B, have upsides and downsides (Smith & Lewis, 2011). It was long-established to interpret the paradox as a dilemma, intending that one of the factors has to be chosen as resolution. Thus, privileging one factor over the other in the form of a trade-off. O’Driscoll called this paradox idea “either-or dilemmas” (O’Driscoll, 2008, p. 95), which is of limited value for addressing marketing and management issues and is not consistent with today’s interpretation.
Consumers showed a variety of strong, often negative emotions, thereby indicating that paradoxes create conflicts and ambivalence which eventually turned into anxiety and stress (Mick & Fournier, 1998). To manage these tensions, coping mechanisms were applied. The idea of coping strategies has been found in several studies as a means to manage paradoxical tensions (e.g. Mick & Fournier, 1998; Otnes, 1997; Jarvenpaa & Lang, 2005). Mick and Fournier (1998) and later Jarvenpaa and Lang (2005) focused on behavioural coping strategies that can be divided into confrontative and avoidance mechanisms, which were subsequently classified into the pre-acquisition or consumption stage by Mick and Fournier (1998). Whereas many studies indicated, that confrontative strategies lead to better adjustment than avoidance strategies, Mick and Fournier (1998) have argued the converse.

This thesis is concerned with the paradoxical tensions that appear with the use of smart devices for self-tracking purposes, namely mHealth apps. Thereby, it focuses on paradoxes of technology. According to Smith and Lewis (2011), several concepts can overlap with the paradox. Therefore, potential tensions, trade-offs and contradictions that might be mentioned in the course of the qualitative research will be taken into consideration. In the following, the contrasting aspects of technology, the ambiguous role of the smartphone as well as an introduction to self-tracking devices and mHealth apps will be presented.

### 2.2 Contrasting aspects of digital technology

„As the world becomes increasingly interconnected, both economically and socially, technology adoption remains one of the defining factors in human progress.“ (Poushter, 2016, p. 3).

The philosopher Heidegger referred to modern technology as a “means to an end” (Heidegger, 1977, p.1) or an “instrumentum” (Heidegger, 1977, p.2). Following this, it can be argued that technology is a means or instrument for people to improve several aspects of their lives, while it can also strengthen society’s overall well-being. Linking to this, Ganju et al. emphasised the importance of information and communication technology (ICT) for society by claiming that “less developed countries increase their level of well-being with mobile phones primarily, while more developed countries increase their level of well-being with any ICT system” (Ganju et al., 2016, p. 417). On the contrary, since the smartphone is associated with negative
consequences as well, Turkle (2011) visualised the ambiguity of technology by arguing that “technology makes us busier than ever and ever more in search of retreat” (Turkle, 2011, p.5).

Research about technology paradoxes has been mostly concentrated on the domain of the working world. Mick and Fournier (1998), however, applied the paradox concept to the private consumer setting and household technologies. Their study presented a theory of paradoxes of technology that focused on consumer attitudes and behaviours after technology adoption. In other words, they investigated consumers’ cognisance and experience of eight primary technology paradoxes. The paradoxes control/chaos and freedom/enslavement were most salient during their research and often appeared together. Other paradoxes were new/obsolete, competence/incompetence, efficiency/inefficiency, assimilation/isolation and engaging/disenengaging. Generally, these paradoxes created feelings of conflict and ambivalence, making the users uncertain about their opinion of the technological device. Apart from these findings, Mick and Fournier (1998) questioned the positivity bias in technology, namely that technological innovations are always positive, by emphasising the paradoxical tensions and negative effects that technology use had on the consumer. A later research by Munene et al. (2002b) concentrated on the freedom/enslavement paradox identified by Mick and Fournier (1998). Their findings were similar to Mick and Fournier’s, suggesting that consumers did not only experience this paradox with household technologies but also using commercial technologies.

Moreover, Castellaci and Tveito (2017) presented four ways how Internet usage affects well-being: change of time use patterns, creation of new activities, facilitated access of new information and use as communication tool. The Internet paradox was investigated in 1998 by an article of Kraut et al., which included the finding that the Internet can be entertaining and harmful at the same time. Greater use of the Internet correlated with a declining size of the participants’ social circles, less family communication and finally, an increase in depression and loneliness (Kraut et al., 1998). In turn, Kim et al. (2009) showed that individuals who felt lonely were at risk for developing compulsive Internet usage behaviours, which resulted in negative life outcomes. Linking to this, Brooks (2015) showed that higher use of personal social media lead to lower task performance, lower happiness and higher levels of perceived technostress. Furthermore, the division of attention due to multiple tasks and environments concerning the Internet, caused lower engagement with each of the tasks due to lower cognitive resources (Zolfagharian & Yazdanparast, 2017). Since people nowadays spend increasingly more time with Internet technologies, their potential to affect them negatively grows as well.

In context of the working environment, Ter Hoeven et al. (2016) showed that communication technology use had the possibility of increasing well-being through accessibility and efficiency, while also leading to a decrease through interruptions and unpredictability. Mazmanian et al. (2006) examined organisational consequences of BlackBerry use and found three types of conflicting elements, namely continuity/asynchronicity, engagement/
disengagement and autonomy/ addiction. On the one hand, they showed that communication devices offered the employees short-term peace of mind, flexibility and control over interactions by being able to continuously monitor and respond to messages. On the other hand, using these devices amplified the employees’ level of stress through reduced ability to disconnect from work and maintaining a compulsive checking behaviour (Mazmanian et al. 2006; 2013). As the entire firm used these devices, implicit norms emerged, expecting constant availability and thereby fuelling a “self-reinforcing cycle of constant communication” (Mazmanian et al, 2006, p. 1).

In contrast, Bargh and McKenna (2004) pointed out positive aspects of the Internet, such as the quality of the communication channel in being relatively anonymous, which consequently encouraged self-expression. Moreover, it facilitated meeting people with similar interests and values. Contrary to other studies, these authors found that the Internet did not make people lonely or depressed and even enabled communication, thereby strengthening relationships. They argued that, thus far, people adapted well to the new technological social world.

2.3 The ambiguous role of the smartphone

“The smartphone is by far the world's most popular and intrusive electronic device” (Rotondi et al., 2017, p.25). Smartphones have been intensely integrated into people’s daily lives and are perceived as an “almost invisible driver of modern life” (Roberts et al., 2014, p. 264). The number of smartphone users is continuing to grow and is estimated to reach 2.71 billion in 2019 (Statista, 2018). Smartphone penetration among UK adults is expected to range between 90% and 95% in 2022 (Deloitte, 2017). However, several studies highlighted the smartphone’s ambiguous and paradoxical impact on the consumer.

In 2017, Deloitte conducted a comprehensive survey of consumer and business usage patterns of mobile technology. They assumed that the conflict that emerged with smartphone usage was not likely to disappear. Turkle called mobile technology a “phantom limb” (Turkle, 2011, p.4), as it could be regarded as part of a person in many cases. Ward et al. (2017) found in their study that “brain drain”, caused by the mere presence of a smartphone, could reduce available cognitive capacity and thereby affected consumer decision-making and eventually welfare. Regarding the smartphone, Twenge even held the view that “all screen activities are linked to less happiness, and all nonscreen activities are linked to more happiness.” (Twenge, 2017).

Furthermore, Jarvenpaa and Lang (2005) applied Mick and Fournier's (1998) paradox concept to mobile technology. They identified eight central paradoxes of mobile technology that shaped user behaviour and experience, most of them being congruent with the findings by Mick and Fournier. The consumers’ overall experience with mobile technology was largely determined by conflicting situations and therefore described as paradoxical. Besides, since consumers
engaged more closely with forms of information technology today, the impact of technological paradoxes was perceived as becoming stronger (Jarvenpaa & Lang, 2005).

On the one hand, the smartphone was associated with freedom, mobility and accessible information (Borges & Joia, 2015; Roberts et al., 2014). It allowed people to stay in contact with each other and could bring them, virtually, closer together. At the same time, it was trading in depth for breadth of relationships, thereby creating distance between people (Deloitte, 2017; Hall & Baym, 2011). Thus, by negatively affecting the quality of real-life interactions it is reducing their effect on well-being (Rotondi et al., 2017). Moreover, the smartphone could have a negative impact on the sleep pattern which in turn was linked to obesity. Nevertheless, it could also encourage people to exercise more frequently, thereby preventing obesity (Deloitte, 2017).

Oulasvirta et al. (2011) described mobile devices as “habit-forming” and especially concentrated on the “checking habit”. Even though users described the constant checking of the phone as annoying, it was not seen as an addiction and positive experiences related to entertainment and distraction were mentioned as well. Overall, the authors stated that smartphone related habits were not yet considered problematic (Oulasvirta et al., 2011).

Contrarily, Roberts et al. (2014) applied Mick and Fournier’s (1998) concept of technology paradoxes to the smartphone and found that there were certain cell-phone activities which were strongly associated with cell-phone addiction. This was in turn largely driven by the desire to socially connect. Greist (2010) stated that there were different terms for this phenomenon, ranging from problematic to pathological Internet usage.

Mihailidis (2014) showed in his study that participants acknowledged different positive capacities of the mobile phone. Yet, they remained sceptical about the phone’s efficacy because they heavily relied on it and even expressed anxiety and inability to separate from it, which lead to several tensions. Thus, the phone could be perceived as showing enslaving tendencies by creating restrictions and dependence (Roberts et al., 2014). Moreover, Borges and Joia (2013) applied the paradoxes of technology, identified by Mick and Fournier (1998), to the domain of executive smartphone usage and found the paradoxes continuity/asynchronisity and autonomy/addiction to show the strongest ambiguity. Also, Trub and Barbot (2016) found in their article about the paradox of phone attachment of young adults two characteristics most prevalent: “Refuge” or the feeling of safety with the phone and discomfort when separated from it and “burden” as relief upon being separated from the phone. Overall, it was found that the majority of smartphone owners was aware of their extensive usage. 40% said they used their phone too much and 48% even stated they had tried to limit the use of their phone (Deloitte, 2017).

Lastly, Sutanto et al. (2013) found a tension between product personalisation and privacy concerns in the domain of smartphones, called the personalization-privacy paradox. Relating to this, Pentina et al. (2016) supported the privacy paradox in consumer technology adoption by stating that levels of privacy concerns were generally high among people and were not determined
by personal or cultural differences. Nevertheless, despite concerns about their privacy, consumers seemed to be willing to trade in their data and privacy for convenience (Garcia-Rivadulla, 2016).

2.4 Self-control through self-tracking

It is a general development in human history to use measurement and technology in order to control the natural world as well as the human body and the “care of self” has been explored by philosophers such as Heidegger and Foucault (Swan, 2013).

The theory of self-efficacy is concerned with people’s ability to apply successful self-regulation (Maddux & Volkmann, 2010). Self-regulation has multiple facets and is shaped by “cognitive processes including self-monitoring, standard setting, evaluative judgment, self-appraisal, and affective self-reaction.” (Bandura, 1991, p. 282). Besides, Baumeister et al. also highlighted the importance of this aspect by suggesting that it is “only by means of self-regulation that human beings can reach their potential and fulfil their ideals” (Baumeister et al., 1994, p. 263). In addition, self-control, which represented a substantial function of the self, is said to be a key to success in life (Baumeister et al., 2007).

Moreover, Tangney et al. (2004) showed that higher scores of self-control had several benefits including better adjustment, performance, interpersonal skills and more optimal emotional responses. Lower self-control on the other hand, posed a risk factor for interpersonal and personal problems. However, applying self-control could lower people’s performance in other areas, indicating that the capacity for active will was limited and that a variety of differing acts have a common resource (Baumeister et al., 1998; Baumeister et al., 2007). In this context, Schmeichel and Vohs (2009) demonstrated that when the resource of self-control was exhausted, self-affirmation as a form of psychological intervention, could facilitate this self-control.

Furthermore, Baumeister et al. (2001) conducted a study about the power of bad events over good events occurring in everyday life. They found that the individual was more motivated to avoid bad self-defininitions than to pursue good ones. Besides, the desire to get out of a bad mood was stronger than getting into a good one. Moreover, Masicampo and Baumeister (2011) demonstrated that unfulfilled goals negatively affected people. Yet, by formulating and committing to a specific plan, goal attainment was facilitated, cognitive resources were freed and multiple pursuits could be more easily managed.

The ‘care of self’, mentioned above, constituted a predecessor of the Quantified Self (QS) movement, which claimed to gain “self knowledge through numbers (Quantified Self Labs, 2015; Swan, 2013). It stands for ‘any individual engaged in the self-tracking of any kind of biological, physical, behavioural, or environmental information.” (Swan, 2013, p. 85). Thus, users showed an active standing toward the gathering of self-tracking information. The World Health organisation
considered the QS being present in domains such as the physical state, psychological state, social interactions and the environmental context. These domains can be assessed through digital data emerging from wearable devices, self-reports and applications. However, since not enough data exists, the connection between QS and quality of life is yet to be fully determined (Wac, 2018).

In today’s society, efficiency orientation is of great importance, which is transferred from the working world into people’s personal lives (Mitteldeutscher Rundfunk, 2018). Next to the search for happiness, self-optimisation of the physical appearance is most salient. The body is described as the expression of the true self, a display where the individual’s discipline, willpower and character becomes visible (Duttweiler, 2016). Asimakopolous et al. (2017) stated that the trend towards self-efficacy was reflected by the growing level of popularity of fitness-trackers. Hence, people were using digital technologies to gain detailed personal information about their bodies and other elements of their life (Lupton, 2017). The practices of self-tracking supported the individual’s responsibility, autonomy, freedom and decision making ability. Self-knowledge was possible through individual performance as well as through comparison and was considered an instrument for self-responsibility and personal affirmation. Moreover, external control was applied since most apps include coaching possibilities in form of reminders and encouragement. Also, connecting and sharing personal data with other people allows “control from the side” (Duttweiler, 2016).

2.5 Mobile health applications

According to the Research2Guidance study, there is no end in sight to the current trend surrounding mHealth apps. The number of these apps has grown significantly with about 260,000 health apps available in the major app stores, being offered from 58,000 sources of mHealth publishers (Research2Guidance, 2016). What differentiates the mHealth market from other industries, is the seemingly altruistic motive as in helping people to improve their health conditions, which is however quickly followed by the goal to generate revenue (Research2Guidance, 2016).

mHealth can be defined as “healthcare electronically supported by mobile devices” (Albrecht, 2016, p. 14). These apps are software programs, exclusively available on the smartphone and other communication devices. For the purpose of this thesis, mHealth apps are defined as applications on the smartphone used for self-tracking in the context of the consumer health.

Furthermore, accessories, such as smart watches, can be attached to these communication devices (FDA, 2015). In 2016, 38.8 million U.S. adults used wearable devices, mostly for tracking their health and fitness. This number is expected to grow up to 57.1 million in 2020, which equals 21.9% of the US population (eMarketer, 2017). The smartphone is and will be
the most preferred device for mHealth in the future, although, wristbands, watches and tablets will increase in business potential (Research2Guidance, 2016; Albrecht, 2016).

Since smartphone ownership has risen and smartphones were now provided with built in sensors, mHealth apps had the potential to help high-cost and high-need populations to manage their health (Swan, 2012; Lamonaca et al., 2015; Singh et al., 2016). These apps, intended for the use in wellness, health and medicine, could be used for prevention reasons, managing diseases or other health related services (Piwek et al., 2016; Albrecht, 2016). The digitalisation of health is supposed to empower people and improve patient outcomes, while also generating data that can promote research and clinical decision making (Forbes, 2017; Sharon, 2016). Thus, more individualized diagnostics can be realized by providing data directly to the physicians (Martin et al., 2017).

Daponte et al. (2013) presented a variety of application fields of the smartphone as measurement tool, such as sport and medicine. Besides, Bort-Roig et al. (2014) found it to encourage physical activity, leading to reduction of health risk factors and improving the user’s quality of life. At the same time, the smartphone could limit engagement by disruptive notifications and strategies based on competition. Through sensors in the form of kinematics, cameras and microphones, different applications such as posture monitoring and heart rate analysis were possible (Lamonaca et al., 2015). Besides, aspects such as sleep quality, calorie intake, step count and the daily mood can be measured. The app then saves and bundles the gathered information and graphically displays the user’s progress or results (Horst, 2015). In this context, Asimakopolous et al. (2017) showed that users’ self-efficacy and motivation were dependent on successful data, gamification, content design and motivational feedback.

Moreover, it was found that 56% of mHealth app developers aim their products at chronically ill people, while 33% target people interested in fitness and health (Research2Guidance, 2016). Linking to this, the most popular apps downloaded were related to weight loss, fitness and heart rate and most mHealth apps can be overall categorized in the area of fitness (American Heart Association, 2015; Whiteman, 2014; Research2Guidance, 2014). Although mHealth apps were proven helpful for weight-loss and improved the chances of quitting smoking, effects had often been only short term and studies were mostly limited in duration and size (American Heart Association, 2015). Moreover, Codella et al. (2018) pointed out that person-generated health data was often lacking sufficient quality due to several challenges in data generation and analysis. On top of that, few mHealth apps have been clinically accredited and only 0.1% have been cleared by the US Food and Drug Administration (BioMed Central, 2015; Southern Methodist University, 2014).

A report by the World Economic Forum identified connected care as a future trend. This means the coordination and synchronization of data across virtual networks from home care to hospitals (Martin et al., 2017). Insurance companies are expected to become a key player in the
mHealth market in the future. The use of mHealth apps for prevention and rehabilitation reasons is estimated to save the U.S. healthcare system 7 billion US$ a year (Research2Guidance, 2016; IQVIA, 2017). However, it is expected that insurance companies will also gain competitors through companies that have not yet been present in the healthcare industry (Mitteldeutscher Rundfunk, 2018). There are already new players entering and stirring up the healthcare market, such as the current partnership between Amazon, JPMorgan Chase and Berkshire Hathaway. This venture aims at using technology to reduce the healthcare costs of the companies’ employees (Wingfield et al., 2018; JPMorgan Chase & Co., 2018).

Furthermore, providing self-generated data to insurance companies might allow “control from above” and thereby support self-efficacy (Duttweiler, 2016). Lupton (2017) states self-tracking could, on a larger scale, promote health and well-being and simultaneously increase socioeconomic disadvantage, which could eventually lead to people abstaining from self-tracking and having to face negative consequences from employers or insurance companies.

Generally, some people remain sceptical about self-tracking and feel that health is the responsibility of healthcare professionals, as they raise concerns about security, safety and reliability of smart devices in healthcare (Piwek et al., 2016; Swan, 2013). Especially in the area of health, data is highly sensitive, which is why ethical and societal concerns emerge and data privacy and security are considered important topics (Sharon, 2016; Lupton, 2017). The study by BioMed Central (2015) found that some health apps sent personal health information to online services without encryption, putting the users’ privacy at risk and not complying with data protection rules. Also, the Charismha study particularly pointed out conflicting objectives between privacy and transparency (Albrecht, 2016). Thus, data security and privacy concerns are crucial aspects for the diffusion of mHealth apps (Singh et al., 2016).
2.6 Concluding remarks

As presented above, digital technology and particularly, the smartphone hold an ambiguous role and reveal contradicting aspects, which have been discussed by several studies. Since mHealth apps require a device such as the smartphone, it can be assumed that paradoxical tensions that were found to be connected with digital technology, emerge with the use of mHealth apps as well.

As means for self-control it can be suspected that mHealth apps affect consumers’ lives positively, since high scores of self-control correlate with numerous positive aspects of life (Tangney et al., 2004; Masicampo & Baumeister et al., 2011). On the other hand, the use of mHealth apps for self-control and optimisation reasons might lead to feelings of conflict and dependency as it has been shown in the domain of smartphones (Jarvenpaa & Lang, 2005). Furthermore, several studies displayed privacy concerns as important aspect that consequently could weaken the apps’ positive usage aspects (Albrecht, 2016; Swan, 2013).

All in all, the literature review has shown that digital technology elicits paradoxical tensions and creates positive and negative usage consequences. This raises the question whether this is true for mHealth apps as well. Since this has not been researched before, the thesis aims at filling the gap in knowledge by investigating which paradoxical tensions arise in the novel domain of mHealth apps. Moreover, through qualitative research it will be examined how these tensions affect the consumer, which emotional reactions are aroused and how these are managed.
3. Methodology

3.1 Research methods

As mentioned before, the objective of this thesis is to answer the research question, which was introduced in the beginning: *What are the paradoxical tensions in the domain of mHealth apps and how do they affect the consumer?*

The research question can be divided into two parts. The first part deals with the paradoxical tensions, conflicts and contradicting aspects that emerge with the use of mHealth apps. In this context, previous research has shown that digital technology evoked several paradoxical tensions (e.g. Mick & Fournier, 1998; Jarvenpaa & Lang, 2005). Thus, it is the objective of this research to apply the concept of technology paradoxes to the domain of mHealth apps.

The second part of the research question highlights the objective to explore how the paradoxical tensions, elicited by mHealth apps, affect the consumer. Here, it is of interest how consumers perceive these tensions and in which manners they are influenced by them. It is further taken into account, how consumers react and manage them. Finally, the overall objective is to explore the field of mHealth apps by gathering valuable in-depth information about the impact that these apps have on the consumer.

In order to explore and gain new insights, qualitative research is the adequate method for this research, particularly because it is used in fields where there is only little existing knowledge (Dresing et al., 2013). Besides, research questions that aim at understanding the reasons, experience and behaviour of people cannot be sufficiently answered with quantitative methods (Hussy et al., 2013). Qualitative research does not require a clear wording of hypotheses, however, it does need a beforehand defined objective (Cropley, 2011). Moreover, the empirical data should be collected and analysed in a manner that is oriented towards the scientific issue of the research (Flick, 2000; Hussy et al., 2013). In order to gain a comprehensive understanding of the object of study, this research employed a combination of the diary method, the Sentence Completion Method and semi-structured interviews.

For the interviews an abductive approach was applied which proves especially useful if the researcher’s objective is the discovery of new thematic aspects (Dubois & Gadde, 2002). This approach aims at generating novel insights and theories, by building an inferential process on a deep and broad theoretical base (Timmermanns & Tavory, 2012). Abduction, which is a form of logical reasoning, gives researchers some initial ideas about the theme and what they might encounter during the research. However, abduction also leaves flexibility for the discovery of new ideas (Reichertz, 2013).

Furthermore, the diary method enables the gathering of longitudinal data and is applied by many researchers in order to gain insights about the realistic experiences of participants (e.g. Asimakopolous, 2017; Derks & Bakker, 2014). Diary entries can capture the particularities of
experiences in a manner, not possible with traditional designs. Another benefit is that the time
between the experience and the account of that experience is minimised. Therefore, the given
information is richer and less biased, compared to being reported in retro perspective (Bolger et
al., 2003).

In the beginning of April 2018, over the course of two weeks, five participants were asked
to track and report their experiences with their mHealth apps. Hence, they conducted diary entries
twice a day, one in the mid-morning and one in the afternoon. With the diary method, the
investigation of ongoing experiences in a natural, daily context was achieved (Bolger et al., 2003).
Furthermore, the insights from the diary entries provided the basis for the semi-structured
interviews and lead to small adjustments of the questionnaire design.

Before the interview was conducted with each participant, the Sentence Completion
Method was applied. Here, respondents were asked to complete two sentence fragments
concerning the topic of digital technology. This method is said to be a versatile and flexible
projective technique and is regularly used to assess a variety of attitudes (Rabin & Zlotgorski, 1985;
Goldberg, 1965). For this research, the Sentence Completion Method was oriented toward the
Rotter Incomplete Sentence Blank (ISB). The ISB suggests 40 versions of sentence stems, which
were used as reference for this research (Goldberg, 1965; Rotter et al., 1949).

Moreover, before conducting the interviews, a pre-test of the interview guide was carried
out in order to detect areas for improvement, such as recognising redundant questions, testing the
logic structure and estimating the interview duration (Mieg & Näf, 2005; Summers, 2001). Based
on the pre-test results, the interview guide was adjusted again.

Generally speaking, the focused but flexible nature of interviews made them an effective
and trustworthy source of consumer data (Arse, 2017). There are different opinions about the
certain characteristics of qualitative interviews, yet, communalities can be found in the following
aspects: information gathering to answer a research question, clear roles between interviewer and
interviewee, openness of answers and depth of information gathered (Evers & de Boer, 2012).

The interview for this thesis’ research was conducted in form of a semi-structured interview
or guided interview. This interview form was adequately structured to address aspects related to
the topic of study, while leaving space for the respondents to offer new ideas. It can be used as
only method or, as in this research, as one of several methods. A key benefit is the possibility to
attain both, the lived experience as well as theoretically driven aspects of interest. Thereby, the
semi-structured interview offers the potential to capture the complexity of the research topic
(Galletta, 2013). The semi-structured interview provided orientation by constituting a basic
conversation structure, fixed key topics and main questions. However, since the order of questions
could be adjusted to the situation, it still ensured a natural course of conversation (Gläser & Laudel,
2010; Bierhoff & Petermann, 2010).
Through the use of multiple methods and data sources, namely the diary study, Sentence Completion Method and semi-structured interviews, a deeper understanding of the complexity of the research object was achieved. This approach is called triangulation (Denzin, 1989). The form of triangulation used in this research can be described as “triangulation within a method” that assumed that the real situation cannot be apprehended from only one single viewpoint. This method builds the data from various perspectives and techniques within the method of qualitative research, but solely addresses one issue (McFee, 1992).

3.2 Sample characteristics

In qualitative research, sampling usually does not require the formal selection of part of a population (Flick, 2007). The sample should be relevant not in a statistical way, but in the sense that it represents the relevance of the phenomenon through the respondents’ experiences and concerns with the issue (Flick, 2007).

The cases in this research were selected according to intensity. This means, respondents were chosen upon the aspect whether they made use of mHealth apps. It was not about finding people that exhibited a certain amount of expert knowledge, but about finding respondents who currently implemented the apps in their daily lives and thereby inherited basic knowledge about them. Furthermore, the criterion of convenience came into play as well, since the respondents were recruited from the author’s extended circle of acquaintances. In this manner, the snowballing technique was applied, where respondents recommended people that were also considered relevant for the study’s purpose. Overall, the chosen cases were heterogeneous enough to make comparisons and homogenous enough to identify common features among them (Flick, 2007).

Generally, qualitative researchers study fewer people than quantitative researchers. There are several aspects that influence the ideal sample size (Flick & Salomon, 2012). Adler and Adler (2012) suggested a sample size of twelve for the purpose of a thesis, in order to ensure a realistic time frame for planning, conducting, transcribing and analysing the interviews. Following this, Guest et al. (2006) found that saturation occurs within the first twelve interviews, especially when it is about describing a perception of a relatively homogenous group. For this research the sample consisted of thirteen respondents including five participants for the diary method. The interview sample consisted of ten women and three men. Also, four women as well as one man conducted diary entries. All of them were German university students with an age range between 21 and 29.
3.3 Research design and implementation

As explained before, the diary method was conducted in the first instance. The participants received pre-formulated Microsoft Word and Google Docs documents to fill in their answers, see Appendix A. However, they were also free to note down their diary entries in other forms, electronically or in paper form. The participants were asked to answer four questions per report which were short and clearly phrased. Content-related, they discussed specific mHealth apps, the feelings and experiences evoked by their use, as well as particularities that occurred in the given timeframe.

Due to the screening of the sampling, it was ensured that every respondent had some experience with these apps. However, since the term ‘mHealth apps’ is quite broad and might have not been correctly classified by every respondent, it was explained prior to the interview to guarantee a common understanding. Moreover, before the interview was conducted the respondent was invited to ask questions about the interview process (Arsel, 2017). For the Sentence Completion Method, the phrasing of the sentence stems was inspired by the items from the ISB method (Rotter et al., 1949). The stems were phrased in a clear and well understandable manner to facilitate quick and intuitive answers. In order not to affect the respondents, only few instructions were given, such asking them to express their real feelings (Goldberg, 1965; Rotter et al., 1949).

For the semi-structured interviews, the research question represented a guiding factor of the study’s design. The operationalization was performed through converting it into interview questions that contributed to answering the research question (Arsel, 2017; Flick, 2013; Gläser & Laudel, 2010). The literature review of current knowledge of mHealth apps provided the theoretical basis of this research, since questions for the interview guide should be developed with theoretical background and context. In particular, the study by Mick and Fournier (1998) about technology paradoxes constituted a basis for the design of the interview questionnaire, which was separated into introductory, main and final parts. The introductory part contained questions about the respondents’ usage characteristics of mHealth apps. In the main part, the questions aimed at the usage motivation, in which manners users were influenced by mHealth, particularities of their respective apps and privacy concerns. The final part covered the assessment of chances and risks, the future outlook and concluding remarks. Overall, the interview questions aimed at understanding the positive and negative effects of the use of mHealth apps, the tensions that consequently emerged and how they affected the respondents.

After collecting the relevant questions for the questionnaire, they were divided into main and sub-questions and assigned to thematic blocks. These blocks were arranged in a manner that they ensured an appropriate course of interaction (Gläser & Laudel, 2010). Furthermore, to provide transparency, the layout of the questionnaire was clear and structured with highlighted main and
sub-questions. These questions were clearly phrased, easily understandable in a manner that encouraged narratives (Bierhoff & Petermann, 2014; Bogner et al., 2014). Linking to this, Hussy et al. (2013) formulated several recommendations, how to phrase interview questions, which were taken into account for this interview guide, such as avoiding simple yes or no questions. In the course of the interview spontaneous follow-up questions, paraphrasing and probing were put into use to encourage the respondents to specify their statements (Arasel, 2017; Lamnek, 2005).

For the diary method, the respondents were free to choose between conducting them in German or English, whereas all participants opted for the English version. Since respondents were German native speakers, the interview guide, which was initially designed in English, was translated by the author, see Appendix B and C. To ensure measurement equivalence it was of great importance to accurately translate the questionnaire. Therefore, the German questionnaire was back translated to its original version by another person in order to detect any inaccuracies in the translation (van Riel, 2018; Temple & Young, 2004).

3.4 Data analysis procedure

The data collected through the diary method, Sentence Completion Method and interviews was analysed with the help of content analysis. This represents a research technique for making replicable and valid inferences from data to the context (Krippendorff, 1980). Since the diary entries were conducted prior to the interviews, they were examined first in order to consequently adjust the interview guide.

After conducting the interviews, the audio data was transcribed by using simple transcription rules to ensure easy readability. Following this, to prioritise the content of the interview, empty words and sounds were omitted from the transcript without changing the key message of the text (Dresing & Pehl, 2013; Meier, 2000). The responses of the Sentence Completion Method from the beginning of the interview have been treated in various ways (Goldberg, 1965). Since the content analysis has been applied for the analysis of the diary entries and the interviews, it was used for the Sentence Completion Method as well.

As mentioned before, an abductive approach was applied for this research, where a phenomenon is not encountered with rigid hypotheses, nor does the gathered data only speak for itself. Abduction can rather be defined as “working from a consequence back to cause or antecedent” (Denzin, 1989, p. 100). Thus, it is not important whether the research’s results are a combination of existing ideas or if they are derived from new insights (Reichertz, 2013).

Before the content analysis was carried out, a generative technique called “contextmapping” was applied, in order to detect underlying structures and themes in the data material (Sleeswijk Visser, 2015). Here, the interview transcript and diary entries were divided into
quotations, which were then paraphrased. Following this, these quotations were discussed in a meeting in order to identify general, overarching themes, first order concepts and a structure within the material, as seen in tables 1-4.

Furthermore, the chosen data analysis method should follow the specific research question and the object of investigation. With this in mind, qualitative content analysis was applied to structure the interview data and to form an information basis that allowed to answer the research question (Bogner et al., 2014). In general, qualitative content analysis should apply a systematic procedure, which is known from quantitative methods. Thus, to filter certain aspects from the material, based on preconceived coding criteria, the structuring technique, which is based on categories, was used (Mayring, 2010).

In the first step, the researcher read through the whole material to receive a general impression and took notes on relevant text passages. In the next step, categories were determined, which reflects a key issue of content analysis (Mayring, 2010). Even though, Mayring only distinguished between deductive and inductive category derivation, the two methods were combined, since this research is based on an abductive reasoning approach. Thus, category ideas were gathered from prior theories and complemented with ideas emerging from the empirical data until the final category set was determined. Following this, anchor examples that depicted exemplary text passages for a category were defined, as well as accurate category definitions, to guarantee unmistakable allocation of passages (Mayring, 2010). These definitions were transferred into an Excel sheet, see Appendix D.

Following this, it was investigated in a trial run, whether these categories, anchor examples and definitions fit the text. If these categories were approved, the text passages that fit to a category were extracted into another Excel sheet, whereas preferably the whole answer to a question was analysed (Mayring, 2010; Gläser & Laudel, 2010). Moreover, especially meaningful quotations were marked and later used as translated versions in the text and tables to enrich certain arguments. These verbatim quotes were a means to illustrate important themes, which were identified in the collected data to deepen the reader’s understanding (Bryman & Bell, 2015). The results of the Sentence Completion Method and of the diary method were included here as well. In this file, the categories were arranged in terms of relevance for answering the research question and references to the transcripts were provided (Kuckartz, 2014).
4. Research results

4.1 Introduction

In the following, the results from the analysis of the diary entries and the interview transcripts will be presented. During the analysis it was examined which paradoxical tensions were experienced and recognised by the respondents. Moreover, it was investigated in which ways they dealt with the upcoming conflicts and tensions. It became obvious that the usage behaviour of mHealth apps evolved over time and exhibited different user reactions during distinct stages. Linking to this, three phases of mHealth app usage could be distinguished from each other, which are visualised in figure 2.

First, respondents expressed their motivation and reasons about initially beginning to use their respective apps, as seen in table 1. Second, in the course of using mHealth apps, respondents experienced several contradicting, positive and negative emotions, which often occurred simultaneously. In this second phase, five substantial paradoxes were identified, which are depicted in table 2. Together with these paradoxes, tensions emerged, which affected the users in several ways. Here, three dominant areas were detected, as seen in table 3. While not every usage situation created these tensions, it became obvious, that paradoxes were experienced by every respondent at some point. Lastly, the third phase dealt with how users managed the paradoxical tensions through coping strategies and mechanisms. Within this third phase, five substantial coping strategies were identified, as seen in table 4.

The analysis of the collected data revealed that some paradoxes were more prominently represented and were acknowledged to varying degrees by the users. Also, certain paradoxes led to stronger user reactions than others, both in a positive or negative manner. These also differed to some extent between the types of mHealth apps. Whereas some paradoxes could be clearly differentiated from each other, many showed some overlaps and were closely related with each other and with the emerging tensions.

When taking a closer look on the types of mHealth apps used, most respondents indicated that they used activity trackers, usually Runtastic or a pre-installed step counter on their respective phones, often Health by Apple. The second category were calorie counting apps, mostly MyFitnessPal. Lastly, sleep trackers and period tracking apps were sporadically used by respondents in this research.

In the following course of this chapter, the elements of the three phases will be described in more detail. On top of that, this chapter is concluded with the chances and risks of mHealth apps, which were mentioned by the respondents.
4.2 Phase I: Initial motivation

Table 1 displays the first phase, which consisted of the users’ initial motivation to use their mHealth apps. Topics that were thoroughly connected with the aspects of this first phase were self-tracking and self-control. Self-control served as motivation and often represented a means in order to improve a certain area of the user’s life. Besides, factual information served as a means to exert self-control by offering quantifiable information, which made the user’s behaviour salient. Self-control will be discussed more closely as an element of paradox in the following.

<table>
<thead>
<tr>
<th>Initial motivation</th>
<th>Definition</th>
<th>Sample Interview Quotes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seeking help through apps</td>
<td>The app is used as a means to solve a problem, exert self-control or to improve a certain area in the user’s life.</td>
<td>Both, the Runtastic app as well as the MyFitnessPal app motivated me because you can control yourself. (MM)</td>
</tr>
<tr>
<td>Receiving factual information</td>
<td>Through the app, users can see their performance represented in numbers and quantifiable information.</td>
<td>Otherwise you may only have the feeling ‘I walked little’ but now you can see it in black and white. (TS)</td>
</tr>
</tbody>
</table>

Table 1. Initial motivation.
4.2.1 Seeking help through apps

The collected data revealed that respondents began using their respective mHealth apps in order to receive help and support from their apps, as well as to understand themselves better. Moreover, the apps were considered a means for problem solving, such as overcoming the lack of fun in running, as stated by respondent MM: “Running to me is like fulfilling an obligation”. Besides, the app was described as a means to for self-discipline: “I find it positive that when I seriously want to lose weight, I’m always doing that with MyFitnessPal because it helps me to be strict with myself and do that in a disciplined manner.” (NL).

Primarily, mHealth apps were used for self-improvement in various areas of life, such as losing weight and increasing activity through self-tracking: “I want to lose weight. Therefore, I want to control my meals and my training.” (DNL).

4.2.2 Receiving factual information

Receiving factual information was another aspect that was considered a reason to begin using mHealth apps. The analysis of the diary entries showed that curiosity about the user’s performance was an initial motivation for using these apps. Respondents valued receiving quantifiable information and seeing their performance in one glance. Qualities such as the accuracy and preciseness of information were especially intriguing as stated by respondent AR: “I believe the accuracy is intriguing”. Especially the benefit of seeing something in black and white was mentioned by a few respondents:

“I: What are positive aspects of the apps?
AB: Yes, mostly those numbers, black and white. That is why I am using it.”

Linking to this, the app’s possibility of making the user’s behaviour salient through factual information was an aspect valued by users. Respondent MM mentioned that the app made his bad eating habits more salient and thereby created a basis for self-improvement: “It of course helped me to eat more consciously. That has to be said. If you weigh things and see how many calories a spoon full of oil really has.” (MM).
4.3 Phase II: Paradoxes

Table 2 below depicts the five most salient paradoxes, which were found during the research. In the following, these paradoxes as well as their subtopics will be described in more detail.

<table>
<thead>
<tr>
<th>Paradoxes</th>
<th>First order concept</th>
<th>Definition</th>
<th>Sample Interview Quotes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integration</td>
<td>The app is easily integrated into the user’s life since it is easy to use.</td>
<td>Of course this app is quick and easy to use and you do not need an extra tool. It is indeed an enrichment. (KY)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Effortless</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Helpful reminders</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disintegration</td>
<td>The app is not easily integrated into the user’s everyday life.</td>
<td>It does not really adapt to my life. Just because I tell the app my weight and height, doesn’t mean it adapts to my metabolism and it doesn’t know my digestive system. (TS)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Time-consuming</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Stressful reminders</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Technical issues</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-control</td>
<td>Users use the app to control themselves and their performance.</td>
<td>Generally, I naively use the app to control myself and I don’t want others to control me. (NL)</td>
<td></td>
</tr>
<tr>
<td>External control</td>
<td>Users feel controlled and influenced by the app to some extent.</td>
<td>Feels as if I had completed a task that has been assigned to me. (DTS)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• App takes over intuition</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Entanglement between app and activity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Confirmation</td>
<td>The app is used to confirm the users’ positive or negative feeling or behaviour by providing them with information.</td>
<td>I wanted to know how much I walked today as I was sitting a long time and wanted to “confirm” myself that I still moved enough. (HI)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Pride</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disconfirmation</td>
<td>The app’s results can also disconfirm the users’ feeling or behaviour. This can lead to either positive or negative sentiments.</td>
<td>I was quite happy as I obviously walked more than I thought. (DHI)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Guilt</td>
<td>I expected a longer distance, so I was rather disappointed. (DHI)</td>
<td></td>
</tr>
<tr>
<td>Individual</td>
<td>Users use the app for themselves and not to share results or to connect with others within the app.</td>
<td>Also, Runtastic offers you to connect with friends and tells you to cheer for them. I have never done that. (FE)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Self-comparison</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Community</td>
<td>Users value the aspect that the app allows them to connect with friends and peers in the app and to share their experiences.</td>
<td>The fact that some of my peers are constantly using the same app as I am, creates some sort of a sense of community. (DTS)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Peer comparison</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Motivating</td>
<td>The app motivates users to achieve a higher performance or to improve their lives.</td>
<td>Both the Runtastic app as well as the MyFitnessPal app motivated me because you can control yourself. (MM)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Graphical representation</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Improving behaviour</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Demotivating</td>
<td>Users can feel demotivated by using the app especially if they did not achieve the performance they wanted.</td>
<td>I found it really demotivating. I once even stopped running because I thought to myself ‘that does not change anything, you won’t get better anyway’. (MM)</td>
<td></td>
</tr>
</tbody>
</table>

Table 2. Overview of the paradoxes.
4.3.1 Integration/ Disintegration

The paradox integration/ disintegration was the most salient paradox across respondents. It consisted of various aspects and contained the subordinated paradox effortless/ time-consuming.

The first side of the paradox termed ‘disintegration’ described the quality of mHealth apps to be easily integrated into the user’s life. Respondents argued that they almost always carried their smartphone with them, which facilitated the app’s integration into their lives: “Yes, because you always have it with you, which is not the case with a laptop or a note. If you do sports or go running, you usually always have it with you” (HI). Moreover, some users mentioned that using their mHealth app became a routine: “I’m okay and it feels like MyFitnessPal is a normal routine.” (DNL).

The paradoxical aspect ‘effortless’ was reflected by respondents’ statements about the easiness of using the app, its time efficacy and not needing additional tools to track themselves: “You only click on it once and you can immediately see your step count. It doesn’t get easier!” (FE). Respondents valued that the app worked in the background and that self-tracking became an automated procedure with little or no effort required: “That it works in the background and you basically don’t have to do anything except for checking how many steps you made.” (TK).

Another facet of integration became obvious in the research as respondents mentioned they perceived reminders from the app as helpful, which often were notifications in the form of push messages. Especially in the first phase of using the app, the reminders were described as helpful since users often forgot to properly track their behaviour: “I almost forgot to log in today and it would ‘hurt’ me to see that I had to start from the ‘very beginning’ again. The app reminded me in the afternoon. Lucky me!” (DNL).

In contrast, the second side of the paradox ‘disintegration’ was supported by respondents who argued that the app was not easily integrated into their lives. This was often due to difficulties with requirements of the app, which was an aspect mostly mentioned by respondents using calorie tracking apps: “As soon as you’re away from home, you cannot really track it properly” (FE). Besides, the Sentence Completion Method revealed the challenges of integrating mHealth apps into users’ lives:

“I: The mHealth apps that I am using
TS: don’t adapt enough to my life. They are too static.”

The paradoxical aspect ‘time-consuming’ was reflected by users’ statements about the complexity and complicatedness of using the mHealth apps: “Like I said, I found this calorie app so exhausting that I wouldn’t recommend it” (HI). The apps’ characteristic of time-consumption was repeatedly mentioned by respondents: “A bit annoyed because I had to search for so many ingredients to track the calories, which was quite time consuming.” (DLS).
Whereas a few users perceived the app’s notifications as helpful, the majority of respondents had bad experiences with them. Users commonly described them as annoying: “The notifications first motivated me, but then became annoying really quick.” (DCS). Apart from that, one user mentioned he felt forced: “Reminded me to enter my meal and tried to force me to do sports …” (DTS) and others experienced reminders as disturbing or stressful: “That stresses me, that totally stresses me. I sometimes get messages ‘step on the scale again’. That stresses me” (FE).

Finally, a facet that frequently hindered integration were technical problems with mHealth apps. Users described situations in which the app did not properly track their activity or did not synchronise with other devices as expected: “I went running and I did something for my health but I’m a bit angry that my app didn’t record it. It doesn’t make sense to me!” (DNL).

### 4.3.2 Self control/ External control

The paradox self-control/ external control also regularly appeared during the research. This paradox was closely related to the tension ‘obsession’, which constituted an extreme of this paradox.

The aspect ‘self-control’ was mentioned by all of the respondents as being one of the main purposes of using mHealth apps. Respondents mentioned receiving factual information in order to track themselves and exert self-regulation: “This is why I’m using the app, to be able to control and motivate myself.” (AL). Users emphasised they were using their respective apps for the purpose of controlling themselves but not for others to control them: “The character of it is that you monitor yourself and not that others monitor you” (TS).

However, users acknowledged the ambiguous nature of self-control: “That you control yourself is both positive and negative.” (LS). With the Sentence Completion Method respondent LS highlighted the paradoxical character of mHealth apps, as she claimed that mHealth apps “control my daily routine a bit, motivate me but also stress me a bit” (LS).

The paradox’ aspect ‘external control’ was repeatedly mentioned by respondents as well, such as the feeling of being controlled by the app. Users argued that the app required them to act according to its regulations and rules: “Bad, because I ate more than I was supposed to” (LS). Moreover, they felt that the app exerted pressure and elicited feelings of judgement: “Not sure if I want to let an app judge me on my eating behaviour. Even though the reminder regarding the vitamins was legit, I still feel that the judgement of the overall health situation of a person should not be done by an app.” (DTS).

Furthermore, the app taking over users’ intuition was a facet of external control that also became obvious during the research, since the app’s results influenced the users’ feelings: “I like the feeling when the app turns green and says: ‘Oh hey this is very good food with a lot of protein
or vitamins!” (DNL). As a consequence, respondent DNL recorded in the diary that she felt healthy. Generally, users often relied their mood and well-being on the app’s results and thereby were dependent on the app’s judgement: “And you forget to eat completely intuitively or to listen to your body. So I think in the long run it can be really restricting.” (LS).

A final aspect of external control was the entanglement between the app and certain activities, as respondents described a close and inseparable connection between them. In this context, some users stated the app belonged together with the experience of an activity and that they would not carry out the activity without the app: “Hence, Runtastic just belongs together with running for me. I wouldn’t go running without it.” (MM). Few respondents mentioned being frustrated when they did not carry their phones: “And I have to admit I was super depressed when I didn’t have my smartphone with me and this step counting app didn’t track it.” (FE).

4.3.3 Confirmation/ Disconfirmation

A paradox often experienced by users was confirmation/ disconfirmation. In connection with this, the subordinated paradox pride/ guilt often emerged as consequence of confirming users’ expectations or disconfirming them.

Users indicated that they made use of their mHealth apps in order to confirm their expectations and assumptions about their behaviour and performance, such as the amount of weight they had lost, calories they consumed and the distance they ran or walked: “Good, confirmed my previous thoughts” (DHI). Besides, users enjoyed receiving information about achievements, being able to document it and thereby confirm their performance: “I've lost weight (0.8 kilo) and that’s really nice to write it down.” (DNL). Moreover, the app was used to confirm users’ positive or negative feelings and moods by providing them with corresponding factual information: “If I have a day where I feel bad or I have the feeling I cannot concentrate well, and then look at the app to find an explanation for that. That does indeed have a positive effect.” (KY). Moreover, users expressed feeling proud after having reached or exceeded their desired performance goal and their expectations were confirmed: “When I go running with Runtastic I am more proud afterwards when I can see black and white what I accomplished, how fast I was and what I have burnt.” (NL).

Contrarily, the findings showed that mHealth apps often also disconfirmed users’ expectations and thereby created tensions and ambiguous emotions. On the one hand, when reality did not match the respondents’ expectation in a sense that they were better than expected, users reacted with surprise: “Positively surprised how much we walked” (DCS). At the same time, users often doubted either the functioning of their app or themselves and their own perception. On the other hand, when users’ performance was worse than expected, this negative disconfirmation led to feelings of frustration and disappointment:
“When I have the feeling that I did more than I actually did. Hence, when I realise I estimated myself incorrectly and then I am disappointed because it is worse.” (HI).

Furthermore, respondents mentioned feeling embarrassed or guilty when their app indicated, they remained below their desired performance and thus, users’ expectations of themselves were not confirmed: “Realized I haven’t moved all day. Felt some sort of embarrassed.” (DTS).

### 4.3.4 Individual/ Community

The paradox individual/community was closely related to tensions surrounding privacy concerns and it contained the subordinated paradox self-comparison/peer comparison.

The paradox' aspect 'individual' was related to respondents' statements about the app being used only for their own purposes. The majority of users insisted that they were not willing to share information with others through the app. When questioned whether respondent KY was willing to share her app’s information with others, she responded: “No, rather not. That’s really intimate”. Besides, users explained that they did not want others to see their mediocre or negative results: “When the run was really bad nobody has to know that. That is my problem then.” (AB).

Moreover, respondent AL questioned the app’s community and sharing functions: “… I find this function a bit strange. I think that resembles a bit George Orwell’s Big Brother. Everyone knows how fast you ran and what you ate. I don’t want that and that is nobody’s business.” (AL). In addition to this, none of the respondents declared that they were willing to share self-tracking information on social media platforms, such as Facebook:

“I: The apps gather certain data. Do you share them with friends or do you compare yourself with others or with yourself?

RC: No, on Facebook or something never. I also don’t have any friends on Runtastic.”

Following this, ‘self-comparison’ was a subtopic of the paradox individual/community. All of the respondents stated they were using their mHealth apps to compare their current self to their former self by contrasting corresponding performance measures: “I do intensively compare my own achievements” (FE). Among others, users stated they compared their weight loss or running times: “Yes, I am only looking at my older runs and compare the times there.” (TK).

In contrast, the second side of the paradox, namely ‘community’ was also highlighted, as few respondents argued that they valued their app for allowing them to connect with friends and peers. Some users mentioned that they enjoyed sharing their goals and achievements with friends who had similar interests and goals: “Some of my friends are back at MyFitnessPal. It’s nice to know that we have the same goal.” (DNL). Linking to this, the motivational factor of the community aspect was also pointed out: “this social component as motivation” (TS).
Even though the majority of users stressed they were not willing to share information on social media, many did share their achievements with others via messaging services such as WhatsApp: “Recently, Runtastic asked me whether I wanted to live stream my run. No thanks! I sometimes send a screenshot to my mother or my boyfriend when my run was good with ‘hey, look what I achieved!’” (AB).

Whereas most respondents mentioned they were using the app for comparing their performance only with themselves, respondent MM experienced peer comparison positively: “I was really motivated by the step counter, that you set your goal to 10,000 steps and could also compare yourself to friends”. However, respondent FE perceived getting into competition with others as negative aspect of her app: “You get into rivalry with friends and with yourself.” (FE).

4.3.5 Motivating/ demotivating

Almost every respondent expressed the benefit of motivation as one of the key aspects why they used mHealth apps. When the self-tracking aspect was obvious users felt especially motivated: “With Nike Running Club the tracking is more obvious and you know what you’re supposed to do, therefore you’re more motivated” (TK). The motivating aspect became particularly apparent through the Sentence Completion Method, where it was explicitly mentioned several times:

“I: The mHealth apps that I am using
AB: help to motivate myself.”

Furthermore, visualisation of users’ performance and progress were often perceived as helpful and motivating. While respondents explained that Runtastic provided them with a graphical summary after their run, MyFitnessPal visualised the user’s weight loss progress with the help of a curve diagram: “I find it quite motivating if you see that there is a curve that goes down. You can imagine it better. For me that is helpful.” (LS).

Moreover, the respondents mentioned that they were motivated to improve their behaviour by using their apps. Several users stated that their mHealth apps motivated them to be more active and eat healthier. Here, the change in behaviour was either motivated by the app displaying negative results: “Motivated to eat better than the day before.” (LS) or showing positive results: “Still motivated, because the day went quite well” (LS). Especially step counters motivated users to walk more and respondents regularly mentioned their goal of reaching 10,000 steps: “The step count motivates me this far that I walk an extra round around the block.” (AL)

On the contrary, respondents also emphasized the second paradox’ aspect ‘demotivating’. Particularly, the diary entries revealed that often the users’ initial motivation faded within the course of the app’s usage: “This is fun in the beginning, but then it is a bit silly, I am not able to do it permanently. Then it is rather disappointing. I am the person who says ‘come on, I don’t care anymore’ and then I stop trying at all. So in total it has a negative effect in my opinion.” (CS). Users
became demotivated, especially when the intended goal was not reached or they realised they could not conform to the behaviour required by the app: “But if you’re stressed then you forget to record something and the next day everything is set back to zero. That is extremely demotivating.” (NL). Respondent MM revealed that due to being demotivated he even stopped running at one point: “I found it really demotivating. I even stopped running at one point because I thought to myself ‘that doesn’t change anything. You won’t get better anyway.” (MM).

4.4 Phase II: Tensions

The table below depicts the three most relevant tensions, which were identified within the collected data. These tensions elicited predominantly negative emotions, such as feelings of conflict, frustration and stress.

<table>
<thead>
<tr>
<th>Tensions</th>
<th>First order concept</th>
<th>Definition</th>
<th>Sample Interview Quotes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Privacy concerns</td>
<td>Users experience privacy or data security issues in connection with their app.</td>
<td>I find this whole data topic quite negative. Because you don't completely know where exactly... So, I am a bit cautious. I don't record my feelings or the weather or connect it with any accounts. (AB)</td>
<td></td>
</tr>
<tr>
<td>Obsession</td>
<td>Users are really focused on the app. They can become obsessed with self-tracking, self-control and improving themselves.</td>
<td>But I think that is really dangerous. For a period of time I was checking how much protein and carbohydrates I ate, which I also tracked. That can almost become addictive and obsessive. (MM)</td>
<td></td>
</tr>
<tr>
<td>Ambivalence</td>
<td>Users are aware of the positive and negative sides of an aspect concerning the app. • Negative aspects are more impactful</td>
<td>I think it is an advantage and a disadvantage at the same time, that you become more self-reflected. (TS)</td>
<td></td>
</tr>
</tbody>
</table>

Table 3. Tensions.

4.4.1 Privacy concerns

While some users were more affected by privacy concerns than others, data security issues were acknowledged by every respondent in the research. Users mentioned that they were worried and suspicious about the storage location of their private information, the amount of data stored and the ownership structure of their data. Especially, sensitive information such as weight information or data from period trackers, were objects of concerns.

In this context, one respondent critically reflected on an incident in March 2018 where MyFitnessPal was hacked and user was data stolen: “It’s a bit disturbing that the app got hacked, because I never thought about the point that the account of my fitness app could be interesting for someone.” (DNL). When being asked whether the respondents were willing to share data from
their mHealth apps with their insurance company, most users did not approve. However, some users mentioned they would share their data only if it would benefit them: “Only if it had a positive effect on my insurance premium” (TK). Yet, they denied, when the possibility existed that health insurance companies could also increase their premium, in case their self-tracking data revealed undesired information. Moreover, a trade-off between data privacy and personal benefits was identified in the research and specifically highlighted by one respondent:

“I: The mHealth apps that I am using…
NL: are really practical, however, I also reveal a lot of data by using them.”

4.4.2 Obsession

Obsession was an aspect related to the use of mHealth apps, which was frequently pointed out by respondents and strongly discussed. Users described a general potential and risk for users to develop compulsive behaviour as consequence of self-tracking: “If people only restrict themselves to the app and use it straight every day for years, this can end in control obsession” (LS). Some respondents stated that users of certain risk groups were especially endangered, such as people who were emotionally unstable or had eating disorders: “Yes, MyFitnessPal should be treated with caution. If you really want to loose weight, yes. There are certainly people who have an eating disorder. For those people it is not recommendable at all.” (MM).

Apart from that, respondents reflected on their own experiences with their respective mHealth apps and acknowledged signs of compulsive behaviour in their past. Hence, some of these users described their past behaviour with regard to mHealth apps as unhealthy or obsessive. Linking to this, one respondent expressed that she realised “this is not going in the right direction” (FE) and another user revealed feelings of failure and claimed she “never should have started calorie tracking apps” (AL). Generally, some users mentioned having been too focused on tracking and controlling themselves:

“I: Why did you stop using them?
AB: In particular, I tracked food and at one point it became a bit too much and became too prevalent. I was too focused on that and therefore deleted the app.”

4.4.3 Ambivalence

Finally, feelings of ambivalence were another tension mentioned by users. Some respondents acknowledged and described simultaneously occurring positive and negative aspects of their mHealth apps: “Happy but disappointed at the same time. Even though I walked a lot, I expected more” (DHI). One respondent put her feelings of ambiguity into words: “It did not give me anything because I was at home and totally unhappy. At the same time, I felt good because I was persistent. Ambivalent feeling.” (AL).
Overall, the analysis of the interviews and diary entries showed that negative effects, for instance due to non-achievement of goals, were more impactful and longer lasting than their positive counterparts. Specifically, sensitive information, such as weight indication, had an apparent negative impact on the respondents: “Yes, I think the negative, especially regarding food and calories, affects me more than with sport.” (HI)

4.5 Phase III: Coping strategies

As reaction to the paradoxes and tensions that occurred with using mHealth apps, the research revealed several coping strategies, which consumers applied to manage the paradoxical tensions. These strategies were aimed at relieving negative emotions and tensions such as stress, frustration and conflict. Table 4 depicts the five significant coping strategies and their subordinated mechanisms, which were identified in the research. They are displayed in descending order from more active to rather passive strategies. Active strategies required the user to take action in order to be relieved from the predominantly negative consequences of the emerging paradoxical tensions. Passive strategies were applied by respondents to emotionally or physically distance themselves from the app and its influence by avoiding the app or its functions.

<table>
<thead>
<tr>
<th>Coping strategies</th>
<th>First order concept</th>
<th>Definition</th>
<th>Sample Interview Quotes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Discontinuing</strong></td>
<td>Users stop using the app or turn off some of its functions.</td>
<td>I never should have started calorie counting apps. I am not using them anymore. (AL)</td>
<td></td>
</tr>
<tr>
<td><strong>Adjusting</strong></td>
<td>Users adapt their behaviour, habits or mind-sets according to the perceived requirements of the app.</td>
<td>When I use MyFitnessPal I have a different eating behaviour, because I know I have to record something. (NL)</td>
<td></td>
</tr>
<tr>
<td><strong>Assuming responsibility</strong></td>
<td>Users assume responsibility for themselves and thereby stay in control.</td>
<td>I don't need an app to remind me, I know that myself. (AB)</td>
<td></td>
</tr>
<tr>
<td>• Restricting information sharing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Emotionally distancing</strong></td>
<td>Users keep emotionally distant to the app and its functions.</td>
<td>Yes, I would say that I am capable of distancing it from myself. I realise relatively quickly when something concerns me too much and that is why. (AR)</td>
<td></td>
</tr>
<tr>
<td>• Limiting to basic functions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Ignoring</strong></td>
<td>Users ignore the app or avoid information provided by the app.</td>
<td>Didn’t want to look at the app because I knew I wasn’t very active. (DHI)</td>
<td></td>
</tr>
<tr>
<td>• Denying</td>
<td></td>
<td></td>
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<tr>
<td>• Doubting</td>
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<td></td>
<td></td>
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<tr>
<td>• Mentally abandoning</td>
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</table>

Table 4. Coping strategies.
4.5.1 Discontinuing

Discontinuing was the most applied coping strategy mentioned in the research. Respondents described that they either terminated the use of their app or turned off functions that elicited negative emotions: “… and the second reason is that it often put me in a negative mood and I didn’t want to be dragged down by it. This is why haven’t used them since then.” (AL).

Discontinuing was a regularly applied strategy to alleviate obsessive tensions. When respondents experienced compulsive behaviour they often took counter action by deleting their apps: “I also believe that calorie trackers can be dangerous. I am not using them anymore.” (FE). Additionally, when users felt their mHealth apps were not functioning properly, they discontinued their use: “Highly disappointed as it did not work. As a consequence, I deleted both the Sleep Cycle and Sleep Better app.” (DCS). Also, the app was terminally or temporarily removed when respondents felt their app was not easily integrated into their lives because it took up too much time or when they felt demotivated. Besides, when users achieved their desired results, the app sometimes was deleted: “I set myself a goal and as I reached the goal I did not pursue it because it was quite time-consuming.” (MM).

The research showed that reminders or notifications were frequently turned off when users felt annoyed, pressured or stressed by them: “There was also an option to be reminded of my performance every two kilometres but I turned this feature completely off.” (DCS). When users were asked about potential reasons why they would discontinue the use of their respective apps, financial reasons were frequently mentioned: “When a fee would be required, I think I would stop using it. Because it is not important enough for me.” (AR). Following this, data security issues were a potential cause for deleting, commonly mentioned why users: “I wouldn’t use the app in the future if they can’t guarantee to protect my data.” (DNL). Besides, respondents stated they would terminate the app’s usage when it became too time-consuming or when the app exercised too much influence over them: “Or when I notice that the app personally affects me and I would develop compulsions and couldn’t live without the app, then I wouldn’t continue using it then.” (LS).

4.5.2 Adjusting

Respondents expressed that they adjusted and adapted their behaviours, mind-sets or habits to the requirements of the app in order to relieve themselves of tensions. Thus, respondents mentioned they tried to be more conscious about themselves, adjusted their eating behaviour and modified their sleeping patterns. One respondent revealed that she “once stayed at home” (AL) and declined meeting a friend in order to achieve her calorie goal and fulfil her app’s requirements. Moreover, users reacted to their self-tracking apps by increasing their activity, which was regularly the case for activity apps such as Runtastic or step counting apps: “I tried to walk and take a few more steps. You try to reach it to finally achieve it.” (MM).
4.5.3 Assuming responsibility

Assuming responsibility was a coping strategy, often applied as consequence of the individual/community paradox or privacy concerns. In this context, respondent TS clearly phrased “If you increasingly hand it over to an app as responsibility, you stop listening to yourself and I don’t think that’s healthy”. Apart from that, respondents indicated that they did not grant the app responsibility for their behaviour improvements and other achievements and attempted to maintain control: “I don't need an app to remind me, I know that myself.” (AB).

A subtopic of this coping strategy was the restriction of information sharing. None of the respondents stated they would share information from their app on social media, such as Facebook. However, even though they turned off their apps’ sharing functions, some users were still suspicious: “I always had the feeling ‘Oh god, imagine this would be posted on Facebook after all!” (RC). Most users also expressed they were not willing to share information directly through the app’s functions. Yet, respondents emphasised they did share information, mostly screenshots of achievements, autonomously on their own terms with selected friends and family via WhatsApp and thereby stayed in control: “Like I said, I do share it via WhatsApp but I wouldn’t post it, so that everybody can see it. I am not the person for that.” (CS).

4.5.4 Emotionally distancing

Moreover, distancing was another, rather passive, coping strategy that was applied by respondents. Users who were emotionally distanced from the app claimed that a negative result would not change their mood or well-being: “With the step counter I got the insights that I walked more or less but that doesn’t change my well-being.” (TS). Further, respondents did not allow the app to get too close to them, as they were conscious about keeping a certain distance:

“AR: I don’t want to put so much pressure on myself. I’m already constrained by so much.
I: So you consciously distance yourself?
AR: Yes, absolutely. That is a conscious choice. I think if I would allow it I would get lost.”

A facet of distance exhibited by some respondents was only using a limited amount of functions: “There are a lot of other possibilities which I am not using. I am restricting myself to only the most important functions.” (RC). Nearly every respondent refused to use a fee-based premium version of their respective app. This was also described by users as a reason in order to prevent themselves from being exposed to more usage options: “I find it good not having too many options on my smartphone, also because you would get many messages. If I would pay for them, I would have the feeling that I would need to use them more. And they you always would have the feeling of pressure.” (CS).
4.5.5 Ignoring

Ignoring was a coping mechanism frequently mentioned by respondents which manifested itself through avoiding or ignoring information provided by the app or ignoring the app itself: “I did not use any mHealth apps since I was studying in the afternoon and afterwards was busy too” (DHI).

In his diary entry one user described his feelings toward the app as “defiant” (TS) as the app notified him to consider a healthier diet and consequently he avoided the app. Another user ignored the app by not recording everything she drank or ate: “… now it happens that I don’t tell the app everything what I ate and begin to cheat. The app just stresses me then.” (NL).

During the research several facets of the coping strategy ignoring became apparent, such as the coping mechanism denying. Respondents denied negative issues or information that occurred in connection with the app: “I think I deny the app. I’m saying ‘that’s not right’ or I share it with a friend to get confirmation that it cannot be possible” (CS). This was especially obvious regarding the issue of data security, where users ignored and denied the negative consequences that could potentially arise with revealing personal data: “When I start walking from home they can eventually see where I live, but well, what do they want to do with that?!” (AL).

Respondents reacted with doubt when information or results provided by the app did not appear logical. This coping mechanism was primarily used for the paradox confirmation/disconfirmation, to relieve conflict and ambivalent emotions in case of disconfirmation. When respondents expected better performance than they actually achieved, they often reacted with feelings of frustration. Yet, when the users’ performance exceeded their expectations, users frequently expressed doubt. On the one hand, doubt was either directed towards the app as users questioned its functioning and whether the presentation of results was realistic: “Sometimes I am wondering if this app is really realistic.” (LS). On the other hand, users described doubting their own perception: “They make you frustrated, which is negative. But in that sense, that is the truth and maybe my perception is not that good” (LS). Another user did not trust the app’s positive results and doubted both, the app and herself at the same time: “I was really surprised as it said I already made 10 floors today. I am starting to doubt the reliability of this app or maybe I just underestimate the distance I walk on normal days…” (HI).

The final facet of the coping mechanism ignoring was mentally abandoning the app. Here, respondents temporarily gave up on their goals and let go of restrictions imposed by the app when they realised they did not reach their goal or were not able to reach it: “Then I thought to myself ’it doesn’t matter now anyway’. Now I can eat a pizza.” (FE).
4.6 Future outlook

When being asked about their opinions about the future developments of mHealth apps, respondents often mentioned both chances and risks together. On the one hand, respondents believed in the increasing popularity and importance of the domain of mHealth: “Yes, definitely. And I believe that it will gain in importance in the future.” (TS). One user also saw potential for the medical field: “When increasingly medical data, such as blood pressure will be recorded, this can be a possibility to individualise analyses and get own diagnoses. I think that is the future, it will go there and it has to go there” (TS). Moreover, respondents imagined that since people became more interested in health topics and smartphone penetration grew, mHealth apps had the potential to become a social movement: “I think that is a huge movement” (MM).

Nevertheless, respondents predominantly emphasised the potential of negative consequences and risks for society and the individual. Here, users pointed out the possibility of mHealth apps supporting obsessive behaviour: “I think in the long run negatively, because it is too restricting. I think that people develop constraints and become even more self-centred as they already are.” (LS). Besides, users especially highlighted the aspect of data security and the risks involved: “On the one hand, I could imagine that more and more people get suspicious when it comes to data security.” (RC). One respondent described specific risks that were related to the issue of data privacy and possible exploitation: “But as everything that becomes popular, it holds risks, namely the possibility of being exploited. Maybe through health insurance or pharmaceutical companies.” (TS).

In the following chapter, these findings will be discussed and integrated into a broader context. Moreover, the contribution to knowledge and practical implications will be explained. Furthermore, limitations of this study, ideas for further research and finally, a conclusion will be presented.
5. Discussion

5.1 Interpretation of the results

5.1.1 Overview

The results from this thesis’ research were conducted through diary entries, the Sentence Completion Method and qualitative interviews and serve to answer the research question: *What are the paradoxical tensions in the domain of mHealth apps and how do they affect the consumer?*

Three different phases of mHealth usage are identified in the analysis of the collected data. The first phase describes the respondents’ initial motivation to use mHealth apps, which consists of seeking help through the apps and receiving factual information. The second phase, includes five predominant paradoxes of mHealth use. These are Integration/ Disintegration, Self-control/External control, Confirmation/ Disconfirmation, Individual/ Community and Motivating/ Demotivating. Some of these also contain subtopics or subordinated paradoxes. Paradoxes elicit both, positive and negative emotional reactions from the respondents and create tensions, such as feelings of conflict and frustration. Three tensions in particular are apparent, namely Privacy concerns, Obsession and Ambivalence. Taken together, these paradoxical tensions often affect the users in such manner that they apply coping strategies in order to be relieved of the negative emotions. In the third phase, the five substantial coping strategies identified by this research are Discontinuing, Adjusting, Assuming responsibility, Emotionally distancing and Ignoring. Moreover, self-tracking and self-control are described as crucial aspects of mHealth apps. Respondents emphasise potential chances that these apps provide for the individual and society. Yet, they also point out risks of mHealth apps, such as issues surrounding privacy and obsessive behaviour.

As explained in the beginning of this thesis, paradoxes, tensions and resulting coping strategies were identified by multiple researchers for the domain of technology (e.g. Mick & Fournier, 1998; Jarvenpaa & Lang, 2005). Even though many insights from former studies are represented in the findings of this thesis’ research, there are also distinctions, such as different predominant paradoxes identified. Since most studies about technology paradoxes were oriented towards the research by Mick and Fournier (1998), their study constitutes the basis of this discussion.

In the following, the research results will be discussed and integrated into a broader context. Moreover, the contribution to knowledge will be presented and how the findings obtained can be valuable for different stakeholders in the healthcare industry. Furthermore, limitations of this research, ideas for further research and finally, a conclusion will be presented.
5.1.2 Phase I: Initial motivation

“Measurement is the first step that leads to control and eventually to improvement. If you can't measure something, you can't understand it. If you can’t understand it, you can’t control it. If you can’t control it, you can’t improve it.” (Tzanakakis, K., 2013)

This quotation, originally by H. James Harrington, reflects ancient wisdom in management, which is still applicable today. Moreover, it represents the core concept of mHealth apps, namely self-tracking, which respondents in the research extensively discuss. The first phase of mHealth usage describes consumers’ initial motivation for using mHealth apps. It is shaped by the idea of self-control and regulation, which is a reoccurring theme in the interviews and diary entries. Here, the majority of respondents positively acknowledges the self-tracking and self-control aspects of mHealth apps. In accordance with this, Baumeister et al. (1994) considered external tools for monitoring useful forms of facilitating self-regulation. Moreover, Bandura (1991) and Baumeister et al. (1994) identified self-monitoring as one of the principal subfunctions or main components of self-regulation. Bandura (1982) introduced the concept of self-efficacy, which can be transferred to the domain of mHealth apps, since respondents value aspects, such as monitoring themselves, exerting self-control and improving certain behaviours. Linking to this, Ajzen (1991) stated that self-efficacy was compatible with perceived behavioural control, namely consumers’ beliefs about the ability to influence their performance.

Furthermore, Lupton (2017; 2014a) stated that digital technologies were used by people to receive detailed information about their bodies and other aspects of their life in order to improve themselves. This research detects curiosity about the users’ performance and wanting to understand themselves better, as important drivers of using mHealth apps. Respondents mention seeking help and support from their mHealth apps in order to improve certain aspects of their lives, often by exerting self-control. Especially calorie tracking apps are frequently used to attain distinct goals such as losing a certain amount of weight. This supports Duttweiler (2016) who mentioned that self-tracking allowed behaviour control, behaviour change and also performance improvement. In this context, Lupton (2017) suggested several areas for self-improvement that become obvious in this study’s research as well, such as losing weight, improving sleep or becoming more active.

Moreover, respondents in this research especially value the factual nature and quantifiable information provided by their mHealth apps. This factual information allows making the users’ behaviours and habits salient and is positively acknowledged by respondents. 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.
5.1.3 Phase II: Paradoxes

This Master thesis is the first study to apply the concept of technology paradoxes, introduced by Mick and Fournier (1998) to the modern domain of mHealth apps. The paradoxes, identified by this research, correspond in their core with the paradox definition as “a situation, act, or behaviour that seems to have contradictory or inconsistent qualities.” (Jarvenpaa & Lang, 2005, p. 7). Additionally, this research reveals several paradoxical tensions in the domain of mHealth apps. These are similar to Mick and Fournier’s (1998) findings that paradoxes can cause several negative emotions in the consumer including conflict, ambivalence, stress, frustration and fear. Therefore, this thesis is in line with the statement “users’ experiences with technology are paradoxical.” (Jarvenpaa et al., 2005, p. 7).

Jarvenpaa and Lang (2005) stated that users recognised that digital technology facilitated several aspects of their lives, while their experience was overall shaped by situations of conflict. This is also true for this research as respondents acknowledge both positive and negative aspects of mHealth apps, yet, they often emphasise negative emotions and tensions. While Smith and Lewis (2011) claimed that various concepts, such as dilemmas, can overlap with the paradox idea, the results of this research show that also paradoxes overlap, since they are closely related with each other. Some of the detected paradoxes include subordinated paradoxes and subtopics that make these paradoxes complex constructs.

Whereas the study by Mick & Fournier (1998) described the paradoxes control/chaos and freedom/enslavement as most salient, this research reveals other paradoxes, such as integration/disintegration as more prevalent. Yet, the aspects control and enslavement have significant weight in this study’s findings as well, especially in the paradox self-control/external control. Moreover, Mick and Fournier’s (1998) paradox fulfils creates needs can be linked to the fact that consumers’ curiosity and desires are fulfilled by receiving factual information about their bodies and behaviours. Simultaneously, this information creates the need to adapt or change their behaviour. Nevertheless, there were also paradoxes, identified by Mick and Fournier (1998), which were not salient in this research, such as competence/incompetence. Since respondents of this research are young adults who are knowledgeable of using smartphones and applications, this paradox does not apply for this research. Apart from that, the paradox new/obsolete, identified by Mick and Fournier (1998) is not detected in this research, since mHealth apps are not likely to be outperformed quickly, due to frequently offered updates. Besides, Mick and Fournier’s (1998) paradox assimilation/isolation does not apply to this research as mHealth apps are not perceived as hindering human togetherness. Overall, these deviations in findings can be explained by the different focuses of the studies. While Mick and Fournier (1998) conducted their study twenty years ago with household technologies, mHealth apps are concerned with self-tracking and health. Thus, it is not surprising that findings varied to a certain degree between this research and other studies.
The paradox integration/disintegration is formed through contradicting perceptions of the mHealth app integration into the respondents’ lives. On the one hand, users value the easy integration of their apps, which is facilitated through effortless usage experience. Also, since they almost always carry their phones with them, integration of mHealth apps is facilitated. On the contrary, users point out difficulties of integrating their apps, often due to technical issues and their apps’ time-consuming character. Linking to this, Jarvenpaa and Lang (2005) found in their study, when technology functioned according user’s expectations, they were satisfied. However, non-functioning of their technology lead to feelings of frustration and depression, which was reflected in their paradox illusion/disillusion. Even though Bort-Roig et al. claimed that “smartphone technology can accurately measure a range of behaviors.” (Bort-Roig et al., 2014, p. 685), evidence from this research reveals a different picture. Due to technical problems, such as the app not properly tracking their behaviour, some respondents emphasise difficulties of integrating their respective mHealth app into their lives.

Munene et al. (2002a) found in their study that the experience of certain paradoxes also depended on the technology under investigation. This research reveals that activity apps, such as step counters are often perceived as being easily and intuitively usable. Therefore, they are often integrated into many of the respondents’ lives. Conversely, apps that require more involvement from their users, such as calorie trackers, are often described as time-consuming and are often not completely integrated. In accordance with this, the technology adoption model by Davis (1985) and its components “perceived ease of use” and “perceived usefulness”, are also crucial for the paradox integration/disintegration. This research shows that these aspects also determine whether mHealth apps are fully integrated into the users’ lives or whether integration is hindered. Linking to this, Ryan and Deci (2000) presented in their article about the self-determination theory that contexts, which supported users’ autonomy and competence facilitated integration.

Furthermore, the subordinated paradox effortless/time-consuming identified by this study can be linked to the paradox efficiency/inefficiency found by, among others, Mick and Fournier (1998). These authors described that technology could support less effort and time for certain tasks but could, at the same time, promote the opposite.

Finally, a frequently discussed aspect of mHealth apps, are reminders and notifications, which are perceived as either helpful or stressful. Yet, the majority of respondents in this research are negatively affected by reminders and mention feeling forced, annoyed or stressed. These findings support Bort-Roig et al. (2014), who examined the smartphone as instrument for measuring and influencing physical activity and found several features which hindered engagement, including disruptive notifications and signals.
Self-control/ external control

The paradox self-control/ external control describes respondents using their mHealth apps primarily to control themselves. However, the research also reveals that to some extent users feel influenced and controlled by their apps.

As mentioned in the beginning, self-control is a crucial aspect of mHealth apps, which is highly valued by all of the respondents in this research. Self-control through self-monitoring depicts a main motivation for using mHealth apps. The importance of this paradox’ aspect is pointed out by Baumeister et al. who stated that “self-control is a central function of the self and an important key to success in life.” (Baumeister et al., 2007, p. 351). The self-control aspect of the above mentioned paradox, reflects the voluntary and self-driven facets of self-tracking, which is termed “private self-tracking” (Lupton, 2017, p. 2). Many of the research’s respondents positively highlight aspects about their mHealth apps that can be connected to the idea of the Quantified Self, such as users being able to track and control their past performances or exerting more self-control with the help of their mHealth apps. This is in line with Swan, who argued the body was becoming more “knowable, calculable, administrable object through QS activity” (Swan, 2013, p. 85). Moreover, the paradox’ aspect ‘self-control’ can be linked to the idea of perceived behavioural control since respondents in this research exerted control with the help of their mHealth apps and restricted or supported certain behaviours, such as eating, sleeping or activity patterns (Ajzen, 1991).

Respondents in this research acknowledge the potential of becoming too dependent on the app and developing obsessive behaviours as consequence of excessive self-control. This resembles Ryan and Deci (2000) who pointed out that excessive control can lead to the lack of responsibility and finally trigger distress and even psychopathology. Moreover, next to private self-tracking, exploitation, was a mode identified by Lupton (2014b), which described people’s self-tracking data being reused by others. Even though, Duttweiler (2016) claimed that self-tracking became attractive through allowing self-control through external surveillance, this is contradicted by this research.

Respondents value the private self-control and self-regulation aspects of mHealth app and do not feel comfortable being controlled or judged by the app. Linking to this, users recognise the paradox’ aspect ‘external control’ as they acknowledge feeling judged and controlled by them, as well as pressured to act according to the apps’ requirements. This resembles the paradox freedom/ enslavement (Mick and Fournier, 1998; Munene et al., 2002b), which described that users recognised pressure from the technology and some even revealed being scared they had become slaves to the machine.

One facet of the paradox’ aspect ‘external control’ is the app taking over users’ intuition. Some respondents in this research reveal that they prefer information provided by the app over their own feelings and also depend their feelings and moods on the apps’ output. Linking to this,
Lupton (2014a) stated the belief that data was considered a superior form of knowledge and Swan (2013) argued that data mediated the experience of the reality.

A second facet of the paradox’ aspect 'external control' is the entanglement between the mHealth app and certain activities. In this regard, Munene et al. (2002b) defined enslavement as the situation when users’ activities were restricted by being dependent on the technology. This is apparent at several points in the research, when respondents state that they would not carry out the activity if it were not for their app. Moreover, some respondents reveal feeling frustrated when not taking their phone with them to track an activity. This finding is in line with Lomborg who pointed out a “crisis of disconnection” (Lomborg, 2015, p. 50), when users did not have their smartphone at hand.

**Confirmation/ disconfirmation**

The results of this research indicate that the salient paradox confirmation/ disconfirmation is closely related to the subordinated paradox pride/ guilt. When respondents’ expectations are confirmed or exceeded they feel proud, whereas when they remain below their anticipated performance, users feel guilty or embarrassed.

Respondents in this research yield to confirm their behaviour, feelings or performance through the information provided by their mHealth app. This can be either positive or negative confirmation as users reveal feeling worse on a bad day due to the app’s indication but also feeling good after the app confirmed their expectation. Self-tracking can also be considered an instrument for self-assurance since the user immediately sees his actions and their consequences (Duttweiler, 2016). Moreover, actively seeking confirmation can be linked to the pervasive confirmation bias, where evidence is sought after and interpreted in a way that pre-existing beliefs are verified (Nickerson, 1998).

However, when respondents’ performance is not confirmed, the second aspect of the paradox, namely ‘disconfirmation’, occurs. In this context, Higgins suggested that “different types of self-discrepancies represent different types of negative psychological situations that are associated with different kinds of discomfort” (Higgins, 1987, p. 319). This research reveals that tensions are elicited when the gap between the expected and actual performance is too large and appears unrealistic. Also, expectation versus reality was one antecedent of consumer ambivalence identified by Otnes et al. (1997). When the actual performance is lower than expected, respondents often react with disappointment, frustration and guilt. When it is better than expected, some respondents react with positive surprise and pride. Yet, the majority of users doubts the functioning of their mHealth apps or more frequently their own perception, instead of attributing success to their own efforts. In this context, doubt is a commonly applied coping mechanism, which will be explained later in this chapter.
Individual / community

This paradox describes respondents claiming they want to use the app and its information only for themselves and not share to their data. Conversely, users value the community functions of the app as it allows them to connect with peers and to share information.

This research reveals that most respondents are using their mHealth apps individually, for their own purposes and private reasons. The majority of respondents are not willing to share information with others through their apps. They certainly do not want to share any data from their mHealth apps on social media, especially not negative results or sensitive information. This is a contradiction to current literature, which mostly argues that users indeed value the apps’ sharing functions. While this opinion is reflected by very few users in this research and represents the ‘community’ aspect of this paradox, the aspect ‘individual’ is more salient among respondents.

The community aspect of this paradox is supported by several studies, such as Asimakopolous et al. (2017), who emphasised that the majority of their study’s participants valued the social features of their mobile healthcare wearables. Moreover, social networking was considered a key aspect for the facilitation of physical activity engagement (Bort-Roig et al., 2014). Lupton stated that people who used self-tracking, valued sharing personal data on social media or through apps to find comfort and provide support, which she termed “communal-self-tracking” (Lupton, 2017, p. 2; Lupton, 2014b). Lastly, sharing self-tracking information is said to lead to receiving support, encouragement, and control from the side (Duttweiler, 2016; Paddock, 2013).

As mentioned above, only a few respondents express they value the social functions of their apps. Yet, when some users achieve or exceed their goals they share this information on their own terms with family and friends via messaging services, such as WhatsApp. This, however, does not represent the community aspect of this paradox, as users share information in a rather private manner.

Finally, the paradox individual / community includes the subordinated paradox self-comparison / peer comparison. In accordance with Bort-Roig et al. (2014) who mentioned that competition-based strategies were found to limit user engagement, this research revealed that the majority of respondents is not willing to compare themselves to others. Respondents do, however, highlight that they compare their own results with past performance indicators.
**Motivating/ demotivating**

This paradox is especially relevant for this research as “self-efficacy and motivation are central to user engagement in mHealth” (Asimakopolous et al., 2017, p. 3). Moreover, the paradox motivating/ demotivating resembles the paradox engaging/ disengaging identified by other studies (e.g. Borges & Joia, 2015; Mick and Fournier; Jarvenpaa and Lang, 2005). Technology was described as engaging when consumers could complete activities without difficulty and with a “sense of flow” (Munene et al., 2002b, p. 1742), while it could be disengaging by causing consumer passivity.

The motivating aspect of mHealth apps is positively acknowledged by almost every respondent in the research. In accordance with Asimakopolous et al. (2017), this research presents that motivation is enhanced through personal data-based insights, which mHealth apps offer. These authors also identified data, gamification and content to be relevant areas for the user experience. Linking to this, Whitson (2014) suggested that gamification can be used as a tool for self-improvement and self-mastering. Yet, gamification, namely a gamified app design does not appear intriguing for the majority of users. Instead, seeing their results, the form of graphs and diagrams is considered helpful and motivating. This finding supports Asimakopolous et al. (2017) who detected that the visualisation of goal achievement strongly impacts user motivation.

Bandura (1991) stated when there was noticeable evidence of progress, self-observation improved performance. Self-tracking tools can be motivating by providing numerical performance indicators instantly and are rewarding when one does well and encouraging when performance is lacking (Paddock, 2013). This is also confirmed in the research where respondents are mostly motivated by positive results but negative results sometimes also serve as source of motivation. However, when respondents do not reach their goals or do not conform to the requirements of the app, they often become demotivated.

Moreover, many respondents indicated they set themselves goals in the context of self-tracking. This research shows that in connection with step counters, respondents usually describe their goal as reaching the recommended 10,000 steps, which can be defined as social standard, according to Duttweiler (2016). Standards, or more precisely setting attainable goals to avoid conflict, could increase motivation through goal challenges (Bandura, 1991). Furthermore, respondents of this research express they are motivated to improve their performance by changing their behaviour as in walking more to reach their goals, eat more consciously or to remain in the allowed calorie range. Self-monitoring was described as key factor of behaviour change and smartphone apps were capable of supporting improvement (American Heart Association, 2015). When goals or the acceptable level of performance were not reached the performance was negatively evaluated and the source of dissatisfaction was either eliminated or the user’s performance was improved (Latham & Locke, 1991).
5.1.4 Phase II: Tensions

In this research, tensions emerge in connection with paradoxes. These tensions elicit predominantly negative emotions and often lead to strong consumer reactions.

Privacy concerns

As described in the beginning of this thesis, the mHealth domain is surrounded by privacy concerns, which is confirmed by this research. While some respondents are more concerned than others, it is found that every respondent acknowledges data security issues as risk factors of mHealth apps, especially when data is sensitive. Lupton (2017) pointed out the highly sensitive and revealing nature of data collected by mHealth apps. When consumers perceived risk, particularly with sensitive data, this had a negative impact on their intentions to share personal information (Norberg et al., 2007). In this context, one respondent reflects on a hacking incident to her calorie tracking app, which makes her suspicious about the security of her data.

Moreover, some respondents in this research point out a risk described by Lupton (2017), who claimed that people who refused to track themselves could consequently face negative consequences from health insurance companies. This is supported by Weintraub (2013) who argued that it does not seem dangerous to share information at the moment, whereas this can change in the future and shared information can be used against the individual. In contrast, Duttweiler (2016) highlighted the positive aspect of providing self-tracking data to health insurance companies, thereby allowing control from above and thus, encouraging self-efficacy. Whereas most respondents in this research express they are not willing to share their data with their health insurance company, some argue they would do so in case they would receive benefits, such as reduced costs of their insurance premium. Yet, when the possibility exists that the insurance premium could increase based on the individual performance, all respondents refused to share their data. In this sense, respondents are faced with trading in their privacy in order to receive benefits. While Sutanto et al. (2013) identified a privacy-personalisation paradox in their research about commercial information technology, this current research rather suggests a trade-off and tension between data privacy and personal benefits.

Furthermore, Garcia-Rivadulla (2016) suggested that even though consumers were concerned about their privacy they were willing to trade in their data and privacy for convenience. Following this, Pentina et al. (2016) argued that perceived privacy concerns did not influence the initial adoption or the future use of apps with sensitive and private information. Contrarily, most respondents are not willing or are hesitant to share their personal data with others, especially health insurance companies, and often insist on staying in control when they do share information.
Obsession

The tendency of respondents to develop obsessive behaviour in terms of self-tracking was surprisingly prevalent in this research. Compulsive, dependent and addictive behaviour concerning mobile devices were also identified by other studies (Mazmanian et al., 2013; Roberts et al., 2014). Borges and Joia (2013; 2015) identified the paradox autonomy/ addiction as generating strong ambiguity, as users felt forced to stay connected through their phones.

First of all, respondents in this research describe their own experiences, such as being too focussed on controlling and tracking themselves or developing an unhealthy relationship with their mHealth app. Second, they also recognise the risk for certain groups, such as people who are emotionally unstable or have eating disorders, to be especially vulnerable for developing obsessive behaviours. Vandereycken (2011) mentions in this context the phenomenon “orthorexia”, which represents an unhealthy obsession with healthy eating behaviour and with the individual’s health in general. Obsession can be defined as “unwanted ideas or thoughts that plague an individual” (Baumeister et al., 1994, p. 83). Moreover, compulsive technology use was described as spontaneous interaction with technology which was not intentional, not controllable, did not require effort and was efficient (Clements & Boyle, 2018).

Weintraub (2013) acknowledged the growing obsession with self-improvement over the past decades. Since technology had developed beyond the boundaries of intention, usage behaviours could become automatic and difficult to control. Baumeister and Vonasch (2015) found that self-control can promote addiction while also serve as a remedy. This is in accordance with this research’s findings, since excessive self-control with the help of mHealth apps lead to obsessiveness. This is revealed by a surprisingly high number of respondents as having experienced it themselves or simply being aware of the potential. Yet, self-control also leads to respondents applying coping strategies in order to mitigate obsessive behaviour.

Ambivalence

Respondents in this research describe simultaneously occurring contradictory, positive and negative emotions. Moreover, they emphasise several contrasting aspects of mHealth apps, suggesting that consumers are aware of the ambivalence and ambiguity that surrounds these apps. Psychological ambivalence was defined as the “internal experience of mixed emotions” (Otnes et al., 1997, p. 81). This form of consumer ambivalence is reflected by respondents in this research several times in connection with paradoxes.

In this context, respondents reveal that negative information provided by their mHealth apps, such as notifications about not reaching a goal, is more impactful than their positive counterparts. Also, these negative effects appear to be longer lasting. These findings support Baumeister et al.’s (2001) theory that bad has a stronger impact than good in a wide range of
psychological phenomena, such as cognition, motivation and emotional responses. Moreover, they stated that negative aspects received more attention and also more comprehensive cognitive processing than positive aspects. Marano (2003) explained this as the brain responding with greater sensitivity to unpleasant news and our attitudes being more strongly influenced by negative than positive news.

5.1.5 Phase III: Coping strategies

After adopting their mHealth apps, respondents often develop conflicting attitudes as consequence of paradoxical tensions. This finally leads to users applying coping strategies. Mick and Fournier (1998) suggested that when consumers’ everyday life is negatively influenced by technology, paradoxes appear more salient and consumers often apply coping strategies in order to be relieved of negative emotions. Linking to this, Baumeister et al. (2001) found that the self was more motivated to avoid bad self-definitions than to pursue good ones and that the desire to get out of a bad mood was stronger than getting into a good one. In this context, Yi and Baumgartner (2004) stated that negative emotions aroused in situations with emotional trade-offs lead to several forms of coping mechanisms directed at the problem or the emotion. Also, findings from this research indicate that users apply multiple coping strategies for different paradoxes, situations and types of mHealth apps.

Moreover, paradoxical tensions in this research can be described as cognitive dissonance, which is defined as relations between cognitions that do not fit together. According to Festinger, the “individual strives toward consistency within himself” (Festinger, 1957, p. 1). Since dissonance was uncomfortable, people were motivated to reduce it in order to achieve consonance. Thus, they actively avoided information and circumstances that would increase dissonance and frustration (Festinger, 1957). In this research, reducing cognitive dissonance is carried out through coping strategies.

Coping strategies were discussed by several studies (e.g. Otnes et al., 1997; Mick & Fournier, 1998; Jarvenpaa and Lang, 2005; Yi & Baumgartner, 2004). In this research, these strategies can be described as active or passive. Active strategies require the respondents to take action in order to be relieved from the negative effects, such as discontinuing the use of their mHealth apps. Passive strategies describe strategies where users mostly emotionally distance themselves from the app and its influence on them, such as ignoring. Similar to this, many of the studies mentioned above distinguished coping strategies into avoidance and confrontative strategies, whereas Mick and Fournier (1998) further differentiated the stages pre-acquisition and consumption. In this research however, only the stage of consumption is investigated since respondents already adopted their mHealth apps. While former studies described avoidance
strategies as less effective, Mick and Fournier (1998) argued the converse. They claimed that avoidance strategies, namely ignoring, distancing and discontinuing, were not inferior to confrontative strategies in decreasing stress and conflict. They even described avoidance strategies as creating “air of superiority (human over machine)” (Mick & Fournier, 1998, p. 141). This research supports Mick and Fournier (1998) and observes avoidance strategies as frequently and effectively applied by respondents.

Finally, Mick and Fournier (1998) focused in their study on behavioural coping mechanisms and did not examine psychological coping mechanisms, as they claimed these were less traceable in the interview data. Nevertheless, this research identifies several psychological coping mechanisms, such as emotionally distancing, denial, doubt and mentally abandoning.

**Discontinuing**

Discontinuing is the most frequently applied and at the same time the most radical coping strategy. This research proposes that discountenance of an app is classified as active mechanism since consumers actively delete the app or turn off functions that elicit negative emotions. Linking to this, Ribak and Rosenthal (2014) described turning off from a routine a conscious effort and a personal statement. Yet, Mick and Fournier (1998) categorised discontinuing a technological possession as consumption avoidance strategy, which was still considered successful and important.

Moreover, Munene et al. (2002b) stated that attitudes towards technology, developed after adoption, influenced the user’s decision whether to continue using technology in the future. When respondents experience demotivation, difficulties with integrating their apps or when signs of obsession occur, users decide to take counter action by deleting the respective apps or some of their functions. Many respondents turn off reminders since they are often perceived as disturbing or stressful. This is in line with findings from the Deloitte survey (2017) which explained that users who wanted to control their smartphone usage removed temptation by, among others, turning off their phone or notifications and deleting apps. Moreover, respondents express they would discontinue their apps for financial and data security reasons as well as when the app became too time consuming or exerted too much influence over them. Often users delete their apps quite soon after adoption when they feel these apps do not provide added value. Thus, integration and accommodation often do not take place.
**Adjusting**

Adjusting was a less drastic but also rather active coping strategy applied by respondents. The research reveals that users adapt their behaviour to the requirements of the app in order to relieve tensions. This can lead to users becoming more conscious about themselves, their habits and behaviours. Thus, they often adjust their eating or sleeping routines or increase their activity to the perceived requirements of their respective apps. Linking to this, Mick and Fournier (1998) termed this coping strategy ‘accommodation’, where consumers changed preferences and routines according to the perceived demands of their technological products. This coping mechanism is especially prevalent for activity apps, as respondents reveal to exercise in order to satisfy their app.

**Assuming responsibility**

This research’s findings reveal that respondents often try to remain in control and assume responsibility for their behaviour and achievements. Linking to this, Albrecht (2016) wrote that control and autonomy were important issues in the domain of mHealth apps and Lupton (2017) emphasised the importance of self-responsibility and self-management in self-tracking. Some respondents mention that the responsibility for themselves should not be handed over to an app, which is in line with Norman arguing “it is our responsibility to use technology responsibly.” (Norman, 2013, p. 103).

Furthermore, respondents often restrict the apps’ sharing functions. They stay in control by sharing information, such as achievements, only with selected people, on their own terms via messaging services, such as WhatsApp. The coping strategy ‘assuming responsibility’ is particularly applied in connection with privacy concerns. This supports Ketelaar & van Balen (2018) who stated that, since people were overall concerned about their privacy, it was important that they could control which information was shared and which is kept private.

**Emotionally distancing**

Distancing was identified by Mick and Fournier (1998) as consumption avoidance strategy, where consumers applied restrictive rules for technology usage. In accordance with this, this research identifies emotionally distancing as frequently applied coping strategy, since respondents often indicate they consciously keep distance to the app. The majority of respondents state they are not willing to download a premium version in order to only have access to a limited amount of functions. Thereby, they distance themselves from too many usage options by not allowing the apps too much influence.
Ignoring

The research results reveal that ignoring is a coping strategies with several facets. Overall, it can be described as respondents avoiding information from the app or the app itself. This coping strategy was also acknowledged by Mick and Fournier (1998) and classified as pre-acquisition avoidance strategy.

A facet of this coping strategy is denying, where users deny certain aspects that have the potential to negatively affect them, such as the seriousness of data privacy issues and the possible consequences arising through them. Moreover, doubt is another facet of this coping strategy, which is especially salient in connection with the paradox confirmation/ disconfirmation. The findings of this research surprisingly reveal that the reversed form of the self-serving bias frequently occurs in situations of disconfirmation. The self-serving bias implies that users attribute success internally to their own efforts and failure to external factors (Duval & Silvia, 2002). When respondents’ expectations are disconfirmed, in being better than expected, users express positive surprise or doubt the app’s functioning and the realistic representation of results. Even more, they doubt themselves and their own perception. Thus, this exhibited behaviour represents the opposite of the self-serving bias, since respondents appear to attribute failure internally but often do not take credit for their achievements and rather doubt them.

One particularity about the coping strategy ignoring is that some respondents are dishonest about their eating behaviour and do not record everything they eat, in order to avoid negative feedback from the app. Whitson (2014) described that cheating was a form of self-defeating behaviour, as gamified systems did require that users complied with the rules.

Furthermore, a form of “self-defeating behavior” (Tice et al., 2001, p. 65) is revealed with the coping mechanism ‘mentally abandoning’. Baumeister et al. even termed this failure in self-regulation a “pervasive source of human unhappiness” (Baumeister et al., 1994, p. 263). However, ‘mentally abandoning’ was a quite frequently used coping mechanism in this research and did not appear more severe than the other coping strategies.

Mentally abandoning implies that a goal and thereby the requirements of the app are temporarily ignored, in order to be relieved from stress and tensions. This is often applied when respondents do not achieve their performance goal or after realising that the goal is not realistically attainable. This supports Bandura (1982; 1991) who stated that negative discrepancies or a sense of low personal efficacy could cause apathy in the consumer. Besides, when consumers were upset and emotionally distressed, they followed spontaneous impulses in order to feel better, thereby giving priority to short-term affect regulation, since people strived to immediately feel better (Tice et al., 2001; Baumeister et al., 2001). Linking to this, giving up, putting less effort into something and quitting prematurely is said to be the most familiar self-regulation failure, which hindered performance (Baumeister et al., 1994; Frankel and Snyder, 1978).
The coping mechanism ‘mentally abandoning’ can also be explained by the learned helplessness theory. Here, a person believes that “outcomes are uncontrollable by his responses and is seriously debilitated by this knowledge.” (Maier & Seligman, 1978, p. 4). When respondents assume they are not able to improve their performance, they often temporarily give up on their desires and goals and ignore the app’s requirements. In contrast, Frankel and Snyder (1978) challenge the learned helplessness theory. Rather they propose a form of self-handicapping, which attributes positive outcomes to the individual and denies blame for negative ones, in order to protect the user’s self-esteem. However, the findings of this research are rather in favour of the learned helplessness theory, since respondents mention feelings of not being in control of the outcome and not being able to change certain situations.

5.1.6 Chances and risks of mHealth apps

During the research, respondents frequently discuss both, chances and risks, surrounding mHealth apps. Thereby they recognise the ambiguity surrounding this domain and the fine line that distinguishes the positive and negative aspects of mHealth apps.

Respondents acknowledge the increasing importance and popularity of mHealth apps and highlight their motivating factors. Moreover, they state these apps have the potential to improve society’s well-being. This view supports Lupton (2017) and Shull et al. (2014) who stated that self-tracking and the Quantified Self movement could promote health and well-being and therefore, benefit society. In accordance with this, Bort-Roig et al. (2014) highlighted the growing acceptance and accessibility of smartphone technology as measurement tool for physical activity. Additionally, Sharon (2017) depicted a positive future were self-tracking devices encouraged individual’s involvement in their health.

Despite the positive aspects of mHealth apps, their negative characteristics are emphasised by the majority of respondents. Users point out negative consequences for society and the individual, such as obsessive behaviour, data security risks and potential exploitation through health insurance companies. As mentioned before, the potential for developing compulsive behaviour is specifically discussed in the research and also acknowledged by several studies (e.g. Mazmanian et al., 2013; Baumeister & Vonasch, 2005; Roberts, 2014).

Moreover, Lupton (2014a; 2017) pointed out the risk that self-tracking information, originally meant for private purposes, could be exploited for commercial, economic and social reasons, which could lead to negative consequences for the consumer, such as paying higher insurance premiums. This fear is also pointed out by few respondents in the research.

Finally, in diffusion research, the pro-innovation bias implies that an innovation should be adopted by the whole society, rapidly and without modifications (Rogers, 1995). Königstorfer
(2008) uses the terms pro-innovation bias and positivity bias synonymously. In their study, Mick and Fournier (1998) contradicted the positivity bias, which implied that new technology is always beneficial. The results of this thesis show several paradoxical tensions within the novel domain of mHealth apps, which often cause negative consequences for the consumer. Thus, the pro-innovation or positivity bias is challenged by this research as well.

5.2 Contribution to knowledge

From a research standpoint this thesis contributes to knowledge through various aspects. Due to the novelty of mHealth apps, there is only little academic literature and research concerning this domain. However, Bort-Roig et al. (2014) found an increase of studies about the smartphone as a tool for physical activity measurement, to which this present study contributes as well. Moreover, through qualitative research in form of a diary study, the Sentence Completion Method and interviews, valuable, in-depth insights in consumer behaviour after technology adoption were gained. Moreover, this thesis applies the technology paradox concept, introduced by Mick and Fournier (1998), to the novel domain of mHealth apps. Thereby it fills a gap in academic literature, expands theory and raises questions for further research.

In their study from 1998, Mick and Fournier mentioned several questions that emerged in connection with the paradox concept, such as whether the paradox concept could be used to expand and develop new theories. Also, they raised questions about predominant paradoxes in certain domains, to what extent they were recognised and how consumers managed them. These questions are answered by this research for the domain of mHealth apps, since predominant paradoxes, tensions and coping strategies are identified. Regarding existing studies about paradoxes of technology (e.g. Mick & Fournier, 1998; Jarvenpaa & Lang; 2005; Borges, 2015), this study detects paradoxes and tensions that are similar to former findings, such as efficiency/inefficiency. On the other hand, it presents additional paradoxes, which were not identified by other studies, such as confirmation/disconfirmation. Moreover, this research confirms Jarvenpaa and Lang, who claim that “technology paradoxes are an intrinsic part of the user experience.” (Jarvenpaa & Lang, 2005 p. 21) and thereby highlights the importance of this topic.

Besides, little attention has been paid to consumer behaviour and experience after technology was adopted, since the focus was usually on behaviour prior to adoption (Munene et al. 2002b; Gill & Saad, 2010). This research contributes to theory by mostly focusing on consumer behaviour after technology adoption, while at the same time also illuminating the reasons for initially adopting mHealth apps. Sharon (2016) suggested that empirical research should study consumers who stopped using self-tracking devices. This is realised by this research which identifies discontinuing as the most prevalent and radical coping strategy. Further, the causes for
terminating the use of mHealth apps or their functions are explored, as well as reasons why users would potentially discontinue the use of their apps. The research results confirm the theory by Baumeister et al. (2001) that bad incidents have a stronger and longer lasting impacts than their positive counterparts. Moreover, this thesis connects Baumeister et al.’s (2001) theory to coping mechanisms that consumers apply in order to be relieved from negative moods or tensions.

Coping strategies, such as ignore and distancing, suggested by Mick and Fournier (1998) were confirmed by this research for the domain of mHealth apps. Whereas, these authors only focused on behavioural coping strategies, this present research also detects psychological coping strategies, such as doubting and denying. Thereby, it expands the knowledge about consumer coping mechanisms. Besides, this research reveals particularities in connection with the coping mechanism ‘doubting’ where the reverse form of the self-serving bias is found in users’ reactions.

Furthermore, a relevant finding is the coping mechanism ‘mentally abandoning’, where consumers temporarily give up self-regulation and give in to short-term indulging behaviour, in order to be relieved of emotional distress. This finding contributes to the knowledge on self-defeating behaviour, self-control and self-regulation (Baumeister et al., 1994; Tice et al., 2001). Moreover, the learned helplessness theory, described by Maier and Seligman (1978) is applied to explain this coping mechanism.

It is further discovered, that users are faced with severe consequences of self-tracking and self-control, such as obsessive and compulsive behaviour and are significantly affected by it. In addition to this, this research points out several negative aspects that could potentially harm the diffusion of mHealth apps, such as data security issues. Thus, this study extends the knowledge on consumers’ perceptions of data privacy. It shows that users assume responsibility about their own behaviour and want to stay in control.

In accordance with Mick and Fournier (1998), this research challenges the positivity or pro-innovation bias, namely that new technology is always beneficial. By describing negative effects on the consumer as a consequence of paradoxical tensions, this study also sheds light on the negative aspects of the innovative technological domain of mHealth apps. Finally, it is shown that the concept of paradox, which is not novel, is still applicable today and appears to be highly relevant for modern technology research.
5.3 Practical implications

The research’s results reveal several paradoxical tensions and contradicting emotions, which have the potential to harm the consumers’ experience with mHealth apps. It is important for companies that develop mHealth apps to be aware of the ambivalent emotions and perceptions consumers hold, in order to provide the best possible product. To gain a deeper understanding in consumers’ behaviour and mind-sets, companies could implement an algorithm, which tracks users’ habits and preferences. This algorithm could be based on parameters, such as the consumers’ usage frequency and intensity, which can be consequently applied to divide users into groups in order to target them differently.

Since data security concerns are considered a crucial factor for the diffusion of mHealth apps, it is advisable for companies to understand the causes of users’ privacy concerns (Singh et al., 2016). Moreover, companies should react to these concerns and risk perceptions in order to regain their trust and lower their perceived risks (Norberg et al., 2007). This can be achieved through the implementation of more transparency, for instance in the design of privacy policy guidelines and phrasing them in an understandable language. The need for transparency is supported by the recently introduced General Data Protection Regulation. This regulation includes the requirement for companies and institutions to request consumers’ consent. Besides, users’ rights are strengthened by granting them information about the processing of their personal data (European Commission, 2018).

Furthermore, this research reveals that respondents apply the coping strategy ‘assuming responsibility’ in situations where they do not feel in control, especially in relation to their data privacy. Therefore, it is advisable that mHealth apps contain a distinct section for privacy settings, where consumers have all information, such as the policy guidelines, at one glance. Moreover, this section should offer options for consumers to turn off certain functions, which, for instance, allow providing their data to third parties. Thereby the users are given the feeling of control. When the app contains sensitive consumer information it is often valuable if password protection is provided in order to lower the users’ perceived risk.

Not only in connection with data privacy it is highly relevant for mHealth app providers to respect users’ boundaries and give them feelings of autonomy and control. Since many respondents mention they do not want to share any information on social media and most of them do not want to share data through the app, companies should consider these consumer preferences. Hence, they should enable users to log in to their app only with their e-mail addresses, without having to connect their mHealth apps to social media profiles. As many respondents mention they use their self-tracking apps only for themselves, mHealth app developers should turn off community or sharing functions in the default settings of the app. This offers the advantage of users having to actively turn on these functions and thereby having the feeling of control and
autonomy. Moreover, the research results reveal that apart from data security issues, financial reasons and difficulties of integrating the apps into users’ everyday lives are potential reasons why users would discontinue their mHealth apps. Besides, the results show that users are often not willing to upgrade to a premium version. Thus, mHealth app providers should ensure that the app’s basic functions are kept free of charge, while providing the same level of quality to avoid that users discontinue their apps or switch to competitors. Besides, if fee-based functions are introduced, their advertisement should highlight the options, which provide added value and facilitate the users’ lives.

Furthermore, app developers should consider the perceived difficulties and the usefulness of mHealth apps (Herrmann & Kim, 2017). As the research results indicate, problems with disintegrating the app into users’ lives, due to technical difficulties, are crucial threats to a long-term use of an mHealth app. Therefore, app developers should concentrate on offering an excellent user experience by providing an accurately functioning app for different operating systems such as iOS and Android. This can be achieved by carefully designing the app and conducting pre-tests prior to the launch to gain realistic consumer insights. Before launching the app, this could be carried out through usability tests, which could take place in a field environment to investigate user behaviour in a natural setting. When only minor updates or adaptions are tested, user interface testing of mHealth apps should be conducted in a laboratory setting (Kaikkonen et al., 2005). After the app’s official launch, updates should be offered regularly. Moreover, an important motivating factor, which was often mentioned by respondents is the visualisation of results. Thus, mHealth app developers should study and understand the design preferences of their target group and design the app and its features accordingly.

Also, respondents sometimes describe notifications and push messages as helpful, while the majority describes them as stressful, annoying or disturbing. Hence, they are often turned off or the app is eventually deleted altogether. In this context, the above mentioned algorithm could provide insights into consumers’ attitudes and behaviours toward these notifications. For instance, the algorithm could consider how often users click on the reminders, which topics are most intriguing and whether users follow the notification’s request. Nevertheless, to support users’ autonomy, they should be given an option in the beginning to activate the reminders and specify the frequency and occasions when they appear, instead of only being offered the options ‘subscribing’ or ‘unsubscribing’. Apart from that, the research supports Baumeister et al.’s (2001) theory that bad incidents have a stronger impact than their positive counterparts, which could lead to users discontinuing their apps. Therefore, mHealth app providers should concentrate on positive reinforcement of consumers’ behaviour. This can be realised by highlighting users’ achievements through personalised notifications and thereby additionally support user motivation.

Another significant reason to consider, which can harm integration, is when apps appear too complicated and time-consuming to use. Respondents value the effortless application of many
activity trackers, such as step counters as they are intuitively used. Contrarily, users of calorie trackers often complain about the complicatedness, as respondents criticise the time-consuming aspect of searching for meals. Thus, developers of these apps should aim to simplify and improve the usage experience and provide automated features, such as the app recommending typical ingredients. For instance, users could indicate that they ate the same breakfast every day and based on this, the app would already include the same meal automatically every morning.

Furthermore, health insurance companies should also respect consumers’ privacy concerns as well as their needs for autonomy and control. Some respondents state they are willing to share their information from their mHealth apps with their insurance company if it would have beneficial consequences. For these users, insurance companies can design bonus programs and loyalty programs, which link the consumers’ self-tracking data to distinct benefits. Moreover, the success of these programs depends on the users’ revealing sensitive information about their behaviours and health situation. Therefore, it is important that the whole process is transparently designed and that the user is informed, which data is required of him for which purposes. Yet, since the majority of respondents are not willing to share their sensitive data with insurance companies, these programs should be offered only on a voluntary basis. Moreover, as the digitalisation also significantly affects the healthcare industry, insurance companies should consider how they can transform and digitalise their business models. Thus, health insurance companies should offer their own apps, through which consumers can participate in bonus programs and store data about medical issues, such as vaccinations, upcoming doctors’ visits and medications. Besides, these apps can also enable connectivity in a sense, that consumers can synchronise them with their mHealth apps on a voluntary basis. For healthcare professionals, such as doctors, it is important to understand how they can most efficiently use the self-tracking data provided by their patients.

For public policy makers it is important to consider both, opportunities and risks of mHealth apps, and to understand their trade-offs. Moreover, they are advised to keep consumers’ concerns in mind, especially regarding data security issues and act upon them. In this context, Albrecht (2016) proposed the application of quality standards and stricter regulations for the incorrect use of apps. This could be implemented through the use of certifications or quality labels for mHealth apps that were reviewed and approved, for instance by the German Medical Association or the Federal Ministry of Health. Overall, due to the rapid developments, the sensitivity of health data and the high complexity of the mHealth app market, it needs a supervisory authority that keeps consumers’ interests in mind.
5.4 Research ethics and limitations

Concerning the research ethics, it is emphasised that the respondents voluntarily took part in the research. Before the interviews were recorded a declaration of consent of the respondents was obtained to ensure they agreed with the use of their given statements. To guarantee anonymity the respondents’ real names were not used within this research and therefore replaced by pseudonyms. Moreover, for confidentiality reasons, data derived from the interviews was only used for the purpose of this thesis and was not shared with third parties.

Although the research achieved its aims and generated relevant results, certain limitations were unavoidable. It has to be mentioned that this research is not representative in the statistical sense since the sample for the qualitative interviews included thirteen respondents. The sample of the diary study contained only five people, who conducted entries over the course of two weeks. This is not enough to capture all the facets and particularities that arise in connection with mHealth apps. Furthermore, as the sample was a convenience sample it solely represented people with certain demographic and socio-economic characteristics. Also, in regard to gender the sample was not balanced, since ten women and only three men were interviewed. Their age range was between 21 and 29 and respondents were German native speakers with an academic education. Because the study was conducted with German respondents only, these findings cannot be simply transferred to other cultures and ethnicities. Also, since only one age group was examined, distinct research results might be not applicable to other age categories. Moreover, the group of respondents can be described as belonging to the generation of digital natives and it can be assumed that they had a fundamental understanding of smart devices. Thus, this research is based on people, which are capable and knowledgeable of using digital technologies and the results might not be applicable to people who are lacking these skills. Besides, the research does not differentiate between people of different adopter groups that might exhibit different characteristics (Rogers, 1995).

In accordance with Yi and Baumgartner (2004), this research faces similar limitations as the interviews are based on respondents recalling past emotions and experiences. Therefore, these reconstructions of past events might not reflect the actual incidents. Nevertheless, through the diary entries this study aimed to balance out this disadvantage by collecting real-time data about the respondents’ experiences. Since the pre-test as well as the interviews were carried out by the author, a certain amount of subjectivity could not be eliminated. Moreover, semi-structured interviews allow the interviewer a certain amount of freedom in formulation and questions, therefore, the interviews were not completely congruent and varied slightly in thematic focus. Regarding the apps investigated in this research, it has to be noted that only a small set of available mHealth apps are discussed in this thesis. Apps that aim at specific medical purposes, are not discussed in this research.
5.5 Future research

Due to the exploratory nature of this research, a qualitative approach was applied. Even though this type of research and the results are suitable for this thesis’ purpose, future research should extend the findings and confirm them for different age groups and cultures. Particularly, since academic research on mHealth apps is scarce, the research results have to be validated through quantitative research and further empirical studies.

This study’s aim was merely explorative by identifying paradoxical tensions in the domain of mHealth apps and the way in which they affect the consumer. Thus, it is valuable if further research would study the most prevalent paradoxes more in-depth, in which situations they arise and which coping strategies are most successful for distinct paradoxes. Besides, it should be studied which types of apps elicit certain paradoxical tensions.

Moreover, since this study only examines people who already adopted their mHealth apps and therefore have some experience with them, future research could investigate users who only recently adopted these apps. Here, the adopter categories introduced by Rogers (1995) can be used as foundation. Besides, an avenue for further research could be the characteristics of users who adopt mHealth apps as well as differences in their user behaviour and intensity of usage. Since only respondents’ motivation to use mHealth apps was examined, further research should explore the barriers of adopting these apps. Furthermore, since respondents often early on discontinued the use of their mHealth apps, future research can assess how these apps have to be designed to be fully integrated into users’ lives and which factors support long-term use. The research shows that aspects of gamification in the design of mHealth apps are differently perceived among users, slightly indicating, that this aspect was more important for male respondents. Hence, it could be explored which design features are appealing for which types of users.

Additionally, this research reveals obsessive tendencies of respondents regarding self-control. An interesting approach could be the investigation of the types of users are particularly vulnerable for developing compulsive behaviour, including studying the characteristics of individuals. Moreover, it could be explored which kind of apps and functions encourage unhealthy behaviour and how developing obsessive behaviours could be prevented. Another considerable aspect for further research are privacy concerns or more precisely analysing which types of users are more worried and suspicious about data security.

As only a small set of mHealth apps are studied, it would be interesting to examine if the results could also be transferred to other apps. This is especially interesting for those apps applied for medical purposes, such as being used by chronic patients. Finally, further research should explore the roles of different stakeholders, such as public policy makers and healthcare institutions and how they can support a positive, consumer-centric development of mHealth apps.
6. Conclusion

This Master thesis explores consumer behaviour after technology adoption. It contributes to science by applying and expanding the concept of technology paradoxes to the innovative domain of mHealth apps. Qualitative research was applied in order to explore the paradoxical tensions that arise in the domain of mHealth apps and how they affect the consumer. The findings demonstrate that mHealth app usage can be distinguished into three broad phases including consumers’ initial motivation for using the apps, paradoxes and tensions that emerge as well as coping strategies.

In the research, five primary paradoxes are found, namely Integration/Disintegration, Self-control/External control, Confirmation/Disconfirmation, Individual/Community and Motivating/Demotivating. These paradoxes trigger both positive and negative emotions thereby creating tensions, such as feelings of frustration and conflict. The most prevalent tensions include Privacy concerns, Obsession and Ambivalence. In order to diminish the negative emotions arising from the paradoxical tensions, users apply coping strategies. Five substantial strategies are detected, namely Discontinuing, Adjusting, Assuming responsibility, Emotionally distancing and Ignoring. Besides, respondents point out the potential of mHealth apps to benefit individuals and society through the motivational and self-regulating aspects of the app. Yet, users also highlight potential risks that surround mHealth apps, such as data security issues and obsessive behaviour as a consequence of self-control.

In conclusion, mHealth apps can positively affect consumers by improving aspects of their lives, facilitate motivation and self-regulation and support consumer well-being. At the same time, these apps can negatively affect users, promote unhealthy behaviour and can threaten well-being. Due to potential chances, risks and rapid developments in the domain of mHealth apps, the future of mHealth apps is uncertain. It is determined by several actors, such as app developers, health insurance companies, public policy makers and, most importantly, consumers. Thus, whether mHealth apps will be considered a blessing or curse in the future, depends on which sides of the identified paradoxes are strengthened and how potential risks are handled.
References

Literature


Articles


Herrmann, L. K., & Kim, J. (2017). The fitness of apps: a theory-based examination of mobile fitness app usage over 5 months. *mHealth, 1*–9 https://doi.org/10.21037/mhealth.2017.01.03.


Online sources


Appendices

Appendix A: Diary study

Diary study: 4. April - 18. April 2018

Dear participant,

this Master thesis research is about Mobile Health applications (mHealth apps) that are used on smartphones for self-tracking purposes. The domain of mHealth apps includes, among others, apps for tracking your activity, sleep or calorie intake.

In the following two weeks, please conduct diary entries about your experiences with your mHealth app(s). Ideally, two diary entries per day, one in the mid-morning around lunch time and one in the evening. When writing your answers, please only consider apps that belong in the domain of mHealth. Your answers can be written either in German or English. If you have not used an app during a certain day, just indicate this in the questionnaire.

Your answers will be treated confidentially and your name will not be visible to ensure anonymity.

Thank you for participating in this study and supporting my Master thesis!

2 Interview transcripts, diary entries and audio files are available upon request.
<table>
<thead>
<tr>
<th>Day 1</th>
<th>mid-morning</th>
<th>afternoon</th>
</tr>
</thead>
<tbody>
<tr>
<td>With which mHealth app(s) did you have contact today?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Were there any particularities (e.g. notifications)?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>If yes, what kind?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>For what reasons did you engage with the app(s)?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>How did you feel after engaging with the app(s)?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>If there were particularities, how did they make you feel?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix B: English Interview Guide

Master Thesis - Interview (ENG)

This interview is about your experience with mobile Health applications (mHealth apps). These apps are used on a smartphone for self-tracking purposes and can include, among others, apps for tracking fitness, calorie intake or sleep.

When answering the interview questions, please keep in mind that there are no wrong or right answers. Also, please only refer in your answers to apps that fall into the category of ‘mHealth’.

First, you will be given two sentence beginnings to complete, ideally spontaneously with the first thoughts that comes to your mind.

Afterwards, the interview will be conducted which takes around 20 minutes.

Your answers will be treated confidentially and your name will not be visible to ensure anonymity. The data will only be used for scientific reasons in this Master thesis!

Sentence Completion Method

1. Digital technology …

2. The mHealth app(s) that I am using …
<table>
<thead>
<tr>
<th>Introduction</th>
<th>Motivation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Which mHealth app(s) are you using at the moment?</td>
<td>Regarding the current app(s), why did you start using it/them?</td>
</tr>
<tr>
<td></td>
<td>For which purposes do you use your current app(s)?</td>
</tr>
<tr>
<td>Do you use a premium version or a fee-based app?</td>
<td>Do you know how to properly use the app and its functions?</td>
</tr>
<tr>
<td></td>
<td>Are that there are functions available in your app you are not using?</td>
</tr>
<tr>
<td></td>
<td>Why?</td>
</tr>
<tr>
<td>Have you used other mHealth app(s) prior to your current app(s)?</td>
<td>Have you ever done something differently (e.g. changed your behaviour or routines) after using the app(s)?</td>
</tr>
<tr>
<td></td>
<td>Is the app easily integrated in your everyday life?</td>
</tr>
<tr>
<td></td>
<td>Does the app help you to control and optimize yourself?</td>
</tr>
<tr>
<td></td>
<td>Does a graphical presentation of your results (e.g. levels) motivate you?</td>
</tr>
</tbody>
</table>

- How long have you been using it/them?
- On average, how often per week do you engage with your app?
- Yes: Why?
- No: Have you considered upgrading?
- Do you own any other smart device for self tracking? (e.g. smart watch, fitness-wristband)
- Why did you stop using them?
<table>
<thead>
<tr>
<th>Impact</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>How do you usually feel after using your app(s)?</strong></td>
<td></td>
</tr>
<tr>
<td>From your point of view, what are positive aspects of the app(s)?</td>
<td></td>
</tr>
<tr>
<td>In which moments do you feel positively affected by the app(s)?</td>
<td>Do you remember a certain time or incident?</td>
</tr>
<tr>
<td>From your point of view, what are negative aspects of the app(s)?</td>
<td></td>
</tr>
</tbody>
</table>
| In which moments do you feel negatively affected by the app(s)? | Do you remember a certain time or incident?  
How do you deal with the negative aspects? |
| **Special occasions** |  |
| Do you remember any particularities that occurred related to your app(s)? | How did it make you feel?  
Does your app contact you, outside of you using the app? (e.g. through automatic push messages) |
<p>| Do you set goals in your app? | How does reaching them or not reaching them make you feel? |
| What do you do with your data in the app? | Do you examine, compare or interact with it in some ways? |</p>
<table>
<thead>
<tr>
<th><strong>(Privacy) concerns</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>When would you stop using the app(s)?</td>
<td>What has to happen for you to stop?</td>
</tr>
<tr>
<td>Would you share the data from your app with others?</td>
<td>Friends and Family? Health insurance company? Companies?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Conclusion</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Would you recommend the app(s) you currently use to other people?</td>
<td>Why? Why not?</td>
</tr>
<tr>
<td>When you think about the app(s) you currently use, do you plan on using them further in the future?</td>
<td>Would you use other, additional mHealth apps? Why? Why not?</td>
</tr>
<tr>
<td>Looking into the future, do you think that mHealth apps will grow in popularity?</td>
<td>Why?</td>
</tr>
<tr>
<td></td>
<td>Is there anything you like to add?</td>
</tr>
</tbody>
</table>
Appendix C: German Interview Guide

Master Thesis - Interview (GER)

In diesem Interview geht es um deine Erfahrungen mit mobile Health applications (kurz: mHealth apps, auf deutsch: mobile Gesundheits-Apps). Diese Apps werden auf dem Smartphone für self-tracking Zwecke genutzt und umfassen, unter anderem, Apps, die Fitness, Kalorien oder Schlaf tracken.

Beim Beantworten der Interviewfragen gibt es keine richtigen oder falschen Antworten. Bitte beziehe deine Antworten nur auf Apps, die in die Kategorie “mHealth” passen.

Als Erstes werden dir zwei Satzanfänge vorgegeben, die du bitte ergänzen sollst. Idealerweise tust du das ganz spontan mit den ersten Gedanken, die Dir in den Sinn kommen.

Im Anschluss erfolgt das Interview, das ungefähr 20 Minuten dauern wird.

Deine Antworten werden anonym und vertraulich behandelt und können nicht mit deiner Person in Verbindung gebracht werden. Die Daten werden ausschließlich für den wissenschaftlichen Zweck dieser Masterarbeit verwendet!

Sentence Completion Methode

1. Digitale Technologie …

2. Die mHealth app(s), die ich nutze …
<table>
<thead>
<tr>
<th><strong>Einführung</strong></th>
<th></th>
</tr>
</thead>
</table>
| Welche mHealth app(s) benutzt du im Moment? | Wie lange nutzt du sie bereits?  
Wie oft in der Woche hast du im Durschnitt Kontakt mit der App? |
| Nutzt du eine Premium-Version oder kostenpflichtige App? | Ja: Warum?  
Nein: Hast Du schon einmal über ein Upgrade nachgedacht? |
| Besitzt du weitere Geräte, die Self-Tracking Informationen erfassen? (z.B. Smartwatch, Fitness-Armband) |  |
| Hast du vor deiner jetzigen App schon andere mHealth apps genutzt? | Warum hast Du aufgehört diese zu nutzen? |

<table>
<thead>
<tr>
<th><strong>Motivation</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Warum hast du angefangen deine jetzige App(s) zu nutzen?</td>
<td></td>
</tr>
<tr>
<td>Für welche Zwecke nutzt du deine App(s)?</td>
<td></td>
</tr>
<tr>
<td>Weißt du wie man die App und ihre Funktionen korrekt nutzt?</td>
<td></td>
</tr>
<tr>
<td>Gibt es Funktionen der App die du nicht nicht nutzt? Warum?</td>
<td></td>
</tr>
</tbody>
</table>
| Hast du schon einmal etwas anders gemacht (z.B. dein Verhalten geändert) nachdem du deine App(s) verwendet hast? | Inwiefern?  
Lässt sich die App einfach in deinen Alltag integrieren? |
| Hilft dir die App dich selbst zu kontrollieren und zu optimieren? | Inwiefern?  
Motiviert dich eine grafische Darstellung deiner Ergebnisse (z.B. Levels)? |
### Einfluss

<table>
<thead>
<tr>
<th>Wie fühlst du dich normalweise während und nachdem du die App(s) genutzt hast?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Was sind aus deiner Sicht positive Aspekte der App(s)?</td>
</tr>
<tr>
<td>In welchen Momenten hast du das Gefühl, dass dich die App positiv beeinflusst? Kannst du dich an einen konkreten Moment erinnern?</td>
</tr>
<tr>
<td>Was sind aus deiner Sicht negative Aspekte der App(s)?</td>
</tr>
<tr>
<td>In welchen Momenten hast du das Gefühl, dass dich die App negativ beeinflusst? Kannst du dich an einen konkreten Moment erinnern? Wie gehst du mit den negativen Aspekten um?</td>
</tr>
</tbody>
</table>

### Besondere Vorkommnisse

<table>
<thead>
<tr>
<th>Erinnerst du dich an Besonderheiten, die innerhalb der App(s) aufgetreten sind? Wer hast du dich dabei gefühlt? Kontaktierst dich die App außerhalb deiner Nutzung (z.B. durch automatische Push Nachrichten)?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Setzt du dir in deiner App Ziele? Wie fühlst du dich beim Erreichen oder Verpassen eines Ziels?</td>
</tr>
<tr>
<td>Was tust du mit den Daten in deiner App? Betrachtest, vergleichst oder interagierst du mit den Daten auf irgendeine Art?</td>
</tr>
<tr>
<td>(Privatsphäre) Bedenken</td>
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<tr>
<td><strong>Wann würdest du die App nicht mehr nutzen?</strong></td>
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<tr>
<td><strong>Hast du Bedenken bezüglich der Daten, die du in die App eingibst?</strong></td>
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<td></td>
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<tr>
<td><strong>Würdest du die Daten aus deiner App mit Anderen teilen?</strong></td>
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<tr>
<td><strong>Schluss</strong></td>
</tr>
<tr>
<td><strong>Würdest du die App(s), die du derzeitig nutzt, Anderen weiterempfehlen?</strong></td>
</tr>
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<td></td>
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<tr>
<td><strong>Würdest du die App(s), die du zurzeit nutzt auch zukünftig nutzen?</strong></td>
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<tr>
<td><strong>Denkst du, dass mHealth Apps zukünftig an Popularität gewinnen?</strong></td>
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# Appendix D: Category Definition

<table>
<thead>
<tr>
<th>Category</th>
<th>Definition</th>
<th>Anchor Example</th>
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<tbody>
<tr>
<td><strong>I - Initial Motivation</strong></td>
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<tr>
<td>Seeking help through apps</td>
<td>The app is used as a means to solve a problem, exert self-control or to improve a certain area in the user's life.</td>
<td><em>I want to lose weight. Therefore, I want to control my meals and my training. (DNL)</em></td>
</tr>
<tr>
<td>Receiving factual information</td>
<td>Through the app, users can see their performance represented in numbers and quantifiable information.</td>
<td><em>Otherwise you maybe only have the feeling 'I walked little' but now you can see it in black and white. (TS)</em></td>
</tr>
<tr>
<td>Salience of behaviour</td>
<td>The factual information provided by the app makes the user's behaviour and habits salient.</td>
<td><em>It of course helped me to eat more consciously. That has to be said. If you weigh things and see how many calories a spoon full of oil really has. (MM)</em></td>
</tr>
<tr>
<td><strong>II - Paradoxes</strong></td>
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<tr>
<td>Integration</td>
<td>The app is easily integrated into the user's life since it is easy to use.</td>
<td><em>Of course this app is quick and easy to use and you do not need an extra tool. It is indeed an enrichment. (KY)</em></td>
</tr>
<tr>
<td>Effortless</td>
<td>The app is quick and easy to use.</td>
<td><em>For example, this Health App by Apple. You click on it once and you can immediately see the number of steps. It doesn't get easier. (FE)</em></td>
</tr>
<tr>
<td>Helpful reminders</td>
<td>Reminders by the app (e.g. push notifications) are considered helpful.</td>
<td><em>A reminder that you should not forget to note down something, I think that is okay. Because I don't use the app daily I sometimes forget it and the app can only function if you appropriately record in your data. I find it good and helpful. (KY)</em></td>
</tr>
<tr>
<td>Disintegration</td>
<td>The app is not easily integrated into the user's everyday life.</td>
<td><em>It does not really adapt to my life. Just because I tell the app my weight and height, doesn't mean it adapts to my metabolism and it doesn't know my digestive system. (TS)</em></td>
</tr>
<tr>
<td>Time-consuming</td>
<td>It is time-consuming or complicated to use the app.</td>
<td><em>A bit annoyed because I had to search for so many ingredients to track the calories, which was quite time consuming. (DLS)</em></td>
</tr>
<tr>
<td>Stressful reminders</td>
<td>Reminders by the app (e.g. push notifications) are considered annoying or stressful.</td>
<td><em>That stresses me, that totally stresses me. I sometimes get messages 'Step on the scale again'. That stresses me (FE)</em></td>
</tr>
<tr>
<td>Technical issues</td>
<td>Users are dependent on the correct functioning of the app to properly track their activities and behaviour.</td>
<td><em>I went running and I did something for my health but I'm a bit angry that my app didn't record it. It doesn't make sense to me! (DNL)</em></td>
</tr>
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<tr>
<td>Self-control</td>
<td>Users use the app to control themselves and their performance.</td>
<td>Generally, I naively use the app to control myself and I don’t want others to control me. (NL)</td>
</tr>
<tr>
<td>External control</td>
<td>Users feel controlled and influenced by the app to some extent.</td>
<td>Feels as if I had completed a task that has been assigned to me. (DTS)</td>
</tr>
<tr>
<td>App takes over intuition</td>
<td>The app influences the users’ mood or they rely on the app to understand themselves</td>
<td>And you forget to eat completely intuitively or to listen to your body. So I think in the long run it can be really restricting. (LS)</td>
</tr>
<tr>
<td>Entanglement between app and activity</td>
<td>The activity is closely connected with using the app to an extreme where users would not carry out the activity without the app.</td>
<td>Hence, Runtastic just belongs together with running for me. I wouldn’t go running without it. (MM)</td>
</tr>
<tr>
<td>Confirmation</td>
<td>The app is used to confirm the users’ positive or negative feeling or behaviour by providing them with information.</td>
<td>I wanted to know how much I walked today as I was sitting a long time and wanted to “confirm” myself that I still moved enough. (HI)</td>
</tr>
<tr>
<td>Pride</td>
<td>Users feel proud when they achieved or exceeded the results they wanted.</td>
<td>Proud, because I ate healthy. (DLS)</td>
</tr>
<tr>
<td>Disconfirmation</td>
<td>The app’s results can also disconfirm the user’s feeling or behaviour. This can lead to either positive or negative sentiments.</td>
<td>I was quite happy as I obviously walked more than I thought. (DHI)</td>
</tr>
<tr>
<td>Guilt</td>
<td>Users feel guilty when they did not achieve the results they wanted to.</td>
<td>Made me feel a bit guilty as I did not move much during the day. (DCS)</td>
</tr>
<tr>
<td>Individual</td>
<td>Users use the app for themselves and not to share results or to connect with others within the app.</td>
<td>Also, Runtastic offers you to connect with friends and tells you to cheer for them. I have never done that. (FE)</td>
</tr>
<tr>
<td>Self-comparison</td>
<td>Users compare their own current results with their own past results to understand their performance.</td>
<td>Yes, I am only looking at my older runs and compare the times there. (TK)</td>
</tr>
<tr>
<td>Community</td>
<td>Users value the aspect that the app allows them to connect with friends and peers in the app and to share their experiences.</td>
<td>The fact that some of my peers are constantly using the same app as I am, creates some sort of a sense of community. (DTS)</td>
</tr>
<tr>
<td>Peer comparison</td>
<td>Users compare their own results with the results of friends and peers.</td>
<td>For me it was the 10 kilometre benchmark because my mother in law always did that and I thought when somebody can do that in their sixties, I can do that in my early twenties as well. (AR)</td>
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<tr>
<td><strong>Motivating</strong></td>
<td>The app motivates users to achieve a higher performance or to improve their lives.</td>
<td>Both the Runtastic app as well as the MyFitnessPal app motivated me because you can control yourself. (MM)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>I find it quite motivating if you see that there is a curve that goes down. You can imagine it better. To me that is helpful. (LS)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The step count motivates me this far that I walk an extra round around the block. (AL)</td>
</tr>
<tr>
<td><strong>Graphical presentation</strong></td>
<td>Graphical presentation of the results in the app motivates the user. Gamification plays a role as well by visualizing the results in a playful way.</td>
<td>I find it quite motivating if you see that there is a curve that goes down. You can imagine it better. To me that is helpful. (LS)</td>
</tr>
<tr>
<td><strong>Improving behaviour</strong></td>
<td>Due to the use of the app, consumers adapt and improve their behaviour in ways that would not have happened without the app.</td>
<td>The step count motivates me this far that I walk an extra round around the block. (AL)</td>
</tr>
<tr>
<td><strong>Demotivating</strong></td>
<td>Users can feel demotivated by using the app especially if they did not achieve the performance they wanted.</td>
<td>I found it really demotivating. I once even stopped running because I thought to myself 'that does not help anything, you won't get better anyway'. (MM)</td>
</tr>
<tr>
<td><strong>II - Tensions</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Privacy concerns</strong></td>
<td>Users experience privacy or data security issues in connection with their app.</td>
<td>I find this whole data topic quite negative. Because you don't completely know where exactly... So, I am a bit cautious. I don't record my feelings or the weather or connect it with any accounts. (AB)</td>
</tr>
<tr>
<td><strong>Privacy Trade Off</strong></td>
<td>Users can be willing to give up privacy or data to enjoy benefits of the app.</td>
<td>I: The mHealth apps that I am using NL: are really practical, however, I also reveal a lot of data by using them.</td>
</tr>
<tr>
<td><strong>Obsession</strong></td>
<td>Users are too focused on the app. They can become obsessed with tracking, controlling and improving themselves.</td>
<td>But I think that is really dangerous. For a period of time I was checking how much protein and carbohydrates I ate, which I also tracked. That can almost become addictive and obsessive. (MM)</td>
</tr>
<tr>
<td><strong>Ambivalence</strong></td>
<td>Users are aware of the positive and negative sides of an aspect of the app.</td>
<td>I think it is an advantage and a disadvantage at the same time, that you become more self-reflected. (TS)</td>
</tr>
<tr>
<td><strong>Negative aspects are more impactful</strong></td>
<td>Users feel more strongly affected by negative events than positive events.</td>
<td>Yes, I think the negative, especially regarding food and calories, affects me more than with sport. (HI)</td>
</tr>
<tr>
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<tr>
<td>III - Coping strategies</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Discontinuing</td>
<td>Users stop using the app or turn off some of its functions.</td>
<td>I never should have started calorie counting apps. I am not using them anymore. (AL)</td>
</tr>
<tr>
<td>Reasons for discontinuing</td>
<td>Users mention reasons for discontinuing the use of their apps.</td>
<td>When a fee would be required, I think I would stop using it. Because it is not important enough for me. (AR)</td>
</tr>
<tr>
<td>Adjusting</td>
<td>Users adapt their behaviour, habits or mind-sets according to the perceived requirements of the app.</td>
<td>When I use MyFitnessPal I have a different eating behaviour, because I know I have to record something. (NL)</td>
</tr>
<tr>
<td>Assuming responsibility</td>
<td>Users assume responsibility for themselves and thereby stay in control.</td>
<td>I don't need an app to remind me, I know that myself. (AB)</td>
</tr>
<tr>
<td>Restricting of information sharing</td>
<td>Users share information via WhatsApp and not through the app. They never share anything on Facebook.</td>
<td>Like I said, I do share it via WhatsApp but I wouldn't really post it, that everybody can see it. I am not the person for that. (CS)</td>
</tr>
<tr>
<td>Emotionally distancing</td>
<td>Users keep emotionally or physically distant to the app and its functions.</td>
<td>Yes, I would say that I am capable of distancing it from myself. I realise relatively quickly when something concerns me too much and that is why. (AR)</td>
</tr>
<tr>
<td>Limiting to basic functions</td>
<td>Users want to stay limited to the basic functions the app provides.</td>
<td>There are a lot of other possibilities which I am not using. I am restricting myself to only the most important functions. (RC)</td>
</tr>
<tr>
<td>Ignoring</td>
<td>Users ignore the app or avoid information provided by the app.</td>
<td>Didn’t want to look at the app because I knew I wasn’t very active. (DHI)</td>
</tr>
<tr>
<td>Denying</td>
<td>Users deny problems and issues that occur together with using the app.</td>
<td>I think I deny the app. I’m saying ‘that’s not right’ or I share it with a friend to get confirmation that it cannot be possible. (CS)</td>
</tr>
<tr>
<td>Doubting</td>
<td>When information seems illogical, the users begin to doubt the functioning of the app or themselves.</td>
<td>I was really surprised as it said I already made 10 floors today. I am starting to doubt the reliability of this app or maybe I just underestimate the distance I walk on normal days… (HI)</td>
</tr>
<tr>
<td>Mentally abandoning</td>
<td>When users do not reach their goal they temporarily give up their ambition.</td>
<td>Then I thought to myself ‘it doesn’t matter now anyway’. Now I can also eat a pizza. (FE)</td>
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<tr>
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<tr>
<td><strong>Future outlook</strong></td>
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<tr>
<td>Chances</td>
<td>Users see the chances and potential of mHealth apps.</td>
<td><em>I think that is a huge movement (MM).</em></td>
</tr>
<tr>
<td>Risks</td>
<td>Users see risks concerning mHealth apps.</td>
<td><em>On the one hand, I could imagine that more and more people get suspicious when it comes to data security. (RC)</em></td>
</tr>
</tbody>
</table>