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## **What are the success strategies for changing behaviour?**

*An explorative intervention study of an application based and  
a non-application based approach for reducing smartphone  
overuse with focus on persuasive design*

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# Abstract

With the growing role the smartphone technology is gaining in our daily life the concerned voices about its negative impacts on human social skills, social interactions and mental health are getting louder. Smartphone use has become a habit not at least due to high access to different kind of rewards provided by this technology. In this thesis, a qualitative explorative study analyses two approaches, an application based and a non-application based, in their ability to deal with the subjectively perceived smartphone overuse in order to find weaknesses and advantages behind those approaches. The study design is based on behaviour change theories such as the Goal-Setting Theory, the Social Cognitive Theory, and the Cognitive Dissonance Theory and on the persuasive design strategies. The results of the five weeks long intervention study, during which eight participants tried both approaches in a within-group design setup, suggests that a combination of an application based and a non-application based intervention could be more beneficial than relying on technology alone in order to support the user with means to reduce the smartphone overuse. The results furthermore suggest that the application based approach functioned well as an eye opener and as an incentive to prepare participants to take own actions.

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# 1. Introduction

During the Syria debate in 2013 where a potential use of force against the Assad regime was discussed the Senator McCain was caught playing poker on his iPhone. Senator's reaction to the incident was making a joke about it on Twitter (Siddique, 2013). Should senator's behaviour be condemned as deeply disrespectful or is he just another victim of a smartphone addiction?

Smartphones are an omnipresent attribute in the daily life of the modern human being as they fulfil many human needs from communication over entertainment and information seeking to relaxing. Besides all the benefits this technology offers, there are some drawbacks that emerge with extensive use when smartphone users experience conflicts between smartphone use and other daily activities. In recent years the question after how behaviours can be targeted and altered has gained an increasing interest within HCI research and new approaches have been investigated. The aim of the current study is to understand how two approaches, an application based and a non-application based intervention, can contribute to behavioural change in regards of reduction of the subjectively perceived smartphone overuse.

The topic of smartphone use and overuse is chosen due to its relevance for the modern society. 81 percent of the Swedish population owns a smartphone and nearly 80 percent are permanently connected to the rest of the world over the internet (Findahl & Davidsson, 2016). Users spent a tremendous amount of time on those devices (Roberts et al., 2014; Junco, 2012) and the time devoted to them is constantly growing (Findahl & Davidsson, 2015, 2016). However, the overload of information and communication can cause an increased stress level (Lee et al., 2014). The social pressure to be permanently available can furthermore lead to feelings of anxiety, stress and guilt among many smartphone users (Ames, 2013; Lee et al., 2013; Lee et al., 2014).

Smartphone usage does not always follow a particular purpose and much of the use happens due to a compulsive checking habit (Oulasvirta et al., 2012). Once a habit is formed the actions are triggered by outside cues and situations and the role of the intention for the behaviour is reduced (Triandis, 1980; Webb & Sheeran, 2006). That means that the smartphone usage might become controlled by extrinsic factors, impairing the pursuit of the more self-guided goals and thus reducing the intrinsic control of an individual, which can lead in extreme case to an addiction (Oulasvirta et al., 2012).

In order to alter attitude and/or behaviour in question the HCI researchers are frequently applying technology as a solution (Munson & Consolvo, 2012; Consolvo et al., 2009; Arteaga et al., 2010; Consolvo et al. 2009b; Matthews et al., 2015; Bang et al., 2009; Lee et al., 2014; Hiniker et al., 2016; Löchtfeld et al., 2013) even if the

technology use itself is the problem. A variety of theories from different disciplines such as sociology and psychology have been applied in this kind of research: Goal-Setting Theory (Locke & Latham, 2002), Social Cognitive Theory (Bandura, 1989), Transtheoretical Model (Prochaska et al., 1992), Theory of Planned behaviour (Ajzen, 1991) among others.

Building on previous research the current thesis investigates how well an application based and a non-application based intervention perform when it comes to altering smartphone usage behaviour. It is of interest to identify which persuasive aspects positively contribute to the intervention, which personal coping strategies users create for reducing overuse and how the users experience those two intervention approaches. To the knowledge of the researcher an investigation of the possibilities of an application based and a non-application based intervention to enable behavioural change, especially for smartphone overuse, is a unique approach and can provide new insights into the design field of future persuasive technology.

As the focus of the study lies in identifying possible solutions for dealing with a societal problem in a real world context such as the smartphone overuse, the framework of Action Design is selected as the overall methodology. To meet the project purpose, qualitative research methods are applied. First, in-depth interviews and a survey provide insights into the daily smartphone usage, issues it brings to the users and ways of dealing with those issues. After that a five weeks long intervention offers study participants the possibility to test an application based and a non-application based intervention in their ability of supporting them to deal with their subjectively perceived smartphone overuse. For the first approach two mobile applications (for Android and IOS owners respectively) are selected. Within the non-application approach the study participants are applying own coping strategies for dealing with the overuse and are supported by an inspirational toolkit that is based on persuasive design strategies (Oinas-Kukkonen, 2009; Fogg, 2009), goal-setting and self-efficiency aspects. A printed calendar diary provides participants with guidance for reflection upon their progress and offers besides the toolkit a support for the researcher for post-intervention interviews. Final in-depth interviews with the study participants round up the study and provide answers to the research questions.

The thesis is organized as followed: first, the background section provides an overview over the role the smartphones have taken in our daily life and their various impacts on the users. Later the smartphone use is discussed from the habit perspective and a look is taken into the habit formation. Subsequently follows an introduction to human behaviour and behaviour change theories. A discussion of persuasive system design and an overview over related works provide the final theoretical steps before the research questions are formulated. The second part of the thesis is concerned with the overall methodology, the chosen scientific research methods and alternative approaches. An introduction of applied methods provides a

deep insight into the study setup: the applied application based and a non-application based approaches. A discussion of ethical limitations rounds off the method section. In the third part of the thesis the study results are presented and analysed starting with the findings of the pre-study, followed by the results of the intervention study with the aim to answer the formulated research questions. At last, the thesis explains its value and contribution to the scientific world and offers further research possibilities within the area of smartphone use and overuse.

## **2. Background and theory**

This chapter is devoted first to a deeper introduction to the topic of smartphones, a discussion of their impact on users' life and the usage habit. Next, it covers relevant behavioural change theories and an overview over current related works.

### **2.1 Smartphones in daily life**

Smartphones have become a crucial part of our daily life and are even seen as being critical for social relationships (Ames, 2013; Roberts et al., 2014). Even though communication applications play an important role in the smartphone usage (Böhmer et al., 2011) it is not a surprising fact anymore that smartphones are used for far more than communication alone. According to the Swedish IIS (Internetstiftelsen i Sverige) the most popular activities on the smartphone are among others checking timetables, checking news, listening to music, checking social media, chatting, gaming and using payment apps.

81 percent of the Swedish population owns a smartphone and 78 percent uses internet on the phone. In average people spend around nine hours per week using internet on their phones (Findahl & Davidsson, 2016). That number, however, looks small when comparing to studies conducted in the US where it has been found that users spend around nine hours per day on their smartphones (Roberts et al., 2014). Another American study showed that US college students spend over 1,5 hours daily using Facebook alone (Junco, 2012).

The challenge with the new smartphone technology is to find a balance between direct social surrounding and online networks because smartphone users are expected to be available in both types of social interactions (Ames, 2013; Lee et al., 2014). Research shows that some smartphone users don't have clear priorities for the one type of interaction over the other and see it as important to give the online networks an immediate response as to the physical surrounding (Ames, 2013).

There are potential problems related to an inappropriate smartphone use, for instance when the expectation to be constantly available on the phone extends even to car driving. Tison et al. (2011) show that especially answering and making phone

calls belong to frequent activities during driving besides reading and sending of text messages. The compulsive smartphone usage, however, is associated with reported motor vehicle crash incidences (O'Connor et al., 2013). While users don't necessarily experience using a phone to have any impact on the driving performance (Tison et al., 2011), there are studies that show that talking on a cell-phone increases the risk of collision by over 30 percent (Wilson and Stimpson, 2010).

The impact smartphones have on our life is seen by the M.I.T. researcher, psychologist and sociologist Sherry Turkle with a deep concern. The author of 'Alone together' and 'Life on the Screen' has spent over thirty years studying the interaction between humans and technology and moved from a rather enthusiastic to a more pessimistic view of it (Wikars, 2017). In her new book 'Reclaiming conversation' she highlights the negative aspects smartphones bring into the modern life especially their impact on the conversation. After conducting series of interviews with children, teenagers, couples, parents and teachers she sees how people emerge more into the technology and unlearn the critical human skills such as self-reflection and empathy. She claims that "conversations with phones on landscape block empathic connection" (Turkle, 2015, p. 21). She mentions studies, which show that the empathy markers among college students have declined by 40 percent. Other studies mentioned in the book reveal that open screens degrade the performance of both the owner and other people, who can see the screens. Furthermore the sheer presence of the phone inhibits conversations that matter and by that Turkle means deep conversations that unfold emotions and help people to connect to each other. Conversations become fragmented and light with topics containing little controversy or consequence as they can be interrupted at any moment by the phone (Turkle, 2015).

Besides the above mentioned societal concerns there are also interpersonal and mental issues related to smartphone overuse. Social expectations of prompt responses and constant connection make smartphone users become heavy multi-taskers but also lead to feelings of anxiety, stress and guilt (Ames, 2013, Lee et al., 2013, Lee et al., 2014). Those negative experiences may be caused by conflicts between smartphone usage and other daily activities such as sleep, work/study, social interactions (Lee et al., 2014; Ko et al., 2015), couple relationships (McDaniel & Coyne, 2014) but also due to increasingly blurring boundaries between home and work (Collins et al., 2015). Besides that, an inappropriate smartphone use may contribute to a rise of stress levels due to an overload of information and communication (Lee et al., 2014). Additionally, ongoing use of technology is linked to heightened psychological distress (Chesley, 2005) and increased usage of smartphones may also cause social problems and damage relationships (Lee et al., 2014).

Smartphone overuse has been investigated by researchers both on the device level (Shin and Dey, 2013) and on the application level with focus on addictive behaviours



to individual apps (Ding et al., 2016). The concept of technology overuse is related to concepts such as extensive use, problematic use and addiction. In all those concepts the use of technology interferes in some way with other activities and aspects of user's life. In order to measure if a problem in use exists the researches usually apply self-reported continuous scales (Turel et al., 2011). The concept of overuse applied in this thesis refrains from an objective overuse measurement and focuses on the subjective perception the smartphone users have regarding how their usage impacts them and their life. The users might experience issues regarding their smartphone usage on different levels and those might regard the total device usage or usage of particular applications.

### 2.1.1 Smartphone addiction

Excessive use of smartphones may potentially lead to this technology becoming a source of addiction. Similarly to other computer related addictions such as addiction to email or social media, computers or in this case smartphones become "overly strong cues for behaviours" (Oulasvirta et al. 2012, p. 107). Cell-phone use is even claimed to be "possibly the biggest non-drug addiction of the 21st century" (Shambare et al., 2012, p. 573).

Smartphone addictions as other behavioural addictions are rather difficult to define as they carry not only physical but also social and psychological aspects (Lee et al., 2013). Media consumption related addictions are hence also defined as overuse due to loss of self-control (Oulasvirta et al., 2012; Roberts et al., 2014) or as dependence (LaRose et al., 2003). According to LaRose et al. (2003) media addiction is nothing but an indicator for a deficiency in self-regulation that on its hand contributes to habit formation.

The point where the smartphone usage becomes an addiction and the user becomes dependent on the phone is defined by a tipping point and is described as a distinction between liking the smartphone and wanting it. The tipping points hence describes how the mostly harmless everyday behaviour defined as liking turns into a physical and/or psychological wanting (Roberts et al., 2014).

### 2.1.2 Psychological predictors for smartphone addiction

Smartphone addiction or dependence is a topic for much current research and several studies have been analysing psychological predictors for addictive phone usage. Social extraversion, social anxiety and low self-esteem are personality traits that are found to be positively correlated to mobile phone addiction (Roberts et al., 2014; Darcin et al., 2016, Hong et al., 2012; Takao et al., 2009, Bianchi & Phillips, 2005). Other traits found to have a significant correlation to addictive cell-phone use

are attention impulsiveness and emotional instability. Also high level of materialism seems to have some kind of impact on smartphone addiction (Roberts et al., 2015).

Regarding the character trait of loneliness the research outcomes differ in so far as some find a relation between loneliness and problematic smartphone use (Darcin et al., 2016), while others could not find it to be a predictor for an excessive smartphone usage (Takao et al., 2009). One study looked at the relationship between usage content and addiction and found out that young people who mainly use their smartphones for social media have a significantly higher risk for addiction compared to those who use it mainly for browsing or making phone calls (Darcin et al., 2016).

## 2.2 Smartphone use as habit

The permanent interaction with the smartphone does not always have a reason and many interactions with the phone happen rather automatically due to a habit. Böhmer et al. (2011) discovered that almost 50 percent of interactions with the smartphone last less than five seconds. This short, repetitive inspection of the smartphone content received the name *checking habit* and is defined as “automated behaviours where the device is quickly opened to check the standby screen or information content in a specific application” (Oulasvirta et al., 2012, p.107).

Habits can be defined “as an automatic behaviour triggered by situational cues, such as places, people, and preceding actions” (Oulasvirta et al. 2012, p. 106). Frequent behaviour and habits are correlated to each other in so far as the latter is a consequence of the former (Oulasvirta et al., 2012). Habits are formed by the strengthening of the association between a cue (situation/context) and an action (Wood & Neal, 2007). Hence the repetition of behaviour in a consistent situation enables the cue-response links to be built. Those context-response associations are what make up habits. Once a habit is learned it is performed without the mediation of a goal to achieve a particular outcome (Wood & Neal, 2007). The time it takes for the automation of behaviour ranges from 18 to 254 days and is related to the complexity of the task (Lally et al., 2010).

Cues and trigger-events play an important role for habit formation as they start to drive the behaviour (Wood & Neal, 2009). Wood and Neal (2007) propose two forms for context cuing of habits to arise: a direct and a motivated form. The *direct* form describes that a habit responding is activated by the cognitive association between context cues and responses. The *motivated* form describes that a habit responding is activated by “by the diffuse motivation that is tagged onto performance contexts when people repeatedly experience rewards for responding in those contexts.” (Wood and Neal, 2007, p.844) With other words when people repeatedly experience rewards when responding to a context it creates a motivation for a habit to be activated.

High demands in daily life such as time pressure, distractions and regulatory depletion strengthen the influence of habits on behaviour in a way that those demands limit the capability of people to inhibit acting on the activated habitual responses and to act outside of the habit. Furthermore people may judge repeated responses to be better alternatives due to post hoc inferences. Hence, those inferences may reduce the purposeful attempts to change habits (Wood and Neal, 2009).

Additionally, smartphone's capacity to provide quick access to different kind of rewards is seen as a reason for the smartphone use to be rather non-resistant to habit formation. Seeing a smartphone lying on the table reminds the user of all the possible rewards that are associated with the usage (Oulasvirta et al., 2012).

## 2.3 Psychology of Behaviour

Habit is a crucial aspect of human behaviour and it plays a crucial role for the smartphone use. The following section is going to take a closer look at factors which, as seen by researchers, influence and change human behaviour.

### 2.3.1 From intentional to habitual control of behaviour

As discussed above habits have a great deal of control over behaviour, which is called in psychology a habitual control of behaviour. It is to be differentiated from the intentional control of behaviour, where intentions are predictors of behaviour. The more frequently behaviour is repeated the more it comes under control of habits and the lower is the impact of intention on it (Triandis, 1980; Webb & Sheeran, 2006).

### 2.3.2 Role of intention for behaviour

According to research intentions play an important role as they are the best predictors of behaviour (Armitage & Conner, 2001). Intentions are instructions people give to themselves to perform particular behaviours (Triandis, 1980). They can be formulated in the form such as 'I intend to do X' or 'I plan to do Y' and they present person's motivation to perform an action. Behavioural intentions carry both a direction, in sense of 'I do this and not that', as well as an intensity of a decision, which refers to time and effort spent to fulfil the intention.

Different factors have an impact on the intention-behaviour consistency. One of them regards the type of the behaviour: is it a single action or a goal. The intentions can be better predictors of a single action than of - what Sheeran (2002) defines as - a goal that consists of a variety of single actions. (An action can be to attend a class, while a goal can be to get a VG in a course). The reason for this lies in the higher control level a person has over one single action than over a goal (Sheeran, 2002).

Furthermore there are several factors that determine the level of control a person has to perform behaviour. In this sense Sheeran (2002) distinguishes between seven control factors such as knowledge, ability, resources, opportunity, availability, cooperation, and unexpected situations to perform behaviour.

Other researchers distinguish furthermore between behavioural intentions and behavioural expectations, and while the former answer the statements like 'I intend to do', the latter estimate the likelihood of a performance, 'How likely am I to do X?' (Warshaw & Davis, 1985). Another development in intentional research is the differentiation between behavioural and implementation intentions. The latter involve premises in form, 'I intend to do Y in situation W' (Gollwitzer, 1993).

### 2.3.3 Theories for behaviour change

When summarizing the aforesaid one can state that intentions are a key determinant of the behaviour performance and of goal realisation (Webb & Sheeran, 2006) and hence play a central role in the theories of behaviour psychology. The following sections introduce several theories that are relevant for behaviour change and hence for the current thesis.

#### 2.3.3.1 Goal-Setting Theory

In Locke and Lathan's Goal-Setting Theory forming a concrete intention to undertake a specific task is a core act of will that promotes goal fulfilment (Webb & Sheeran, 2006). A goal is defined as the "object or aim of an action" (Locke & Latham, 2002, p.1) generally within a specified time limit. According to the Goal-Setting Theory goals affect the performance in four dimensions. First, goals direct attention and hence lead to goal relevant activities. Second, goals have an energizing function – the higher the goal the higher the effort. They can have an effect on the effort persistence and therefore on how much time to spend to reach a goal. Fourth, goals trigger the acquirement of existing knowledge and the discovery of new skills (Locke & Latham, 2002). Interestingly the research doesn't indicate a significant difference between assigned goals and self-set goals in their effectiveness, given the fact that the reason for the goal is provided (Locke & Latham, 2002).

Goals are most effective when they are specific (compared to do-your-best goals), when the individual is able to follow the progress as well as gets feedback on it and when the task difficulty is at a high level. Another relevant factor for goal fulfilment is the commitment of a person to the goal. The goal commitment is facilitated by two factors: the importance of the goal to the individual and the belief in achieving the goal (self-efficiency). Self-efficiency on its hand is important in several ways: first, when the goals are set, people with high self-efficiency set for themselves higher goals than people with low self-efficiency. Second, people with high self-efficiency

are also more committed to assigned goals, use better strategies to fulfil goals and respond more positively to feedback (Locke & Latham, 2002).

Goal-Setting Theory is not the only one that acknowledges the importance of self-efficiency and of conscious goals, so does also the Social Cognitive Theory (Locke & Latham, 2002).

### 2.3.3.2 Social Cognitive Theory

In the Social Cognitive Theory (SCT) social and cognitive aspects are combined. The social portion of it recognizes the importance of an individual being a part of a society while the cognitive part acknowledges the impact of thought process to human attitudes, motivations and actions (Luthans & Stajkovic, 1998).

When explaining the SCT Luthans and Stajkovic (1998) highlight five basic human capabilities. The first one is the capability of *symbolizing*, which allows humans to successfully react, change and adapt to their environments. *Forethought* describes the second basic human capability, which is to plan actions, anticipate the consequences and determine the level of desired performance. *Vicarious learning* is the capability to learn by observing the performance of others and the consequences others receive for their actions. *Self-regulation* describes how people self-control their actions by setting internal standards and by evaluating in how far the performance met the standard in order to improve it. The fifth basic human capability is the *self-reflection*. It allows people to look back at their actions and to estimate their belief to successfully perform a task in future given the same context (Luthans & Stajkovic, 1998). Hence, self-reflection enables people to analyse their experiences and by that to gain knowledge. The central knowledge people can gain from self-reflection is the judgement of their abilities to find motivation, cognitive resources and directions for actions in order to perform a specific task successfully. This type of perception is referred to as *self-efficiency* and it is the central and most pervasive of human believes in having control over events in live (Bandura, 1991).

In SCT behaviour change and its maintenance are the results of subjective expectations about possible behaviour outcomes and subjective expectations on one's ability to execute the behaviour (Strecher et al., 1986). Thus, behaviour can be predicted on the basis of personal self-efficacy. For example, an individual with low self-efficacy doubts his/her ability to do what is needed to success. Likewise, perception of high self-efficiency may help a person to stay positive even in situations with uncertain outcomes (Stajkovic et al., 1998).

While SCT and the Goal-Setting Theory approach behavioural change from the perspective of individual control, the next theory - Transtheoretical Model - sees behaviour change as a part of a sequence (Fogg & Hreta, 2010).

### 2.3.3.3 Transtheoretical Model

According to the Transtheoretical Model (TTM) the change of behaviour is not a linear process but a loop where a person undergoes several stages and each stage several times until a long-term effect has been reached.

The model defines five stages of behaviour change: during the first two stages people move from not being aware of their behaviour (pre-contemplation) to a stage where they consider changing it (contemplation). The third stage (preparation) describes how people prepare themselves and their social environment to make a change. During the final two stages a person initiates actions (action stage) and continues to perform the desired behaviour for six or more months (maintenance) (Prochaska et al., 1992).

When the Transtheoretical Model is applied to initiate behavioural change the persuasive technology must meet person's needs depending on the current stage of the person. Consolvo et al. (2009) propose how the design of persuasive technology can approach each stage of TTM. So for instance design that targets the first stage should focus on education. For the second stage the design should use techniques or rewards that help to overcome barriers. For people going through the preparation stage the design could reward behaviours and encourage consistency by increasing awareness of behaviour patterns. In the action stage the design should help people to keep track of their progress and include elements of social influence. For the people in the maintenance stage, the design could focus on the strategies that helped overcoming previously encountered problems and on helping the individuals realize how they have managed to reach the desired result (Consolvo et al. 2009).

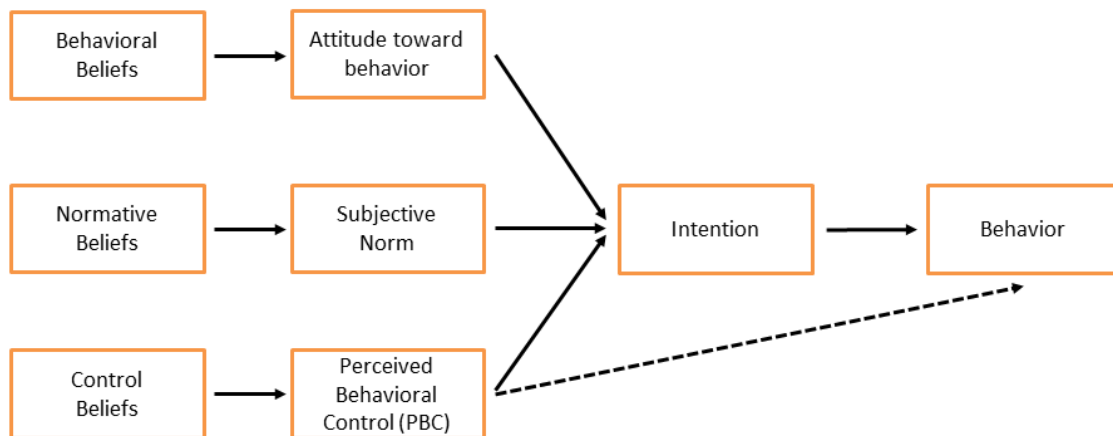
### 2.3.3.4 Theory of Planned Behaviour

First introduced by Ajzen in 1991, the Theory of Planned Behaviour (TPB) has become an important framework for explaining and predicting behaviour (Fishbein & Ajzen, 2010). According to the TPB intention is the main driver to perform behaviour (see figure 1). There are several underlying motivational variables that drive intention, such as behavioural beliefs, normative beliefs and control beliefs, attitude toward the behaviour, subjective norm and perceived behavioural control<sup>1</sup> (Steinmetz et al., 2016). The latter refers to subjective capabilities and abilities to perform behaviour and moderates the effect of intention on behaviour (Ajzen, 2002). Based

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<sup>1</sup> *Behavioural beliefs* are beliefs about a perceived outcome to occur as a result of performing the behaviour. Those beliefs positively or negatively influence the *attitude* toward behaviour. Hence, the attitude depends on how the behaviour is perceived to be. If the behaviour is not believed to result in desired outcomes then the person will likely have negative attitudes towards this behaviour and its effectiveness to produce the expected outcome. *Intention* predicts how much a person wants and plans to perform the behaviour. Thus, the greater the intention the bigger the likelihood that the person will perform the behaviour. *Normative beliefs* refer to the person's belief of what other people might think about the behaviour. There is a relationship between normative beliefs and *subjective norms* regarding positive and negative shifts. *Behavioural control beliefs* consider perceived obstacles and/or ease of doing the behaviour. At last, *perceived behavioural control* refers to subjectively perceived behavioural capacities and abilities of an individual to perform a specific behaviour (Arteaga et al., 2010).

on that, TPB postulates that the best way to change motivation is by changing beliefs (Steinmetz et al., 2016).



**Figure 1: Theory of Planned Behaviour, based on Steinmetz et al. (2016)**

The perceived behavioural control and self-efficacy according to Bandura are two very similar concepts as both are concerned with the perceived ability to perform behaviour (Ajzen, 2002).

When applying TPB as a theoretical framework for behaviour change the interventions aim at changing normative, behavioural and control beliefs in order to motivate performance of behaviour. Hence, a successful intervention is such that is able to increase positive outcomes, decrease beliefs in negative outcomes, increase knowledge or skills to perform behaviour and decrease barriers and/or generate facilitators (Steinmetz et al., 2016).

### 2.3.3.5 Cognitive Dissonance Theory

The following theory doesn't deal with behaviour change in the same manner as the previous theories. It does rather explain how and why behaviour and attitude change might occur and is therefore of interest.

As attitudes and behaviours of people are not static (Kessler, 2013) it is of interest to consider the reasons and ways how they are being modified. The Cognitive Dissonance Theory describes a psychological state when inconsistency in cognitive elements arises. With other words it explains situations when an individual realizes that his/her attitudes and his/her behaviours are not consistent with each other. In those situations the person experiences a psychological dissonance, a psychological discomfort, which the person will try to eliminate. There are three approaches to eliminate dissonance: 1) the person will change her behaviour, 2) the person will change his/her attitude and 3) person will create new cognitive elements (Kessler, 2013). The likelihood that a person will try to eliminate the dissonance depends on the subjective importance of the attitudes and behaviours to that person (Consolvo et al. 2009).

In case of smartphone overuse the dissonance might appear when a person believes using the smartphone in social encounters is highly impolite but still does it. What a person can do is to change his/her behaviour and stop doing it or to change his/her attitude toward it and view it as not problematic. Alternatively the person can rationalize the dissonance and change the way he/she sees his/her actions by convincing him/herself that all others use their phones in social encounters and that many of them use their phones much more intensively in such situations than he/she does.

Cognitive Dissonance Theory can be also applied to enable behaviour change by addressing factors that prevent the individual from incorporating the change into the everyday life. In order to do so, the technology could help the person to stay focused on the commitment to change and to stay focused on the relevant behaviour patterns. The awareness enabled by the technology should be easy to access and in the same time support information avoidance (Consolvo et al., 2009).

The above presented theories pursue two main purposes. First, they offer ground for the methodological implementation, discussed later in the thesis. Second, they are incorporated into persuasive system design and are relevant for persuasive technology.

## 2.4 Persuasive system design

Persuasive technology describes an interactive information technology that is designed for changing users' attitudes or behaviour (Fogg, 2003). Persuasive technology includes both the human-computer interaction and computer-mediated communication (Oinas-Kukkonen & Harjuma, 2008). The latter implies that the persuaders influence others via computers (Oinas-Kukkonen, 2009).

Fogg (1998) defines the term persuasion "as 'an attempt to shape, reinforce, or change behaviours, feelings, or thoughts about an issue, object, or action.'" (Fogg, 1998, p.225) While traditionally persuasion was meant as human communication designed to influence the judgements and actions of others (Simons et al., 2001), with the growing importance of the web, mobile and ambient technologies new opportunities have occurred to create persuasive interaction. The ability of the modern technology to combine attributes of interpersonal and mass communication brings them the advantage to be the optimal persuasive communicators (Cassell et al., 1998). Hence, also in mobile applications the persuasive technology can be well used to influence attitudes or behaviours of users (Matthews et al., 2015). To consider is that persuading is not the same as convincing, as the former relies first of all on symbolic strategies that trigger emotions, while conviction relies on logic strategies and appeals to reason and intelligence (Miller, 2002).



Main contributions to persuasive technology that are considered in this thesis include Fogg's behaviour model, Fogg's persuasive technology, and Oinas-Kukkonen's persuasive system design. Those methods have been applied to facilitate software design and product design in various areas (Shih, 2016).

Fogg's behaviour model (2009) defines three core factors that must be present for behaviour to occur: motivation, ability and triggers. While the first two factors are rather self-explaining, the last one, triggers, is going to be elaborated more in detail. Even if the other two factors are present and high, behaviour will not occur without an appropriate trigger. Fogg differentiates between three types of triggers: sparks, facilitators and signals. Sparks are triggers that motivate behaviour when motivation is lacking. Facilitators make the behaviour easier, and they are then appropriated when the motivation is high but the ability is lacking. Similar to sparks, facilitators can be embodied in video, graphics, text and more. Signals carry the role of indicators or reminders and work best when users have both motivation and ability to perform the target behaviour. Another important factor in persuasive design is the simplicity. According to Fogg (2009) a persuasive design has a faster success by making the behaviour simpler instead of adding motivational factors.

Fogg (2003) summarized insights about persuasive system design in his book 'Persuasive Technology' that received both praise and critique. One of the main critique points highlights the limited possibility of Fogg's framework to be directly applied to persuasive system development and evaluation (Harjumaa & Oinas-Kukkonen, 2007). To address that Oinas-Kukkonen (2009) proposed another framework, the model of Persuasive System Design (PSD). As many parts of PSD are an adaptation and modification of Fogg's framework, only PSD is going to be presented and discussed in this thesis.

In his framework Oinas-Kukkonen (2009) identifies three potential successful outcomes for a persuasive system design: 1. voluntary reinforcement, 2. change or shaping of attitudes and 3. change or shaping of behaviours. Furthermore he divides persuasive systems into a three steps development process (see figure 2). The first step focuses on key issues behind persuasive systems and plays an important role as an understanding phase.

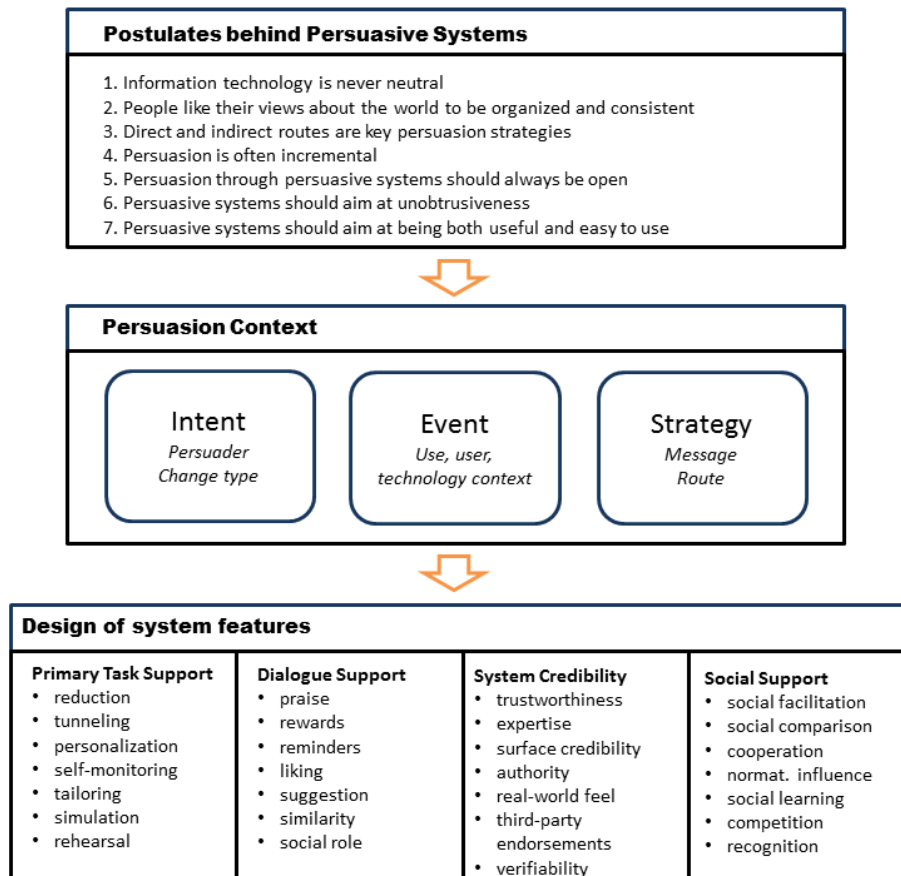


Figure 2: Persuasive System Design, based on Oinas-Kukkonen (2009)

In this step Oinas-Kukkonen (2009) defines seven postulates to be addressed when designing and even evaluating persuasive systems. The first postulate states that information technology is never neutral, meaning that it always influences people's attitudes and behaviours in some way. Second, people like when their views about the world are organized and consistent. Third, direct and indirect routes are key persuasion strategies. Direct route occurs when an individual carefully evaluates the content of a persuasive message, whereas when an individual is less thoughtful and applies simple cues for evaluating, the message may be persuaded through the indirect route. Fourth, persuasion is often incremental, meaning that it is better when the system enables the individual to take incremental steps towards the target behaviour. Fifth, persuasion through persuasive systems should always be open, in the sense of being transparent and true. Sixth, persuasive systems should aim at unobtrusiveness by avoiding disturbing the users while they are performing their tasks with the aid of the system. Seventh and last, persuasive systems should be both useful and easy to use.

The second step of Oinas-Kukkonen's (2009) development process concerns the persuasion context according to the intent, event and strategies for the use of a persuasive system. For the *intent* it is central to analyse the type of persuasion, meaning is the persuasion aiming at changing attitude and/or behaviour. Central factors in analysing the *event* are the use context (problem domain dependent

features), the technology context (technology dependent features) and the user context. User context covers user dependent features such as user's goals, motivation, lifestyle, and others. The *strategy* asks two central questions: what is the message and what is the proper route for persuasion (direct, indirect) to be used to reach the end user.

The last step covered by the framework discusses the design of system features. Those are categorized in four persuasive software features: primary task, dialogue, system credibility, and social support. The design principles in the first category support user's *primary tasks* and cover reduction, tunnelling, personalization, self-monitoring, tailoring, simulation, and rehearsal. The *dialogue* category covers system feedback that helps users to move towards the target goal or behaviour and it includes design principles such as praise, rewards, reminders, liking, suggestion, similarity, and social role. The design principles of the third category (credibility) describe how a system can be designed in order to be more credible and hence more persuasive to users. This category consists of trustworthiness, expertise, surface credibility, authority, real-world feel, third-party endorsements, and verifiability. The design principles of the last category (social support) aim at motivating users by applying social influence. The following design principles belong to this category: social facilitation, social comparison, cooperation, normative influence, social learning, competition, and recognition.

The benefits of this framework are its ability to be applied in a variety of areas ranging from analysing existing applications, research literature to evaluating specifications in system development (Oinas-Kukkonen, 2009). Especially the 23 design principles that are partly based on Fogg's framework, and partly are developed by Oinas-Kukkonen (2009) present a useful tool for the empirical part of the current thesis.

## 2.5 Related current works

Intervention technologies for behaviour change have been the focus of a range of studies. Among most frequently studied areas are intervention technologies that target physical activity and health, followed by pro-environmental behaviour interventions.

In order to build or evaluate interventions for behavioural change researchers rely on theories from sociology and/or psychology. Also persuasive technology plays a crucial role within the research of behavioural change and finds a wide usage in interventions for physical activity, health and environment. The table 1 shows an overview over applied theories and techniques in the nineteen selected studies per research area.

Authors	Research Area	Theoretical techniques for behaviour change
Ko et al., 2015	Smartphone use	Social cognitive theory, self-monitoring, goal-setting
Hiniker et al., 2016	Smartphone use	Technology non-use, goals, planning, feedback, monitoring
Lee et al., 2014	Smartphone use	Temporary non-use, coping strategies
Löchtefeld et al., 2013	Smartphone use	Digital detox, self-set rules to restrict app usage
Stawarz et al., 2015	Mix	Self-tracking, reminders, positive reinforcement
Conroy et al., 2014	Physical activity	Instructions, feedback, goal-setting, planning social support/change
Munson & Consolvo, 2012	Physical activity	Goal-setting, reminders; rewards, sharing, social networks, persuasive technology
Consolvo et al., 2009	Physical activity	Goal-setting, goals, goal source, goal timeframe, goal strategy, persuasive technology
Arteaga et al., 2010	Physical activity	Persuasive technology, Theory of Planned Behaviour, Technology Acceptance Model, Big 5 Personality Model.
Consolvo, et al., 2009b	Physical activity	Persuasive technology, Presentation of Self in Everyday Life, Cognitive Dissonance Theory, Goal-Setting Theory, Transtheoretical Model
Matthews et al., 2015	Physical activity	Persuasive technology, Persuasive Systems Design
Ludden & Hekkert, 2014	Healthier lifestyle	Transtheoretical Model
Maitland & Chalmers, 2010	Healthier lifestyle /physical activity	Self-monitoring
Choe et al., 2015	Healthier lifestyle	Self-monitoring, self-tracking, self-reflection, self-awareness
Bang et al., 2006	Sustainability	Persuasive technologies
Bang et al., 2007	Sustainability	Persuasive, pervasive <sup>2</sup> mobile games
Yun, 2013	Sustainability	Self-monitoring, advice, control
Kappel & Grechenig, 2009	Sustainability	Awareness
Bang et al., 2009	Sustainability	Pervasive persuasive games, motivation

**Table 1: Overview over applied techniques in selected studies**

<sup>2</sup> Pervasive games present a subfield of games. They are describes as games with the possibility of a playful interaction with the real world (Svahn, 2014).

Some interesting relevant results regarding effectiveness of persuasive features and techniques found in those selected papers are presented below.

### 2.5.1 Works related to smartphone use and non-use

Mobile phones due to their omnipotent presence in most people's life have regularly been used as means for behavioural change interventions. Recently studies aiming at changing specifically the smartphone use behaviour started gaining on popularity and importance in the field of HCI. Four studies that looked at strategies for supporting users to limit their smartphone use are going to be presented and discussed.

Löchtefeld et al. (2013) developed the app AppDetox and released it on Google Play Store. This app allowed users to create three types of rules in order to regain control over their smartphone use: the first type allowed opening specific apps only during selected daytimes. The second type of rules restricted selected apps forever and the last type used a customized countdown during which the access to the app is restricted. The second type of rules, restriction forever, was used most often in 60,6 percent followed by restriction during specific daytimes with 21,9 percent, which suggests that users are rather strict on themselves when it comes to smartphone rules. However, from over 11.000 different rules created by 11.700 app users, those rules were broken 78.927 times.

The online survey conducted by Lee et al. (2014) revealed a range of strategies people use to deal with negative aspects of smartphone use. The researchers identified five types of coping strategies: altering smartphone settings, intervention software, physical separation, mental methods and downgrading. The most used method was altering settings such as switching the silent mode on, turning notification off and removing apps. Users reported having troubles maintaining their coping strategies due to various reasons. Researchers state that this may lie in lacking systematic methods for self-monitoring. Interestingly, mental efforts such as personal norms on usage behaviour were able to successfully maintain the coping strategies.

Results regarding strategies for limiting smartphone use and their confined success were confirmed by another survey conducted by Ko et al. (2015). Their survey also showed that there are two categories of smartphone overuse that users would like to change: frequent short usage and occasional long usage. Among the survey participants 64 percent felt they were overusing their smartphones. Additionally to the survey the researchers analysed 41 smartphone intervention apps dealing with issues around smartphone addiction. They identified various persuasive and intervention techniques for mediating smartphone overuse, e.g. locking screen or apps, self-monitoring, and different kind of alarms. The most commonly used

mechanisms belong to the primary task support feature: 70 percent of apps used locking apps/screens and 68 percent supported self-monitoring, while only one app utilized social support. In order to analyse a new way of dealing with this issue the researchers developed the app, Nugu, for a group based intervention for improving self-regulation strategies. The app aims to help users with self-regulation by visualizing current behaviours, sharing them with a group and encouraging engagement through social competition. After a two week employment of the app the researchers concluded that social aspects could support the users' willingness for limiting usage and that social support is more critical than self-monitoring. Hence social learning and social competition could be relevant extensions to help limiting smartphone overuse (Ko et al., 2015).

The last paper to be introduced here deals with the smartphone overuse from the perspective of mindfulness and technology non-use. Hiniker et al. (2016) place the smartphone overuse problematic under the term of lagging resistance, which is according to Baumer et al. "a sense of wanting to quit but not doing so just yet" (Baumer et al., 2013, p. 3264). In order to face the overuse issue the researchers built the app MyTime by applying techniques such as goal-setting, planning, feedback, self-monitoring, and reflection. Furthermore the researchers categorized the users into four groups according to users' desires for change: reduction-focused users (users interested in reducing the smartphone usage in some way), non-reduction-focused users, context-focused users (willing to make a contextually specific adjustment) and non-context-focused users. The researchers draw a connection between the type of change users aspire and their interest in adopting different app features. For instance, context-focused users were keener to see reminders of their priorities than other users. Hence, according to their research outcomes, the desired change can be a predictor for the effectiveness of the intervention features.

## 2.5.2 Related works in other research areas

Works related to behavioural change interventions often target aspects of life such as physical activity, healthier lifestyle and sustainability. The most interesting aspects from the 15 selected papers are presented below.

In a meta-study Stawarz et al. (2015) analysed 115 habit formation apps and found that most of the applications focus on the initial stages of the behaviour change process and not on the habit formation. They identified 14 features that support behaviour change or habit formation. To the most often applied features counted: task tracking, goal-setting, progress tracking, self-monitoring, reminders, and rewards. While literature suggests that contextual cues, trigger events (event-based tasks) and, to some extent, positive reinforcement support habit formation, most apps are lacking those features (Stawarz et al., 2015).

Another meta-study conducted by Conroy et al. (2014) addressed the question about what kind of behaviour change techniques are mostly used in interventions for physical activities. The researchers came to the conclusion that techniques for behaviour change are not widely marketed in current physical activity apps and that users might need several apps to initiate and maintain behavioural change.

The goal-setting technique was the centre of the study conducted by Consolvo et al. (2009), who found that users preferred to set their own goals or work with an expert to set goals. Visual feedback build the core of another study by Consolvo et al. (2009,b). The researchers used a garden metaphor to provide visual feedback on behaviour and found this type of visualization to be highly effective, as it enabled the users to have an ongoing reflection of the progress, was visually appealing, and provided positive feedback.

When it comes to features of reminders and rewards the work by Munson & Consolvo (2012) found non-judgmental reminders to be positively perceived by users. Surprisingly, rewards such as trophies and ribbons failed to motivate users and thus raised the question about the design of such rewards.

Self-monitoring and self-tracking were investigated by Maitland & Chalmers (2010) within cardiac rehabilitation and by Choe et al. (2015) for sleep tracking. According to the former study the system should support partial changes of data and not represent incomplete changes as failure. It should also facilitate prioritization of behaviours in case multiple goals exist and show prioritized information first (Maitland & Chalmers, 2010). While investigating the sleep tracking app, SleepTight, Choe et al. (2015) came to following conclusions: it should be easy to remember to track data and here visual reminders such as widgets can be more powerful than time-based notifications. A very interesting finding was that people rarely take time to review feedback and to think about it aside from when they are entering the data. Based on that result, researchers emphasize the important difference between a fully automatized and a partly manual tool.

How to make interventions better correspond the users' current stage of change was investigated by Ludden & Hekkert (2014). The researchers suggest that matching the intervention design to the current stage of the user according to the TTM will help to create solutions that will be more easily accepted by users and will consequently increase the use of this kind of services.

Persuasive technology in form of persuasive games has found a broad implementation in interventions that aim at changing behaviour towards more pro-environmental. In this sense several persuasive games have been implemented and tested with the intent to modify behaviours related to energy usage in the household (Bang et al., 2006; Bang et al., 2007; Bang et al., 2009).

## 2.6 Summary of background and related works

The various and practical functionality of smartphones made their presence ubiquitous in people's daily life and so in lives of the study participants. The usage becomes a strong habit and the user cannot other than use the phone even in cases where there is no actual reason for it (Oulasvirta et al., 2012). Based on that, it is of importance for this thesis to design the intervention in a way that allows to study usage over a period of time in different life situations and hence in a real life context.

To solve the smartphone overuse issue is a tricky endeavour, as one must consider a variety of factors leading from harmless, controlled use to a problematic overuse and in extreme cases to addiction. The definition of overuse applied in this study is based on the subjectively perceived overuse that is investigated during interviews.

As the relevant works have shown, many smartphone users experience that they are using the smartphone too much and it interferences with their other daily activities (Lee et al., 2014; Ko et al., 2015). The questions and results regarding the usage and its impacts found in those works are supporting the design of interview questions, especially during the pre-study. Other related works like Consolvo et al. (2009) and Choe et al. (2015) provide valuable insights for the setup of the intervention study.

Most applications and technological interventions presented under related works aim at behavioural change or at change of habits in some way or another. In order to accomplish that, they use various persuasive and interventional techniques. However, apps like those tend to be abandoned after a short while (McLean, 2011) and if the app didn't manage to change the habit the user will most likely fall back into the previous behaviour before the intervention (Klasnja et al., 2011). The main issue behind those interventions according to Stawarz et al. (2015) is that they teach users to rely on technology and are only effective as long the technology is in use. Those aspects play a crucial role for the analysis and the evaluation of the study outcomes, as they provide a critical perspective for the limitations of technology itself and the ways the technology is designed.

## 2.7 Summary of theory

The Goal-Setting Theory argues that setting a goal is a crucial part to direct people's actions and has a direct effect on the performance. This theory is hence going to lead the design, the implementation and the analysis of the method.

Besides including goal-setting the methodology is going to be built around the features of self-regulation, self-reflection and hence self-efficiency, three core aspects of the Social Cognitive Theory. Those aspects play a crucial role for the



application based and even more for the non-application based approach of the empiric part of the study.

The Cognitive Dissonance Theory will be used in particular in the analysis of interviews, as the theory might explain some changes in perceptions, opinions and maybe actions among participants regarding their smartphone use. It can also help for the construction of post-intervention questions in order to see if participants tried to eliminate some inconsistencies and how they did it.

The table below shows the summary of the three theories that are going to be applied for the empirical part for the thesis:

Theory	Summary
Goal Setting Theory	Goals affect performance by directing attention and effort, energizing, persistence, and by triggering acquirement of new or use of task-relevant knowledge and strategies. Specific, difficult goals lead to higher performance than urging people to do their best. When goals are self-set, people with high self-efficacy set higher goals than people with lower self-efficacy. People with high self-efficacy are more committed to the assigned goals and to responding more positively to negative feedback.
Social Cognitive Theory	Five core human capabilities enable people to change and react to environment. Most important of them is the ability to learn by observing others and the ability to reflect. Self-efficacy defines how individual's perception of own capabilities impacts the perception of the performance success.
Cognitive Dissonance Theory	Human beings seek consistency between their attitudes and behaviours; inconsistency creates dissonance that needs to be eliminated.

**Table 2: Main theories**

Persuasive design as an approach that combines features from various theories into a method for behaviour change is used to evaluate which and how many persuasive features the tested applications use. Furthermore persuasive design is going to be applied as means for creating non-application based utilities that aim to support participants with ideas and inspirations for building own strategies for limiting smartphone overuse.

## 2.8 Research goal and research question

Based on the presented background and the related works around smartphone overuse, it can be stated that the problem is of general interests not only for the scientific world but for the modern society itself. The goal of the current thesis is to investigate different strategies applied by smartphone users in order to avoid or limit subjectively perceived overuse, which they personally experience as disturbing in some way. As previous research shows the non-application (or non-technology)

based approaches have so far only been approached in online surveys and are solely based on self-reports. To the knowledge of the author the non-application based approaches have not yet been investigated in a frame of an intervention study, neither in a combination with application based approaches. The current thesis is aiming at filling this gap by answering the following research question and three sub-questions:

**How does an application based and a non-application based intervention influence behavioural change?**

1. In how far do goal-setting and self-efficiency related aspects contribute to the intervention?
2. What strategies do the participants implement for behavioural change?
3. How do the participants experience the two intervention approaches?

Based on the study outcomes the second research question takes a look into the future by asking: **What can be learned from the results for future persuasive design?** By answering that question the current research is aiming to provide insights and recommendations for possible future designs for interventions that intent to support a healthier balance between the pressure of always being available and the presence in here and now.

## **3. Method**

The following section is devoted to the overall methodology and the choice of the applied scientific methods within the project. Furthermore the alternative scientific methods are discussed and the limitations of the chosen methods presented.

### **3.1 Research paradigm**

Before diving into the chosen methods there is a need to define how the knowledge and context are scientifically perceived and approached. Ontologically, the question after the nature of reality, the world and knowledge are built socially, in interaction between different agents and psychologically, by making sense of the collected data. Concerning the epistemology, the type of knowledge and how to generate it through research, this study focuses on understanding and evaluating different perceptions of the reality based on the subjective understanding of study participants and the researcher. As the constructivist standpoint allows interpreting the context within the frame of reference, it offers the appropriate research paradigm for this study (Oulasvirta et al., 2005).

## 3.2 Overall methodology

The overall methodology applied in the thesis follows the principle of Action Research. Action Research studies how technology is applied in the real world and the practical consequences of actions enabled by technology. Action Research can be applied to address various fields ranging from health or environmental problems to workplace issues (Kock, 2014). An action researcher aims at bringing improvements through making changes in a problematic situation and at generating new knowledge as a result of his/her activities (Hayes, 2011). The key data collection methods for an action researcher are participant observation and interviews. While trying to have as little control as possible on the environment being studied, the researcher applies some kind of 'positive' intervention (Kock, 2014). The action researcher is actively involved in the context of the investigation and works together with "people experiencing real problems in their everyday lives" (Hayes, 2011, p. 15:3) in order to bring about change. In the process the researcher engages relevant literature and identifies existing theoretical frameworks of relevance (McKay & Marshall, 2001).

Action Research typically follows a five steps circle: diagnosing, action planning, action taking, evaluating, and specifying learning. Diagnosing involves the identification of a general problem to be solved. The second stage, action planning, is considered with alternative solutions to solve the identified problem, while the action taking stage deals with the selections and implementation of the chosen solution. The evaluation stage analyses the study outcomes. The last stage, specifying learning, reviews the outcomes and builds new knowledge (Kock, 2014). The five stage process is repeated until the desired change is achieved (McKay & Marshall, 2001).

For the current thesis this methodology is seen as the most suitable one as it aims to bring change in a problematic situation by first engaging relevant literature, evaluating alternative solutions, analysing the investigation results and gaining transferrable knowledge.

There are however differences between the typical Action Research process and this thesis. The objective is not to instigate change in the study subjects, but to let them reflect on their own strategies for change. The research goal is rather to understand the strategies that trigger change than to cause change. Furthermore the study undergoes only one iteration of Action Research, hence the researcher might not be staying with the process until the desired goal is achieved.

## 3.3 Research methods

The following section presents and discusses the chosen methods and scientific approaches for the study.

### 3.3.1 Qualitative research method

For the current project the researcher's interest lies not in measuring and comparing data like total time users spend on the phones or amount of times users check their phones over the intervention period. On the contrary, the interest behind this research lies in a better understanding of the role the smartphones have in users' daily lives and in finding ways to make the interaction with the technology to not negatively interfere with other activities. The study is aiming at finding out how each approach of coping with smartphone overuse is perceived and what are the factors that contribute to a successful behaviour change. Due to the nature of the research questions and the studied phenomena, the qualitative method was chosen as means to collect and analyse the data from both the interviews and the intervention.

Within qualitative research methods the researchers systematically evaluate and arrange the material in order to get to results (Bogdan & Biklen, 2007). The main challenge of this method is to differentiate between relevant and irrelevant information and to identify meaningful patterns (Patton, 2002). Flick (2014) differentiates between three purposes of qualitative research. The first one can be to describe a phenomenon, which can be anything from subjective experience, social situations and interactions to social practices. It is also possible to compare several cases in order to see what they have in common and how they differ. Another purpose is to identify reasons for those differences that had been identified. And the last purpose can be to develop theory around the studied phenomena.

### 3.3.2 Within-group design

Each study participant is going to be exposed to both intervention conditions due to the sample size. While one half of the participants starts with the application based approach, the other half starts with the non-application based approach, which will limit the likelihood that the order of conditions impacts the outcome (learning effects of dealing with overuse, fatigue with the study). Since in a within-group study design setup the same participants are exposed to different conditions, only one group of participants is needed, which allows for a smaller sample size than in the between-group design, where each participant group is exposed to only one condition (Lazar et al., 2010).

### 3.3.3 Semi-structured interviews

Before and after the intervention the researcher conducts in-depth interviews in order to, first, understand the situation and, second, analyse the intervention outcomes. The method of semi-structured interviews combined with an online survey was implemented for the pre-intervention data collection. The advantage of interview as a research method lies in the possibility to dig deeply into a topic by providing

interviewees with the freedom of giving detailed responses. Reflections and considerations can be stimulated. The disadvantage of interviews lie in recalling of the past, and hence in relying on the information that interviewees remember at the moment of the interview (Lazar et al., 2010). The choice of semi-structured interviews was made due to the benefit of this method of addressing specific prepared questions with the possibility of digging deeper and broader into the topic where possible, depending on the experience and answers of the interviewee. Furthermore questions can be rephrased in case they were not clear or do not lead to a reply and new questions can be added on the flow (Lazar et al., 2010).

To collect additional information besides the interviews the researcher constructed an online survey on the basis of the questions and replies gathered in the pre-study interviews. That offered a quick way to gain additional insights about the smartphone usage and to supplement the interview data. The advantage behind using a survey lies first of all in the access to a larger amount of people and in the unobtrusiveness of this method due to anonymity of participants. Similar to interviews surveys rely on the recalling of the information but compared to interviews they don't allow to go deeply, as no follow-up questions can be asked. Besides, resulted data may be biased "when the questions are related to patterns of use, rather than clear factual phenomena." (Lazar et al., 2010, p. 101)

### 3.3.4 Diary

In order to guide the participants through the intervention and to give them inspiration for the non-application based approach a toolkit was used. An additional benefit of the toolkit is the possibility to collect information and to reflect on it, which can provide a support for the post-intervention interviews. One of the most important features of the toolkit, however, is the diary feature. Applying a diary as a research method gives the advantage of "studying the use of a technological device in a real-world setting" (Lazar, 2010, p. 130). The participants received a paper calendar with predefined fields for entries for each day of the intervention study (see figure 7). They were asked to fill the calendar every day by answering one specific question. The diary fulfils partly the purpose of a feedback and partly of an elicitation diary. A feedback diary aims at data collection, where data is recorded on a regular basis based on an instruction, while an elicitation diary is recorded when participants find events worthy of recording and is used for later interviews (Lazar et al., 2010). The structure of the project diary has features of a feedback diary, but its purpose is not to record data only but to reflect upon it together with the participants. A detailed description of the toolkit including the diaries is discussed in the subsequent section.

As the participation to keep a diary typically tends to drop off after one to two weeks (Rieman, 1993), it was necessary to add an additional component to the paper diary.

Furthermore, as all research methods have their strengths and weaknesses, combining different research methods can provide a better understanding of phenomena than when using only one method (Lazar, 2010). Thus, an online weekly survey was sent to the participants to provide them with means for reflection on their weekly goals and the researcher with information for later interviews (more about survey in section 3.6.2).

The toolkit including the online survey provides a ground for the interviews that are conducted in the end of the intervention study in order to summarize participants' experiences and to answer the research questions. The toolkit is therefore beneficial as it allows, in similar way as a cultural probe<sup>3</sup>, to familiarize oneself with the interviewee and to complement data with longer-term reflections and subjective issues (Mattelmäki, 2006).

### 3.4 Methodological limitations

The study setup has several limitations: The study has an explorative character and focuses on qualitative research methods while analysing a small sample group. The sample group is not representative neither for the entire population nor for the analysed age group due to the selection method of the participants. Those aspects delimit the possibility of the generalizability of the results. Furthermore the study is limited to subjective measurements, while statistical significances are not considered. The length of the study does not permit to make conclusions regarding long-term effects and therefore the actual behaviour change cannot be studied.

### 3.5 Discussion of alternative methodologies

Alternatively to considering only qualitative data collection and analysis methods a combination of qualitative and quantitative research was considered, especially for the gathering and analysing of the survey data from the pre-intervention survey and the online diary data (elaborated in the next section). Indeed a very limited quantitative analysis of the survey data is going to be conducted, however, in order to answer the research questions the main focus of the data collection lies on the qualitative method.

Instead of using the toolkit or as addition to it one could have organized a group meeting with all study participants and gone through persuasive techniques and coping strategies for limiting smartphone use. This way a discussion could have been encouraged and a possibility for new ideas to evolve. However, the addition of an organized workshop to two in-depth interviews and a five weeks intervention

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<sup>3</sup> Cultural probe as a method was originally introduced by Bill Gaver et al. (1999) as a tool that is able to "address a common dilemma in developing projects for unfamiliar groups" (p.2). The probe is usually a package including several objects such as postcards, maps and other items. The aim of cultural probes is to provoke inspirational responses among study participants.

study might have felt too overwhelming for the participants. Thus, the researcher decided to skip the workshop as its benefit might not have paid off the effort and it might contribute to participants dropping off.

Another alternative to the toolkit could have been to design the intervention study without the toolkit and instead the researcher could highlight participants' personal goals based on the interview results and later leave it completely to the participants how to reach those goals. The toolkit, however, plays first of all a role of a reminder about the study but it also serves as ground for a later discussion and provides an easier access to participants' experiences and thoughts.

It has been also considered to design an online diary in form of a survey instead of a paper diary. This online survey would be sent daily at a specific time asking a specific set of questions. One benefit of this type of diary lies in its reminder character, another is that the researcher could directly see the responses. However, the presence of the researcher would be more permanent and hence more obtrusive throughout the intervention study, which could lead to more biased results (Trochim, 2006). Furthermore in a study, which deals with limiting technology use, applying a technology to gather daily information seemed contradicting. The calendar on the other side has the advantage of allowing participants to reflect on their progress, which represents one of the core aspects for the self-efficiency and its physical presence could be a stronger reminder than an online survey.

### 3.6 Method application

The following section includes a description of the chosen methods and techniques and their relationship to the theoretical background. The figure 3 provides an overview over the different phases of the study, starting with a pre-study that included interviews and a survey, followed by a five weeks long intervention study and finishing up by final interviews.

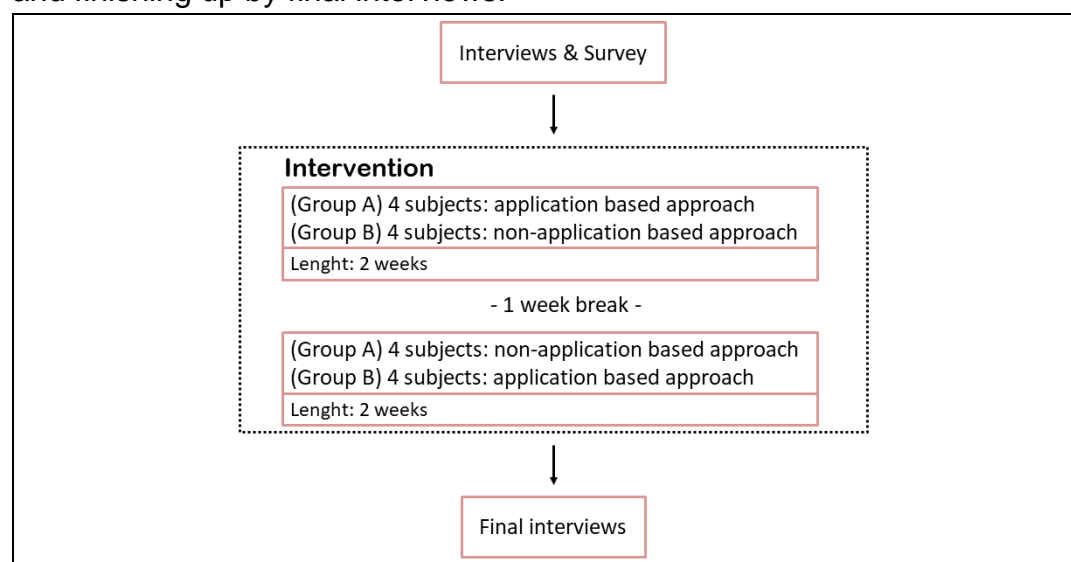


Figure 3: Study setup

### 3.6.1 Pre-study interviews

The first step in the study was to conduct interviews with smartphone users in order to get an overview over usage, coping strategies with the overuse and the personal perception of the smartphones and their roles in the daily life. Altogether 12 in-depth interviews were conducted and each interview lasted between 30 to 60 minutes. The length of the interview depended on the willingness of the interviewee to share and also on the amount of considerations the person had regarding the smartphone use. A convenience sample was used to recruit interviewees, people the researcher knew and acquaintances of those people. The interviewees are between 24 and 40 years old and live in Sweden. Three of them are female and nine male.

The interview contained 22 questions, starting with warm-up questions as recommended by Lazar (2010). The two warm-up questions were: "Can you please describe what you use your smartphone for?", "In which situations during the day do you use your smartphone?" Those questions were supposed to help the interviewee to start reflecting on his/her smartphone use and on the role this technology has in his/her personal life.

The next set of questions aimed at a deeper reflection of the smartphone use, e.g.: "In which situations do you feel using a smartphone is inappropriate?"

Another set of questions targeted more personal experiences of the interviewee such as a question if anyone has ever criticized interviewee's smartphone use and vice versa and either the interviewee has tried anything to reduce his/her smartphone use.

In order to understand in how far habits, in particular the checking habit (Oulasvirta et al., 2012), play a role for the users, following questions were constructed: "Why do you think it is easy or difficult to reduce smartphone use?", "Have you experienced situations when you check your phone without any particular purpose?"

Some questions were inspired by the other works such as the question about the priority of offline versus online interaction was inspired by Ames' (2013) research on an American college campus. Three other questions were borrowed and adjusted from Hiniker's et al. (2016) paper, as they were relevant for the current research: "How do you feel about the amount of time you spend on your smartphone?", "If you could change one thing about the way you use your smartphone, what would it be?", "Describe an activity on the smartphone or an app that leaves you feeling drained of energy, unproductive, or dissatisfied".

The last set of questions concerned social rules users may apply for not using the phone as well as a deeper discussion about the impacts of smartphones on social



interactions. At last to close the discussion with an easier question each interviewee was asked if he/she could imagine his/her life without the smartphone.

Not all questions were asked in the same order and some questions were skipped depending on the dynamic of the conversation. The full questionnaire is attached to the appendix.

In order to test the quality of the interview questions the first interview functioned as a pilot-test. That helped to organize the order of the questions in a better way and gave an idea of the length of the interview (Lazar, 2010). For instance the last question was previously among the first ones but was moved to the end after the test interview.

During the interviews the printed sheet of paper with the questions was held in a block, so that the interviewee was not able to see the list.

Almost all interviews were audio-recorded, except of two where participants preferred to not be recorded. In all cases the interviewer recorded the main parts of the replies on paper as this helped to keep track of non-verbal cues and researcher's own comments (Lazar, 2010).

In order to analyse the collected interview data the researcher went through the written notes and the audio recordings of the interviews and transcribed the answers digitally. After that the interview replies were organized by themes, which allowed getting an overview over similarities and differences in answers. The identified themes mainly overlap with the interview questions. An overview over the topics and a detailed elaboration on them follows in the chapter 4.1.

### 3.6.2 Survey

In order to collect further insights and to back up the interview outcomes an online survey was conducted. GoogleForms were used as means to set up the survey and collect the data. The questions for the online survey were based on the interview questions and answers but were rephrased and adjusted to fit the closed-ended setup. Altogether twelve closed-ended and two open-ended questions were constructed for the survey. It was deliberately chosen to limit the amount of open-ended questions as those might be easily misunderstood (Lazar, 2010). Based on literature recommendation the demographic data were asked in the end of the survey (Lazar, 2010).

As both the wording and the overall structure of the survey are important, the survey was tested in two steps (Lazar, 2010). First, the survey was analysed by two colleagues and by an expert, who works with research in the industry. In the second

step it was tested by a potential respondent in the presence of the researcher, which allowed an evaluation of the cognitive and motivational qualities of the survey. After each test the survey was optimized accordingly to the received feedback. The final survey was sent to a convenience sample consisting of co-students, but also to students from other programs. Twenty one replies were gathered and the gender distribution was 13 males and 8 females. 16 of them were between 21 and 30 years old, 4 were between 31 and 40 years old and one was over 41. The country of living was mostly Sweden followed by Germany, Japan, and Israel.

The survey data was mainly analysed within GoogleForms since the tool provided a good overview over the collected results. Each question or in some cases a group of questions represented a theme according to which the data was analysed (see chapter 4.1). The themes were the same as the ones identified in the interviews, except that interviews covered more topics.

### 3.6.3 Intervention study

The intervention period run for five weeks starting on the 27th of February until the 2nd of April 2017. The study consisted of two intervention parts, the application based approach using two mobile applications and the non-application based approach. Each intervention lasted for two weeks with a break of one week in between. The reason for the break is going to be explained later. In the end of each intervention week the participants received a weekly survey asking them after their goals, perceived success of fulfilling those goals and the applied strategy. The survey was adjusted depending on the approach the participant was currently testing. The goal behind the weekly survey was to collect information such as participants' goals and their applied strategies to alter their behaviour as a basis for the later interviews. It furthermore allowed participants to have additional explicit reflection on their progress.

#### 3.6.3.1 Participants

Out of the twelve interviewees eight agreed to participate in the intervention study. Three participants were female and five male. The age ranged from 25 to 32 years and all participants live in Sweden in the Stockholm area. All participants are employed, have no children and live individually or with their partner. The table 3 presents an overview over the eight study participants including fake names, demographic data, which intervention approach they started with, living situations and a short introduction to their smartphone usage and relevant personal reflections on the impact of the smartphones.

Name	Age	G	1 <sup>st</sup>	Living s.	Main usage	Personal facts + reflections
Dan	31	m	App	With partner	News, work e-mail, chat apps	-One reason to not buy a new phone with a bigger screen is because he thinks he would use it more. -Dislikes the expectation to be always available.
Helen	25	f	App	With partner	Games	-Feels guilty when others complain but still wants to finish playing. -Thinks we miss reflection in our lives.
Anna	28	f	N	With partner	Social media, chatting	-Has it always with her, tries to use it a bit less due to partner's complains. -Believes the phones make us less focused.
Noah	29	m	App	Alone	Social media	-Got a new phone with a large memory & has lots of apps. -Feels that people forget to be social.
Olga	32	f	N	With partner	News/ social media	-Might use it when being bored in a conversation. -Gets irritated at people in subway being slow because they are staring at the mobile.
Steve	31	m	N	Alone	News, social media, notifications	-Tries to create usage rules for himself. The only participant who may criticise his friends' usage. -Sees an impact on discussions: Why don't we have a common etiquette for usage?
Kim	32	m	N	With partner	News, short pick-ups	-Didn't think he is using the phone too much until girlfriend complained. -Believes we might need common usage rules.
Andrew	30	m	App	With partner	Games, notifications	-His phone is always on silent so he keeps it with him to feel vibrations. -Tries to use it less as feeling too stressed. Practices mindfulness.

**Table 3: Overview over the study participants including the approach they started with**

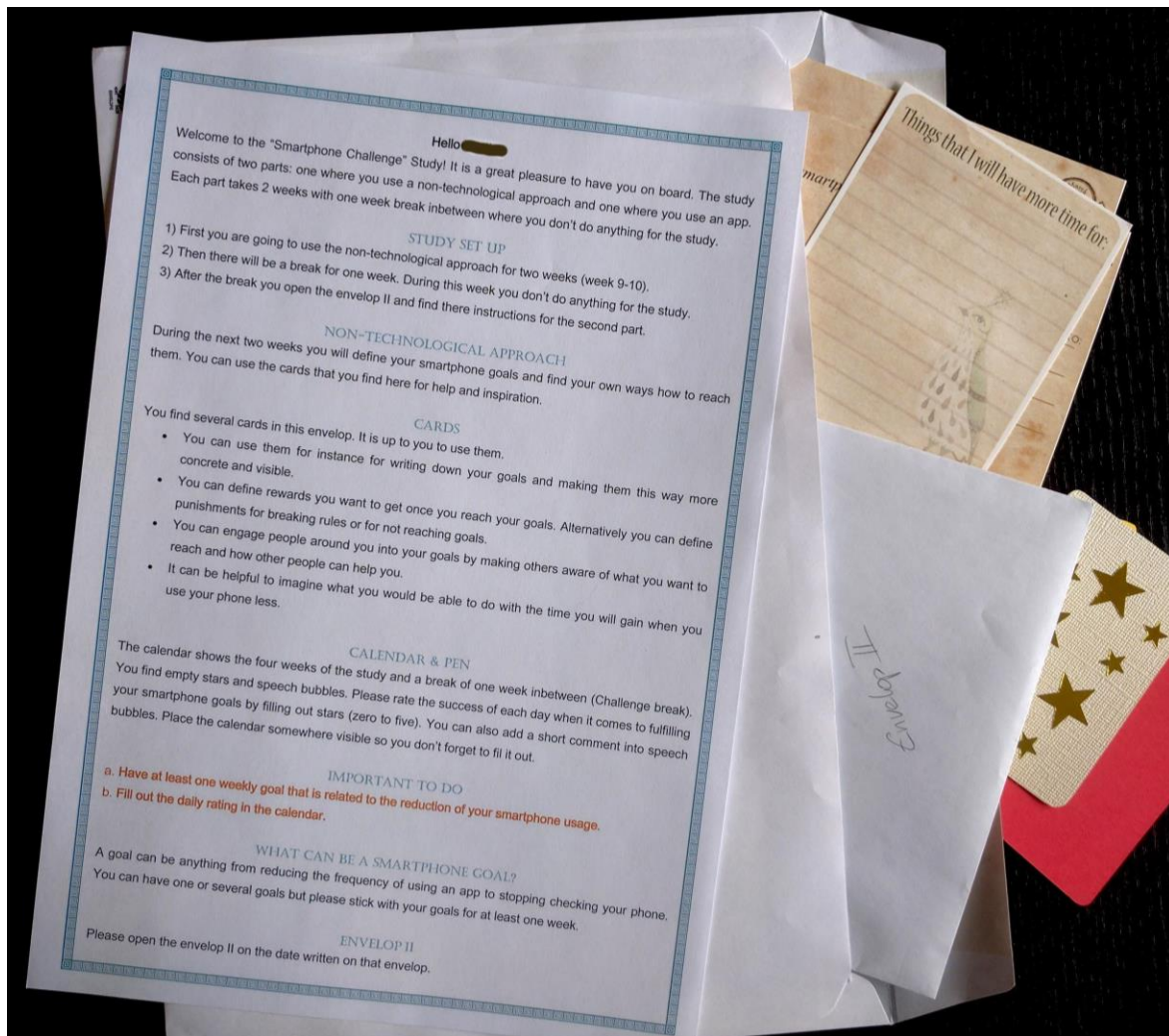
After the initial interviews the participants were informed about the basic setup and the length of the study. Before the intervention study started, each participant received an envelope containing the study description and several other items. This envelope is referred to as toolkit for better understanding.

### 3.6.3.2 Toolkit

During the preparation for the intervention study it was crucial to find an appropriate mobile application that can help users to reduce smartphone use and to define what is going to be a part of the non-application based approach. Inspired by the cultural probe approach (Gaver, 1999) a probe (a toolkit) has been designed that included both intervention parts. Each of the intervention parts is going to be presented in detail.

The purpose behind the toolkit was to communicate the study procedure, the meaning of each intervention part and the expectations on the participants in the best possible way. Additionally the toolkit provided inspiration and food for thought for the non-application based approach in order to not leave the participants in uncertainty.

The toolkit consisted of two envelopes, a big envelope for the first intervention and a smaller envelope inside the big one for the second part of the study. A text on the smaller envelope explained when the envelope is to be opened.



**Figure 3: Toolkit**

As a within-group study design was applied, four participants started their intervention by using the mobile application and four others started with the non-application based approach. Hence, the content of the first envelope depended on the first condition to be tested. A calendar and a pen were included in the first envelope independently on the approach. Furthermore each envelope included a personal letter with a description of the current part of the study.

### **Letter**

The letter depicted the aim of the study, its setup and the detailed information about the current approach and what is expected from the participant. Two mandatory things were requested in the letter: participants should daily fill out the calendar and they should have at least one weekly goal. Those two aspects are crucial for the study, as by defining the goals participants allocate energy and focus toward their achievement (Locke & Latham, 2002) and the calendar allows for self-monitoring that helps participants to evaluate their performance and to reflect on it (Luthans & Stajkovic, 1998). Deliberately the researchers limited the mandatory elements to only two in order to not make the participants feel overwhelmed and to leave them the freedom to act in their most natural way.

The letter was tested on one of the participants in order to figure out if the text was understandable and the person knows what is expected. After the test and minor text adjustments the envelopes were distributed to all other participants. (Examples of the letters are attached to the appendix of this thesis.)

## **Setup**

To optimize the intervention design and in the same time to simplify it for the participants the setup followed the research outcomes made in Consolvo's et al. (2009) work. In their study the researchers found out that their study participants preferred their goals to run for a calendar week starting on Monday and then to reset them at the end of the week. Furthermore the participants preferred a seven day window, as it gave them a clear deadline and provided a fresh start each new week (Consolvo et al., 2009). Based on those results both interventions start on a Monday and the weekly survey is sent in the end of the week on a Sunday. Here lies also the main reason to include an intervention break between the two approaches. As each intervention was targeted to run a full week from Monday to Sunday, it has been decided that a break would help to organize the two intervention parts so that no day is lost. Furthermore the break was expected to help the participants to easier mentally differentiate between the two intervention parts.

## **Calendar and pen**

The calendar included the four intervention weeks and the break week (see figure 7). Each day had five empty stars and a small empty speech bubble that allowed for short comments to be written. The participants were asked to fill out the stars every day by answering the question "How successful was my day when it comes to fulfilling my smartphone goal(s)?" One of the functions of the calendar was to track participants' progress during the entire study by visualizing it and this way to allow the participants to reflect on their progress. According to the Persuasive System Design (Oinas-Kukkonen, 2009) a system that keeps track of users' performance fulfils the principle of self-monitoring. By allowing participants to evaluate their performance according to their goals by looking back, the calendar fulfils the self-regulation and the self-reflection capabilities (Luthans & Stajkovic, 1998). Another function of the calendar was to remind participants of the study and the goals they set for themselves (Oinas-Kukkonen, 2009), as they were asked to place the calendar in a visible spot in their apartment.

The pen had no further function as to be a pen that can be easily attached to the calendar and hence to minimize the hassle for participants to fill it out. When designing persuasive systems one of the core aspects in Fogg's Behaviour Model for Persuasive Design is simplicity (Fogg, 2009). Attaching a pen serves the purpose of minimizing the physical effort of looking for a pen, which is the third element of simplicity according to Fogg (2009).

### 3.6.3.3 Application based approach

The envelope for the application based approach contained besides the calendar and the pen a letter with the name of the application to be tested. None of the participants has used any of the two tested applications, as proven in the interviews. The android smartphone owners received the name for the android application and the iPhone owners received the name of the IOS counterpart.

Ideally all participants would test the same mobile application. Three of the participants had an android phone and five owned an iPhone. The researcher searched for an application that both systems have in common. Two such applications were found, however one of them “Checky” has only one single feature, which is to count how often the phone has been opened. Due to this major limitation that application was excluded. Another application, “BreakFree”, seemed first appropriate but it turned out that the IOS version of it is lacking several important features of the android version and thus was extremely limited. This way the participants would actually not be testing the same application. Additionally the interface of that application looks very cheap and mediates little trustworthiness. Hence it has been decided to find two different applications with as similar features as possible. In the end the app “Moment”, at this moment of time only available in IOS, has been selected and the app “QualityTime” for Android. As the “Moment” app has a strong feature of teaching users to change habits that was missing in the android app, the IOS participants were asked to not use that particular feature.

#### **Quality Time App**

The “QualityTime” application shows on the home screen current day’s smartphone usage by providing information about the total usage time, the total amount of times each smartphone app has been used and opened, screen unlocks and an overview over today’s actual usage as a vertical bar starting at midnight (figure 5/1). Tipping on the arrow opens the more detailed usage view where the user gets an overview over apps she/he uses mostly per day or on a weekly base. The “QualityTime” app also provides a graphical view over usage over time, which allows the user to understand when the phone has been mostly in use (figure 5/2-3).

This intervention application provides the user with the possibility to schedule breaks for a specific amount of time (figure 5/4-5). While on break the user is not able to use apps on the smartphone since a screen is blocking the apps (figure 5/6). Furthermore the user can set usage and/or unlock alerts, that will alarm the user when the targeted amount of total usage time or of screen unlocks has been exceeded.

All the tracking runs automatically and the user does not need to do anything but provide the “QualityTime” app with accesses it requests.

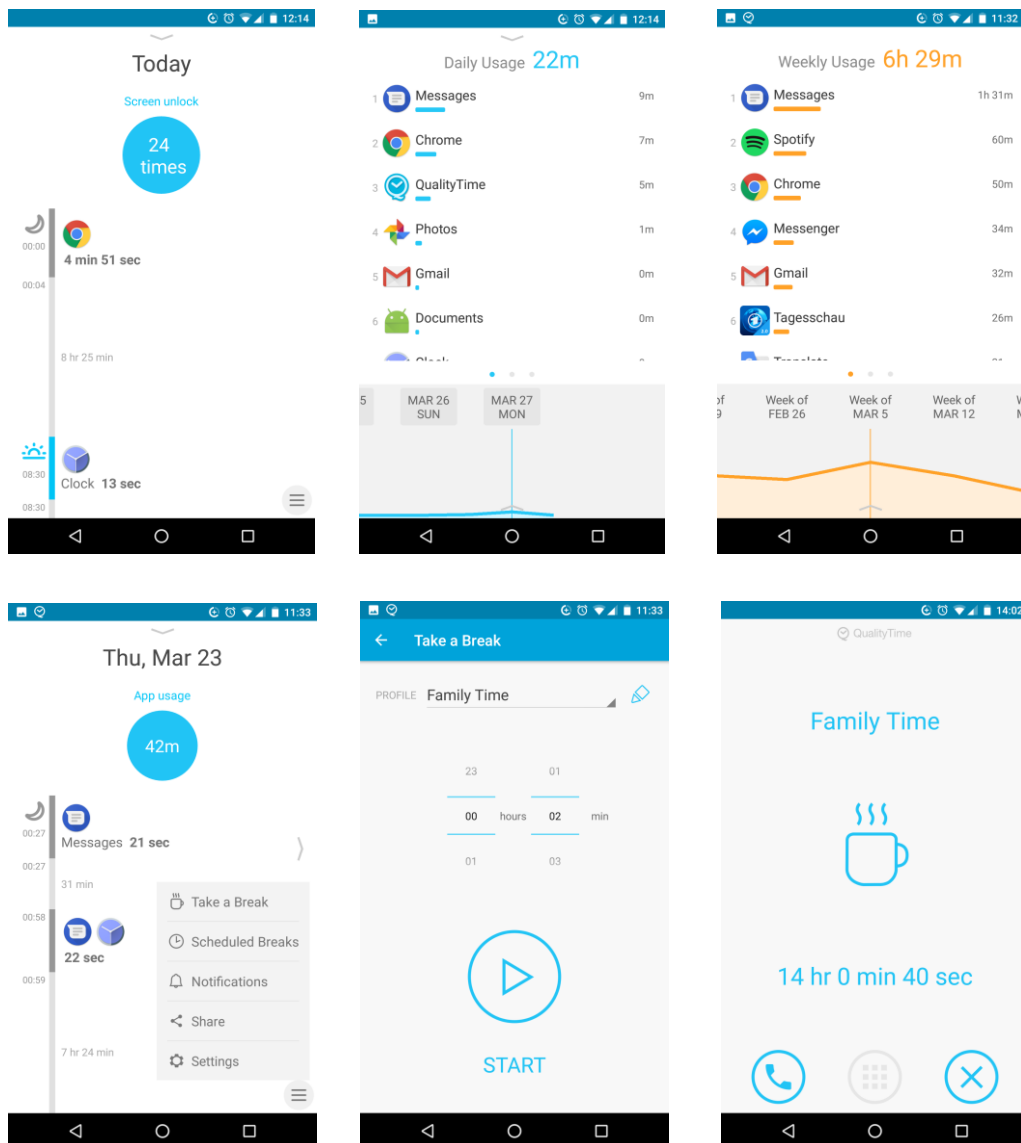


Figure 5: QualityTime App

## Moment App

The participants who own an iPhone used the “Moment” app. On the home screen of the “Moment” app the user sees an overview over today’s total usage time and the usage time from the latest days. The colour of the bars indicates with green, yellow and red low, high and very high usage, which depends on the limit the user sets for him/herself. When choosing one day and clicking on it the user gets more detailed usage information visualized by a vertical bar starting with the first pick up. Here the user can also see the total amount of phone pick-ups. The app is capable of showing the most used apps, but it doesn’t do it automatically, thus the user must take some steps to import this information into the app.

Under ‘Settings’ the user gets the opportunity to set daily mobile usage, which is the total time the user wishes to use the smartphone, to personalize reminders when the limit has been exceeded and to schedule screen free time. For the latter the user can personalize from when and for how long the screen free time is supposed to last.

Once screen free time is active the user receives pop-up messages reminding about it.

The app also has a few social features for family monitoring and a so called 'Bootcamp' feature, but those have not been used as they are missing in the android app.

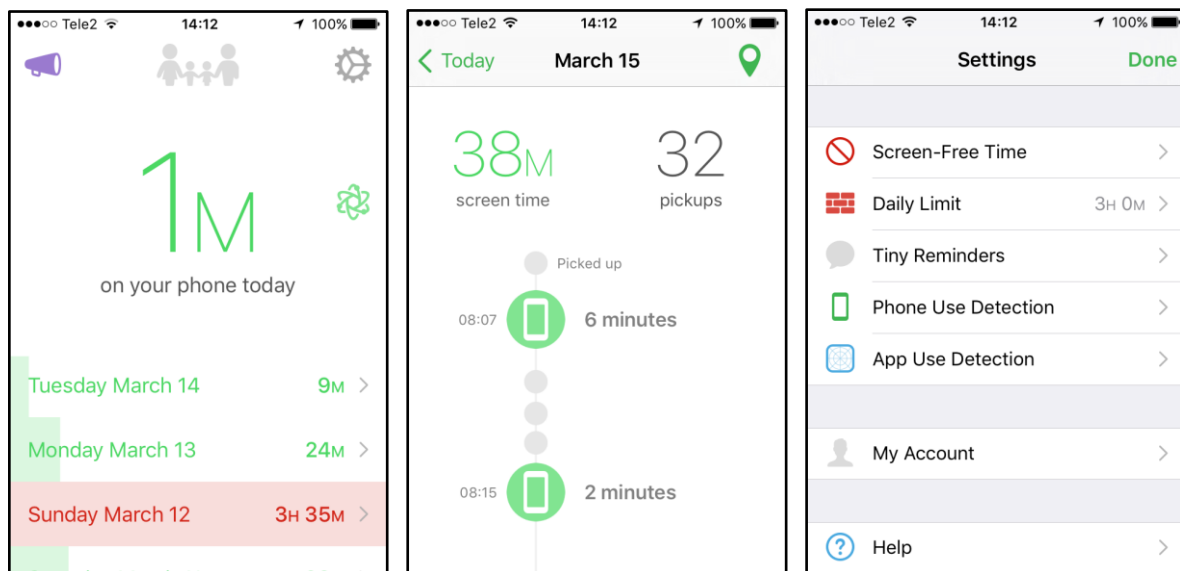


Figure 6: Moment App

### Persuasive design features

The applications include several persuasive design features. One of the core features both applications share is the possibility to provide the users with means for *self-monitoring* by tracking the usage performance (Oinas-Kukkonen, 2009). And this is implemented in various ways by showing time of usage, content of use and different types of overviews (daily, weekly).

*Visual praise* (Oinas-Kukkonen, 2009) is offered by the “Moment” app by highlighting the usage time in different colours.

Both applications allow the user to set *reminders* (Oinas-Kukkonen, 2009) that help to limit the mobile screen time while the system is in use. Those reminders are also means for users to define own *goals* such as the maximum amount of time the user wishes to spend using the mobile phone or goals connected to screen free times in more or less specific context of use (i.e. time of the day).

Both applications can be described as visually appealing and fulfil hence the principle of *liking* according to the Oinas-Kukkonen’s persuasive system design (2009).



### 3.6.3.4 Non-application based approach

In the envelope for the non-application based approach the participants could find besides the letter, calendar and the pen several cards (see figure 7). In the letter for this part of the intervention the participants were informed that it is up to them to use the cards and that the main purpose with the cards is to provide them inspiration but it is not a must to use them all.

It was also up to the participants to apply any strategy they want to limit their smartphone use. Originally, it had been considered to supply participants with a set of coping strategies, the ones found in literature and in the pre-study and to ask participants to test them. However, it was of a bigger interest to analyse people's own strategies instead of ones brought upon them.

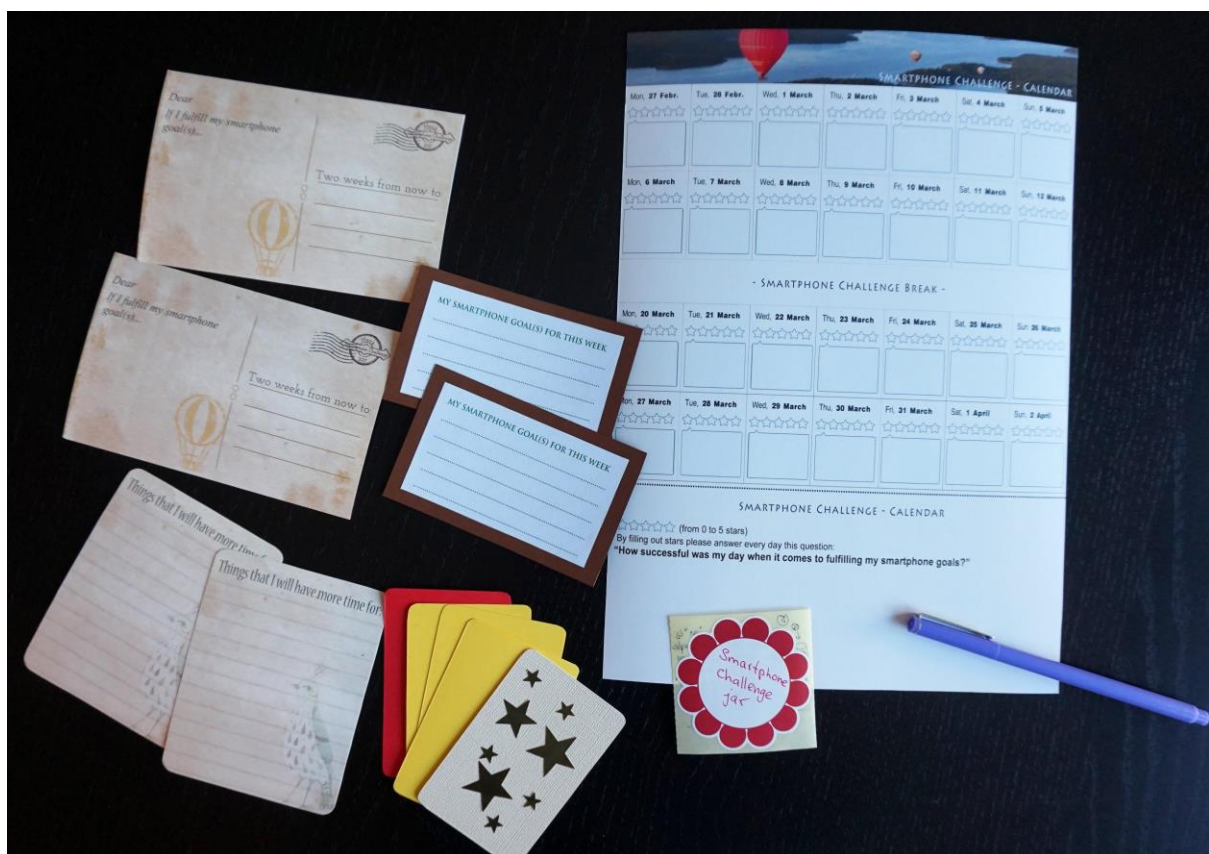


Figure 7: Non-application based approach

*Goal cards* motivated the participants to write down their smartphone overuse related goals. According to the Goal-Setting Theory goals have a variety of effects on the performance (Locke & Latham, 2002) and hence were chosen to be a part of the toolkit. Each participant received two goal cards, one for each week of the non-application based part of the intervention.

Another type of cards represented the *reward cards*. When filling out the card, the participant defines a reward he/she wishes to gain once the goal is fulfilled. In Oinas-Kukkonen's (2009) Persuasive System Design rewards are stated to have great

persuasive powers while they give users credits for their performances. The reward cards stand furthermore for an anticipation of a positive outcome (the hope/fear dimension), which is one of the core motivators in Fogg's behaviour model (2009).

As counterpart to rewards and hope stands the *swear jar* concept as a fear motivator (Fogg, 2009). "Fear is the anticipation of something bad, often the anticipation of loss." (p. 4) In the case of the swear jar it is the fear of losing money that is a motivator for a behaviour.

The cards that ask the participants to write down things they would have more time for when spending less time on the smartphone follow Bandura's *success scenarios* visualisation (Bandura, 1989). These cards represent the idea that cognitive "simulations in which individuals visualize themselves executing activities skilfully enhance subsequent performance." (Bandura, 1989, p.1176) According to Bandura perceived self-efficiency and the cognitive simulation have a bidirectional effect on each other. While a high sense of self-efficiency contributes to cognitive construction of effective actions, a cognitive simulation of efficient actions enhances the self-perception of efficiency. By visualizing positive scenarios, here the possibilities the participant will have when wasting less time on the smartphone, the cards might increase the perceived self-efficiency and hence provide a positive guide for the performance (Bandura, 1989).

The last type of cards has a social character. The cards with stars could be used to provide *visual praise* for positive progress (Oinas-Kukkonen, 2009). This way they provide social feedback based on the behaviour. The cards can be freely interpreted by the users and used as warning, in the sense of different stages of warning (yellow and red) or only for praise. Those cards can also serve for cooperation between the participant and with him/her together living partner, which in its turn can motivate users to adopt target behaviour (Oinas-Kukkonen, 2009).

### 3.6.4 Post-intervention interview

Before the final interview took place the interviewer went through each participant's weekly survey replies and pre-study interview data in order to familiarize herself with the process each participant went through and hence to be able to optimally use that information for the final meeting.

The interviews started with a warm-up question where the participants could talk about his/her general experience with the study. The calendar and the other cards, as far used, served as supporting tools for both the interviewees to recall facts and the interviewer to target more specific questions.

Similarly to the interviews in the pre-study the post-intervention interviews followed the semi-structured setup. Besides aiming at finding answers for the defined research questions the interview questions also included the theory of Goal-Setting, the Social Cognitive theory and the Dissonance Theory for guidance. Hence, one set of interview questions discussed in details the goals that the participants set for themselves. The Social Cognitive Theory guided the interviews in two ways, first by evaluating in how far participants believed in achieving their goals and secondly by leading the interviewees toward a discussion about self-awareness and self-regulation. The Dissonance Theory provided ground for evaluation of participants' possible changes in opinions regarding mobile usage and for an understanding how participants went along with breaking rules they set for themselves.

Another set of questions analysed in detail the experience the study subjects had with each approach and how those approaches helped them to reach their goals.

At last, different topics were discussed with the participants ranging, depending on the participant, from experience of stress level, personal benefits for smartphone use reduction to things users found most useful to reach their goals.

The interviews took place during two weeks after the intervention study had finished and lasted between 45 to 60 minutes. All interviews were audio recorded in agreement with the participants. The interview questions can be found in the appendix.

In order to analyse the collected interview data the researcher first transcribed the entire interviews digitally and printed them out to get a better picture and the possibility to overview all interviews at a glance. The interviews were then colour coded based on discussed themes, which simplified the analysis. Once the themes were identified the researcher was able to summarize the results and to see patterns. An overview over the themes is presented in the result section 4.2.

### 3.7 Ethical aspects

The researcher had informed the participants about the reasons behind the study and its procedures in advance so they could decide whether they are willing to participate or not (Lazar, 2010).

Due to the fact that during the interviews both audio recordings as well as interview notes were taken, it was of highest importance to respect the privacy and anonymity of the study subjects (Lazar, 2010). All the notes were written in a way that the interviewee name was not identifiable as every interview was marked by number. All audio recordings were conducted accordingly to the agreement with the interviewee after the consent form was signed. The interviewer clearly emphasized the moment when the audio recording was initiated and finished.

## 4. Results and analysis

This chapter contains the results and analysis of the study outcomes starting with the pre-study.

### 4.1 Pre-study results analysis

Before the actual intervention study took place, insights about the smartphone usage and usage reduction strategies were inspected in twelve in-depth interviews and an additional survey.

The previous section elaborated how the data has been coded and organized by themes. The survey and the interview data cover the same topics but the interviews include additional topics that could not be covered by the survey. The figure 4 shows an overview over the pre-study topics according to which the results are analysed and presented.

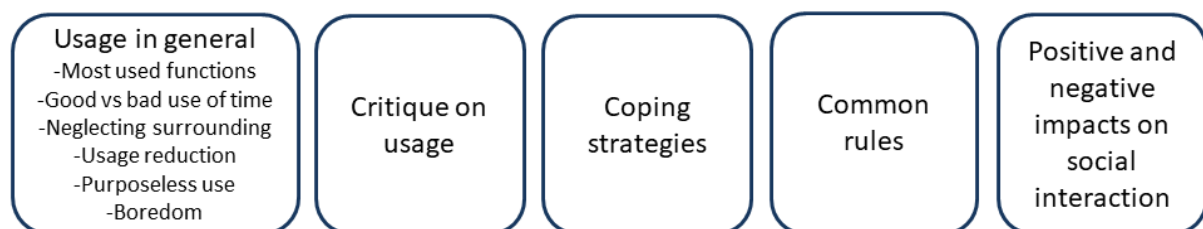


Figure 4: Overview over topics identified in the pre-study results

#### Usage in general

The survey asked as a warm-up question, in order to initiate a reflection on the usage, what are the most used smartphone apps and functions among the users. The table 4 shows the corresponding results.

Functions/Apps	Survey
Social media	81%
Listening to music	76%
Email	76%
Alarm, clock	76%
Payment applications	71%
Taking pictures	71%
Other communic. platforms	67%
Navigation	67%
News	29%

According to Findahl & Davidsson (2016) the mobile internet use among Swedish people shows similar results when it comes to checking emails (83%), listening to music (73%), social media like watching YouTube (70%) or Facebook (68%) and banking (67%). Watching news however had with 82 percent much higher usage than in the current study, which may lie on the study's sample group.

Table 4: Most used smartphone functions/apps

One of the questions in the interview asked to name applications and smartphone functions that users personally see as a good use of time and a bad use of time. While banking, educational apps and smartphone's core features such as the calendar and alarm were perceived often as a good use of time, nine of twelve users

mentioned social media as a bad use of time followed by news apps (mentioned three times). Additionally news apps and social media were mentioned four times as apps that leave the user drained of energy after usage. Similar results were found by Hiniker et al. (2016) where social media (37%) was among the most commonly mentioned among products that were associated with draining the user of energy beside games (30%). Reddit after Facebook counted to the second most mentioned product.

Interviewees reported about different situations where they experienced neglecting their surrounding while focusing on the smartphone. Those range from curious cases to rather dangerous happenings: *"I missed an act in a concert while checking the phone", "I missed my station", "I walked into the street lamp and hit my head", "I got almost hit by a car"*. One interviewee highlights that people concentrate so much on their smartphones that one *"could get naked on the bus, no one would notice"*.

The interviewees saw the difficulty in reducing the smartphone usage because it has become a habit. Furthermore control was mentioned several times in this context: *"You feel you lose control"* or *"It is about self-control. It's a bit tricky - I have the need to have constant updates."* One person mentioned the word "addiction" when speaking about reducing the smartphone overuse: *"[...] very hard, it is like an addiction but it is not good for you. One's whole life is in the mobile."*

Every interviewee has experienced using the smartphone without any purpose: *"Sometimes I just open my mobile and close it"* or as another person describes it: *"I push the button to check if I have notifications. When I have checked everything I still sit with it and open the same thing and close it again."* This short repetitive inspection of the smartphone content corresponds the behaviour defined by Oulasvirta et al. (2012) as the checking habit.

The results also show how much users are relying on the phone to entertain them in any situation they feel bored. Two interviewees reported taking the phone with them when they go to the toilet; two others mentioned using the phone if they feel bored during a conversation: *"If they talk about something boring I want to check EBay"*. One participant reported about using the phone as a distraction when feeling bored in work meetings: *"I have a problem with the work mobile: when I am bored I check emails."* In the same time the latter user also mentions that he dislikes the fact of using the smartphone this way: *"I don't want to use the phone as a tool for distraction."*

### **Critique on usage**

The interview results show that users are often annoyed by other people's usage habits, but unless it is very close people to oneself, such as family members or partner, they prefer to not comment on others' use habits despite the irritation: *"I would not criticise my friend, I find it inappropriate even though it annoys me"*. The

reason for it is that people avoid creating conflicts or making others feel uncomfortable. This goes along with the fact that the interviewees criticised or got criticised on their smartphone use only by their partner or parents. Instead of giving a critique one interviewee tries to motivate others by his actions: *“I never take it when I have lunch at work. It is a statement.”* The survey results show that the half of the respondents has experienced to receive a critique on their smartphone use and all of them state to have reacted to the critique in an agreeing way. Some even tried to change their usage habits.

### Coping strategies

Users reported about different strategies they tried to not use their mobiles too much. The table 5 provides an overview over those strategies collected during the interviews and the survey.

Coping strategies	Intvw.	Survey
Putting the phone on mute	33%	95%
Putting it out of reach	33%	50%
Deleting social media apps	8%	25%
Deleting other time consuming apps	8%	25%
Deleting addictive games	8%	20%
No emails during weekends/vacation	/	15%
Intervention software	8%	15%
Taking occasional breaks from the phone	8%	10%

Similarly to Lee et al. (2014) results altering smartphone settings is a frequently used method but keeping a physical distance to the phone also plays an important role for the users as the results in the table show.

**Table 5: Coping non-use strategies applied by the users**

When discussing the strategy of taking breaks from the phone such as leaving it at home one interviewee says: *“I feel more free. When I have it with me, I have to check it. When it is not with me I don't need to explain myself”*. While one person might find it liberating leaving the phone at home, another user had a different experience: *“Once I left the phone at home when I took a walk but it felt scary. You give away control.”* When discussing the strategies two interviewees even mentioned they wish to buy a feature phone: *“I often think it would be nice to have a dumbphone”*.

One of the interviewees had actually stopped using his smartphone for a while and went back to using a feature phone. His experience he summarises as *“liberating”* but also as *“difficult to be outside the home without the phone”*. The reason for that was on one side the irritation of others to not be able to contact him via social media and the challenge of not having internet on the go. The experience of not having a smartphone has taught him to be more patient and to plan more in advance. After he went back to using a smartphone he minimized his usage to core functions: *“Now I use it less for communication but more for useful features.”*

## Common rules

According to the survey results shown in the table 6 users seem to have some common understanding for situations where using a smartphone is perceived by the most of them as inappropriate.

Situation	Survey
When listening to a presentation	91%
In cinema/theatre	86%
In meetings	81%
While eating with someone	76%
When interacting with another person	71%

**Table 6: Situations where smartphone use is seen as inappropriate**

Digging deeper during the interviews revealed that the last rule “When interacting with another person” becomes fuzzier when it comes to people who are close to oneself: *“I don’t use it when I am with other people. It happens when I am with*

*family. Not with my boyfriend anymore because he complains”*. This finding confirms the outcomes in Ames’ (2013) study, in which college students prioritised direct social interactions over phone social interactions not in favour of people who are close to them but in favour of people in position of power over them. This finding also emphasizes that how one uses the phone in particular situations and what is seen as appropriate differs from person to person. One interviewee for instance finds answering phone calls in social interactions as acceptable, and another explains that when everyone in the group is tired then it is fine to spend some time with the phone. The lack of a common agreement can lead to irritation and feeling of disrespect, when what one person sees as inappropriate collides with a different perception of another person. In this sense two interviewees saw the lack of common social rules for smartphone usage as problematic: *“People cannot decide by themselves when not to use it, maybe there should be rules for social interactions, where using a smartphone is not allowed”*. Another interviewee describes it as followed: *“There is no etiquette for the mobile phone. When you sit in the restaurant or cinema it is not unusual that someone picks up the phone... It can be irritating... It is anarchistic”*.

## Impacts on social interactions

In the end of each interview and the survey the participants were asked after their opinion on general benefits and disadvantages of the smartphone technology especially when it comes to social interactions. The possibility to be less decided and more spontaneous was one of the most interesting beneficial factors beside the more known ones as easier communication on distance, making life more efficient and more fun, avoiding boredom and having an easy access to information among others. The negative impacts on social interactions mentioned in the interviews and in the survey are shown in the table 7 including selected quotes and the amount of times each impact was named.



Negative impacts		Quotes from interviews & survey
Social pressure of constant reachability	2	"I dislike that everyone expects you to be available all the time", "[...] is super stressful".
Distraction	9	"It distracts from the conversation at hand."
Dependency	4	"One does not memorize phone numbers [...] or birthdays"
Lack of attention to the social surrounding	14	"it takes away your presence in the world and actively competes for your attention"
Isolation	3	"One talks and looks less at other people. You are isolated".
Lack of reflection and overload with information	5	"There is too much information that we don't need but still consume. We have no possibility to digest all the information" "Before you could relax but now you can't have a moment of doing, thinking nothing".
Unpunctuality	3	"People don't try to be on time".
Reduced patience to listen	2	"It reduces the patience I have since all my needs can be accessed through my smartphone, so I don't have the patience to listen to others all the time."
Lowered conversation quality	4	"One always has to show things instead of just talking. When one says something then others have to check it up. We talk with the help of the phone". "One tells one half in words and the other half in a picture. [...] the discussions get more boring" "By checking, the conversation is over. Some things you could discuss and now it could finish in 10 minutes by one person taking the phone and checking up the facts."
Initiating conversation	5	"You hardly find someone to talk while on bus, or waiting in the bus station".

**Table 7: Overview over negative impacts of smartphones on social interactions including users' quotes**

The researcher Sherry Turkle's is also concerned with the impacts of smartphones on humans and especially on the human communication. According to her, the access to those devices made us ramp up the velocity of online connections and expect immediate answers. That has changed the nature of the conversation, "we move away from the pace of human conversation" (p.40) and "dumb down our communications" (p.35).

## 4.2 Post-intervention results analysis

The figure below shows an overview over the main themes that were identified during the post-study interviews. The presentation of the post-study results follows those themes, whereby some of them are clustered into bigger areas.



**Figure 5: Overview over identified themes in the post-study interviews**



Additionally to the main themes the discussion that took place during the post-interviews broke down participants' perception of overuse in so far as they carefully differentiated between a needed (or as Olga called it, *justifiable*) and a wasteful use. Furthermore the post-intervention discussion allowed a summary of the observed usage patterns, which combine the usage activities identified during the pre-study with new findings and participants' reflections.

The following section begins with those general observations, followed by a presentation and discussion of the main themes and the answers to the research questions.

#### 4.2.1 Wasteful and justifiable usage

Already in the pre-study the researcher discussed with the participants their perception of smartphone overuse. During the post-study the participants' definition of overuse became more crystallised in so far as they clearly differentiated between what they see as a wasteful use and a justifiable use. While some mobile applications tended to be seen as a general waste of time, in other cases the amount of time spent in the application or the amount of time the application has been opened was perceived as wasteful. Some participants felt besides overusing specific applications also using the smartphone in general too much. The subjective perception of useful or wasteful usage led to the definition of goals and to evaluation of the success of the goals.

#### 4.2.2 Main usage activities

The reasons for overusing the smartphone depend on the personal needs and established habits. Based on the study results one can differentiate between five dominating usage activities that stand for strongest triggers to use the smartphone: checking habit, boredom, fear of missing out, tiredness and use in order to look busy.

The checking habit is one strong trigger for overuse: Users reach out for the smartphone without any further purpose but to open the screen, maybe to scroll through the phone and switch it off again. The total usage time of the smartphone might not be very high as each interaction is of very short time, but this checking behaviour is often experienced by the users themselves as distracting, which differs from the findings made by Oulasvirta et al. (2012), according to which the people described the frequent checking "as, at worst, slightly annoying." (p.107)

Several participants mentioned boredom as one of the core reasons for overusing the phone. Olga describes it as followed, "*when you are bored you just want to pick up your phone and search on the web,... shop...*" The feeling of being bored might

appear when alone or in interaction with other people like friends, family, and co-workers. Especially during the weekends of the intervention study the participants experienced using their phones more because they had more free time. The usage time rose to one or several hours over the usage time during work days. Besides what participants described as boredom a closely related reason is the need to be constantly entertained and hence distracted from the current situation. This way both a lack of stimuli and the need for other stimuli are important triggers for an extensive smartphone use. Anna for whom self-entertainment is one of the core reasons for the smartphone usage concludes during the final interview this: *"I don't need to be entertained. I can do nothing as well."* The topic of boredom is also mentioned by Sherry Turkle (2015) after her interviews with college students, for whom the greatest fear is boredom and who like to have "someplace else to go" (p.36). She concludes that people got used to the constant online stimulation and use their phones in any quiet moment because those moments are perceived as boring and lull, although "boredom is directly linked to creativity and innovation." (p.39)

The third reason often mentioned by the study subjects is the need to be updated and the fear of missing something out be it news or social media. Kim, a heavy news user, explained that he found himself in the vicious circle of constantly updating the news that led him to feeling disappointed when no additional news were coming in. Breaking the circle can lead to a new perception of the necessity to check for updates: *"The less I use the phone the more useless I find checking social media"*.

One very interesting reason for smartphone overuse mentioned by some of the participants is when being tired. Escaping into the smartphone is described as a possibility to take a mental break from the current activity and that activity can be related to work or even to a social interaction such as meeting with friends or colleagues.

The last main reason to pick up the phone was actually only mentioned by Steve but it shows a very interesting usage factor: *"One just uses it to look busy"*. Using the smartphone or rather pretending to use it could be a way to fit into a social environment. Similarly Andrew describes how strange he sometimes feels when he is not using his smartphone on the subway: *"Sometimes I feel I am the creep. It really feels strange. Maybe people think what a weird guy just looking around."*

#### 4.2.3 Goal-setting and self-efficiency related aspects

The table below shows the goals set by each participant per intervention approach and the rating of difficulty to achieve each goal on the weekly base (two numbers mean that the difficulty rating of the same goal changed). This information was collected in the weekly surveys.

No gaming and no phone before sleep.	Andrew	4	<b>App</b>
Reduce Facebook and general phone use	Olga	3	
I put a max. time of 2 hours a day and also had screen-free set from 9-11am.	Anna	3	
Use each of these apps maximum 3 times a day: SVT Nyheter/DI, Mail, Avanza	Kim	4;2	
To regulate to have access to only the most important apps (sms, Clock, calendar, banking). No waste of time in social media or games. To reduce the usage of the mobile by reducing access to most apps and by measuring the total usage time in the app QualityTime.	Helen	4	
Not using after 23:00 and reduce the time I spend with my mobile in general.	Dan	2	
To reduce the usage to max 2 h.	Andrew	3	
Limiting The usage of the mobile to 30 min/day & not using the mobile before sleeping	Dan	5;3	
To not start the screen too many times	Steve	4	
To reduce my usage on workdays between 8-17 to 30 min and weekends to 1,5 hours a day and to reduce my usage of Facebook and Instagram.	Noah	5	
To have max. 25 clicks according to the app QualityTime every day	Steve	4	
Reduce using social media apps.	Olga	3	<b>Non-A</b>
To check news app and social media app 3-4 times/day (breakfast, lunch, evening, +1) Music, SMS and calls are ok more often	Steve	4;3	
Reducing the usage in certain situations (in the morning, on the way home, at night)	Anna	4	
Not using smartphone when "bored" or when I am busy doing something else	Kim	4	
Limit the amount of pickups without reason and no use of the mobile after 23 or bedtime if earlier	Dan	2	
To reduce the usage of phone on specific hours and occasions i.e. an hour before sleep, not look at the phone while i am eating dinner at home or with other people. Try to be more present in real life and not on the phone.	Andrew	3	
No games and no unneeded surfing or checking of the phone. Allowed to reply to calls or sms. Because the mobile is in mute most of the time I am allowed to check it at three decided occasions per day (but only to see and reply to sms).	Helen	2;4	
Reduce my amount of opening apps to: Facebook & Instagram 3 times/day, Hemnet & Blocket to one time a day, Aftonbladet 0 times only look at the notifications.	Noah	4	
Not use my mobile after 23:00 or bedtime, put my mobile in one place at home and not carry it around	Dan	4	

**Table 8: Users' goals per approach and rating of the goal achievement difficulty (1: very easy - 5: very difficult)**

In general most goals aimed at the reduction of mobile usage related to certain applications or times and situations. Some of the goals were very specific, while others were of general nature. The main difference between the intervention application and non-intervention application related goals is that the application related goals included the amount of total usage time and the amount of phone pick-ups, while the non-application based goals aimed more at limiting the access in certain situations, at counting the access to certain apps and at limiting the general mobile usage. The most common smartphone features that participants were keen to reduce access to were social media and news applications as well as useless internet browsing.

### **Goal difficulty and specificity**

The weekly survey asked each participant to rate his/her weekly goal(s) on a Likert scale from very easy (1) to very difficult (5). As the last survey was not answered by two participants, the total amount of replies was 30 instead of 32, hence the data is based on that number. In total, the participants perceived their goals as rather difficult with 53 percent (4-5), while only in 13 percent the goals were seen as easy (1-2) and in 33 percent they were perceived as medium difficult (3). There was no big difference in the perceived level of difficulty between the technology and the non-technology related goals, except that in two cases the technology related goals were seen as very difficult, while none goal was rated with a 5 during the non-application based approach. The results of the survey can be confirmed by the interview outcomes that show that the users experienced most of their goals as medium difficult to difficult depending on what type of goal the participants set and how they tried to reach them. Here one particular factor seems to play an important role: how specific and measurable is the goal. While most participants set rather concrete and specific goals, some defined very unspecific goals e.g. reduce usage of social media, reduce smartphone overuse in general, don't use phone when bored. Kim, who tried both types of goals, explains it this way: *"My conclusion is also that it is easier when you have measurable goals than unspecific goals [...]. It was easier to reach the [specific] goal and to track it."* In line with that Locke & Latham (2002) emphasize the positive effect of specific goals on the performance.

### **Importance of goals**

Another goal related factor that was examined during the interviews was the personal importance of the goals to the participants. It is however not possible to make a clear conclusion whether the more important goals were achieved better. Some participants experienced that they accomplished goals that were personally more important to them better than other goals, while a few participants did not manage to achieve the desired outcome for the goals that were more important to them. Here one explanation might be that the more important goal was not easy to measure and hence didn't lead to the desired success: *"Most important for me was to not pick the phone up when I don't need to and it was more difficult."* The goal to

not pick up the phone for no reason is not very concrete and not easy to keep track of.

### **Motivating factors and personal benefit**

The type of goal played an important role for the motivation of some participants, so for Kim: *"The second goal was more motivating. Because it was more clear, more control to reach the goal."* Noah explains it this way: *"Reducing times of use was more motivating and more reachable."* For Dan the combination of easy and challenging goals was a success: *"It was motivating to have a mix. It was motivating to see now I have achieved this and now I can take it a step further in my challenge."* The motivation factors were very different from person to person and range from having more reachable goals, over having rewards, seeing the usage in numbers, being more efficient to having goals that affect one's life. It might be of interest to mention that even though all participants experienced that they are overusing their smartphones, the reasons for seeing it vary a lot. While some participants see the overuse as a problem due to other people's complains, others find intrinsic reasons such as the smartphone taking too much of their attention and time. Two participants didn't have any need for any extrinsic motivators but found the benefits of reducing their smartphone use in reducing the stress level in their life and in finding more balance within themselves. Andrew describes it as followed: *"You get distanced from yourself. Yourself is not in the phone."*

One core benefit most participants saw in the smartphone use reduction was to be more present in real life besides being able to focus on one thing at a time and have time for other things. Further benefits were reducing the dependency on the smartphone and hence gaining more self-control.

### **Self-efficiency**

In order to build on the Social Cognitive Theory and the meaning of self-efficiency for goal fulfilment the participants were asked in how far they believed they will achieve their goals. (It needs to be considered that the results are based on retrospective reports.) Three participants (Kim, Andrew, Dan) reported that they believed in reaching their goals, while Dan believed that he will achieve the ones he was determined to. Anna and Steve hoped to achieve their goals, Helen knew she will be making exceptions and Olga and Noah got surprised as they thought their goals were easy in the beginning but it turned to be more difficult to achieve them. To summarize, all participants had a rather positive attitude toward the achievement of their goals in the beginning with some doubts on the quality of success. As Anna said: *"I knew I would not be able to manage them as good as I want."* In how far self-efficiency actually influenced the goal achievement could not be clearly identified.

### **Breaking set rules**

It was also of interest to see how the participants reacted when they broke the goals and rules they set. Every interviewee reported of having guilt or a bad feeling once

they broke their own rules and all of them tried to find excuses and reasons for why the goals were not achieved or a set rule broken. Helen for instance reports: *"I asked other people for things that I could not do on my mobile. When I asked other people [...] it didn't feel like breaking rules"*. Andrew explained it this way: *"If I talked for a half an hour I don't find it a wasteful usage. This way I reduced this half an hour from the total usage and land under the total two hours"*. And Dan highlights: *"Sometimes it was out of my hands, so I had an explanation for breaking the rule. What was more scary is when I don't have an explanation [...]. I felt I am not in control of my own behaviour."* Those processes of adjusting the facts so that they fit with the own point of view is what the Dissonance Theory is dealing with.

### **Changing opinion**

Additionally it was of interest to see if the participants have changed their opinions about smartphone related questions. Dan has changed his view about how the smartphone overuse of other people impacts him: *"Before I was irritated but now I feel sorry for them, because they should see it themselves."* Dan, as many others, reported in the pre-study to not comment on other people's use although it highly annoys him.

### **Self-monitoring & self-reflection**

All participants were asked in how far the calendar has been useful for them and what they see for a general value in monitoring own behaviour. The self-monitoring was experienced by the participants as helpful for understanding the actual behaviour and becoming more aware of it: *"You learn your behaviour from monitoring, you are more aware, if you don't like it, you do something about it."* They were fully aware that their subjective perception might be misleading. Kim said: *"It is a different thing how one perceives the behaviour and what the data says."*

They mentioned the possibility for reflection and evaluation: *"Sometimes when I check the usage I wonder, did I spend so much time on Facebook?! Was it valuable to spend time on it?"* Helen, however, saw a negative aspect behind self-monitoring: *"The awareness can make one more stressed, when I think, now I have been so long on the mobile phone."*

According to the results the manual calendar made participants reflect on their behaviour and their current goals and also helped to evaluate the reasons for success or failure: *"One had to think why it went bad. It was a good way to evaluate yourself."* It also supported some participants in finding behavioural patterns: *"I can see patterns. Especially good with comments."* According to Noah the calendar provided in the same time *"satisfaction when you can fill out the stars"* and *"it was annoying to remember to fill it out every day."* Andrew however highlighted that the calendar *"didn't not help for reflection, just to keep track"*.

#### 4.2.4 Strategies related to intervention applications

All participants but one used the intervention applications in some way to manage and track their goals. The most used feature of the applications was time counting and this was also the most favourite feature, as it was found to be helpful and eye opening by many participants. While some participants were not surprised by the total amount of time they spend on their phone, others didn't expect as high number as they saw being tracked by the app. Anna for instance commented: *"I realized that I used it one day for 4 hours. What did I do for four hours?!"* The app was therefore used to count the usage time and to notify the user when the time is exceeded or to send frequent notifications about the time spent on the mobile phone. For some participants the total usage time was of a subsidiary interest since they found it rather interesting what they used the time for or how often they interacted with the phone (the amount of total pick-ups): *"Maybe the time focus is not important, not as much as the amount of pick-ups. If you pick it up 100 times [...], it is 100 interruptions."*

While most participants set one or two usage rules in the intervention application e.g. not using the phone during specific times or notifying when the desired total time limit was exceeded, Helen set several restrictions limiting access to a variety of smartphone applications. Once the access was restricted, to enter an application required her to wait some time, which she found good on one side but the limitation to applications was also experienced as frustrating.

#### 4.2.5 Applied non-application based strategies

Both the pre-intervention interviews and previous research have shown that most smartphone users have their own strategies for non-use. Therefore it was of higher interest to let the study subjects come up with and apply their own methods instead providing them with the methods.

All but one participant didn't experience coming up with a use-limiting methods as difficult. Some participants either thought about them earlier but just didn't implement them or those methods were directly related to the habit e.g. to avoid the checking habit users tried to turn the phone with the screen toward the table. Anna explains it this way: *"I don't see the screen, so I can't press the button."* One most often applied method was to keep a physical distance to the phone by either leaving it in the jacket pocket, on the table in the corridor, on a specific spot in the room or generally not carrying it around all the time. Andrew explains why it works: *"Keep a distance, because the habit is to reach for it, so by not having it next to me it makes it easier."*

Olga and Andrew used hiding of applications as a method. They hid applications from which they tried to reduce the usage of further away in the phone: Olga placed

the Facebook icon into a folder, while Andrew hid a game in the very end of the application list. This way both tried to make the access to the app more difficult.

Steve's most successful method in reducing the checking habit was to remove notifications. According to him when hearing a notification coming in, he could not stop thinking about checking up what the notification was about, which made him unfocused. Once he removed them he felt: *"I didn't need to think about it so I became much calmer. It was a big difference."*

To not carry the phone around meant for some users to come up with alternative activities. Helen, who used to take her phone when going to the toilet, placed a newspaper in the toilet in order to have something that substituted the mobile phone. Other users found that they don't necessarily need to do something when not using their phone and found it good to do nothing: *"[...] giving myself time for being alone"*.

A unique method to stay away from overusing the phone at work was applied by Kim, who would take his phone and go into another room to check private information. *"It is a hinder to move to check something quick"*, hence this restrains him from doing it too often.

As the cards used during the non-application based intervention encouraged involving other people into the process, some participants did try it out. Several of them reported about, if not deeply involving, but at least telling their partner or colleagues about the study and their goals. All but Andrew found it helpful. He explains it as followed: *"I need to do it myself. I need to convince myself. It is just a mental process."* Kim found involving his partner and hence not being the only one who knew if he reached his goals or not to be the most helpful thing during the entire process. Also involving colleagues at work by asking them to comment on phone pick-ups was experienced by Steve as helpful. For Anna involving the partner also meant something else: *"Shame worked well. If I take my phone and my boyfriend sees it, he looks at me [...]. Just knowing that he is aware of what I am doing already helped to not take the phone an extra time."* Helen tried several of the cards involving her partner and discovered that some methods worked by far better than others. While using only punishment was not experienced as a good method, to have a possibility for punishment or a reward was more successful: *"If you have something fun to look forward to, it is much easier to be motivated."*

All participants used the goal cards, two used reward cards and five applied the cards that encouraged them to think about things they will have more time for. The ones who used rewards experienced them as motivating. The success scenario cards helped to think of alternative activities for using the smartphone and to understand what one might be missing out when spending too much time on the smartphone. Helen applied the swear jar but found it not effective as it involved only punishment.



Most of the participants stated they would keep some of the non-application based methods also after the study.

#### 4.2.6 Experience with the two approaches

The participants did not experience the two approaches as two very different things but rather saw one part of the study to prepare them for the second part: *“It gets easier during the process”, “I don’t think it depends on the app or not the app. It was more the time and convincing yourself, finding your way.”, “The first two weeks helped for the other two weeks because you go through a process of understanding that I have to do something”.*

The participants who started with the application based approach answered the question after which approach they preferred quite similarly: they would like a combination of the two of them. Dan was especially fond of the order: *“I liked the order. First using the app to make you find the problem, reflect on it and the other one to continue by yourself.”* Despite liking to have a combination, two participants from this group, Noah and Andrew, had doubts regarding the benefits of the app: *“The app is a reminder but it is also a bit stressful. It is another thing you need to keep track of”, “You can’t get technology to do the convincing for you.”*

The participants who started with the non-application based approach did not mention a combination as a possibility and had in general more polarized opinions. One possible explanation might be that while Anna had a little awareness in the beginning of the study of her own overuse and based her knowledge of it on the complains she received from other people, Steve and Kim had a deep awareness for own overuse and the overuse of other people. Hence Anna might have benefited more from an outside tool to limit her use than Steve and Kim, who relied more on own mental strategies. Another explanation might be also that once a person has created mental strategies, a technology might be experienced at first as interfering and hence useless. By saying that Anna (the only one of all eight participants) clearly preferred the application based approach, while Steve and Kim found it less beneficial: *“I didn’t take the app seriously [...]. I didn’t like it”, “I didn’t use the app for my goal”.* Olga experienced the part of the study where she didn’t use the intervention app as easier *“because your brain tricks you. The app is more accurate.”*

Interestingly Anna who preferred the application based approach and who also experienced troubles with the non-application based approach raised, on her own initiative, the question about how it could have worked for her if she started with the application based approach instead.

The empirical results provide an indication that the participants appreciated the ability of the intervention applications to clearly visualize their usage and to make them this way more aware of it. Dan explains the benefit of the intervention app as following: *“Even if you agree with a person who is complaining about your mobile usage, you will deny it.”* He further explains: *“It is your own mobile that is telling you, so you listen to it.”* However, the participants were not very fond of other features of the applications such as the sending of notifications and reminders or limiting access to the smartphone content. Steve, who experienced troubles with the application, mentioned he would like the intervention application to communicate some kind of *“golden standard for usage”*.

Two participants, Steve and Olga, removed the intervention application directly after the study had finished and would not use it again. Olga is in general highly concerned with applications that require access to other applications, while Steve didn't see much value in the app. Anna and Andrew said they will continue using it. The other participants explained that they may use it some other time or when they feel they need it. Those who would use it, underlined they would mainly use it without notifications for the time counting feature.

## 4.3 Answering the first research question

Before the first research question can be answered the results of three sub-questions are going to be analysed and discussed.

### **Sub-question 1: In how far did goal-setting and self-efficiency related aspects contribute to the intervention?**

Goal-setting and self-efficiency have proven to be two very valuable aspects for guiding the participants throughout the process in changing behaviour toward the desired outcome. The type of goals is influential in so far as both the difficulty and the specificity can determine the goal performance. The personal importance of the goal and the commitment to it seem to have played a role for the study participants, however, not in all cases the more important goals were achieved better. This may lie on the applied strategy, complexity of the goal or the specificity of the goals. Self-monitoring is a powerful tool to learn and to reflect about the own behaviour but it can be experienced in the same time as stressful to be actually aware and to keep track of the behaviour. Self-reflection is well supported by a manual self-monitoring tool such as calendar. Both self-monitoring, self-reflection and defining goals provide means for reflection and regulation of own behaviour as they create a backbone for deepening the awareness and for change to take place. Although those are crucial aspects they are not the only ones that decide about the success of an intervention but they can help to guide the user into the right direction.

The correlation between believe in goal achievement and the actual goal achievement could not be clearly proven.

### **Sub-question 2: What strategies did the participants implement for behavioural change?**

What kind of non-application related strategies the participants created and found helpful varied a lot from person to person but the most applied and successful method was keeping a physical distance to the phone and to not carry it on the body. This created a physical burden to reach out to the smartphone and functioned also as a reminder of the goals. To other strategies count making the access to applications in question more difficult by hiding them, and removing notifications. Another coping strategy was to create mental rules for usage based on time and location.

From the provided non-application based methods only two participants used some kind of rewards and found them a positive motivator while most participants didn't need extrinsic rewards and saw a reward in getting their behaviour under more control. The *success scenario* card was useful in a way as it motivated to substitute the existing habit of taking the phone by something else e.g. taking a book instead. Another applied strategy was to involve colleagues or partner into the process and hence receive social support from them.

Among application based strategies the most used and appreciated was the time counting feature of the applications, which created awareness for the actual usage in a very concrete way. It helped the users by proving them with a number that either confirmed or surprised the existing subjective perception of the usage. When it comes to other applied app related methods the feature of alarming the user when he exceeded the allowed usage time proved to be helpful once but otherwise notifications and alarms were seen as annoying in longer run.

### **Sub-question 3: How did the participants experience the two intervention approaches?**

All participants saw the first part of the study, independent on the approach, to be preparing them for the second part. The combination of the two approaches has been seen by the participants starting with the application based approach as especially positive, while other participants had more struggles with the one or the other approach. One may conclude that the intervention application was more eligible to bring attention to the use and to prepare to take own actions, while after having started with own strategies the application might be seen as interfering.

### **First research question: How did the intervention approaches influence behavioural change?**

Both intervention approaches influenced the behaviour change in different ways. As just discussed above, the intervention applications contributed to behavioural change by opening eyes to the actual usage. They helped the users to realize how dependent they are on their smartphones and what role those devices play in their

lives. The non-application based intervention changed the behaviour by letting the participants create own mental strategies or take concrete actions that either prevent the physical usage or teach alternative behaviours.

## **5. Discussion and conclusion**

This section is devoted to the discussion of the field of contribution, the summary of the main study results and the answer to the second research question. It furthermore covers the strengths and limitations of the applied methods, the ethical implications of the current study and presents suggestions for potential future research.

### **5.1 Field of contribution**

The main concern of this thesis was devoted to the interaction between humans and technology and to the question how the technology can be created in a persuasive way in order to make users change behaviour. Hence how people think, make decisions and behave played an important role for the research. Another main point in the study concerned the design of technology: smartphones and intervention applications must be designed according to users' needs with the focus on persuasion, acquiring knowledge from a variety of design areas ranging from graphic, persuasive and product design to human-computer interaction. Within the HCI there are, according to Benyon et al. (2005), four core disciplines that contribute to the design of interactive systems: technology, people, activities and contexts as well as design. Based on that definition this study mainly contributes to the disciplines 'People' and 'Design' and to the field of persuasive design.

### **5.2 Summary of the core findings**

Already the pre-study has shown that there are common patterns for appropriate and inappropriate smartphone use especially in regards of context of use. There are public situations and spaces where most people perceive using their smartphone as a bad manner. There are also private contexts that invite users to create common rules and smartphone free zones and times. Irritations at the partner who is overusing the smartphone, which can be mutual, were common among all study participants. It is also mostly the partner or family members who would dare to criticise a bad usage habit. The person concerned by the critique must undergo a process of internalization of the potential usage problem. The study participants have undergone this process to different extents. There seem to be a possibility that the current stage of awareness of the usage problem, correspondingly to the Transtheoretical Model, matters in regards of what a person finds helpful and motivating to reduce the smartphone overuse. The current study however does not offer enough material to properly support that.

The main advantage of the intervention applications was the time counting feature because the participants appreciated the ability of the intervention applications to clearly visualize their usage and to make them this way more aware of it. If this effect is long-lived is not clear as the participants of the study tried to find explanations to make a long usage time acceptable.

Another key finding regards the non-application based strategy of keeping a physical distance to the smartphone, which seemed to be the most widespread and helpful solution.

Besides those two main intervention related findings on strategies the participants mentioned a range of other factors that they found very helpful in order to achieve their goals such as social support, defining measurable goals, monitoring and evaluating the process.

The order of interventions seems to have mattered to participants' perception of the two approaches. It is not possible to make a doubtless conclusion due to the sample size, but starting with the application and then creating own strategies contributed more positively to the intervention than starting with own strategies and moving later to the application.

## 5.3 Implications for future persuasive design

What can be learned in regards of future design implications was the concern of the second research question. In order to answer it a critical look at the tested applications is needed. Except the main benefit of the intervention apps mentioned in 5.2 they didn't manage to communicate to the participants the best practice of applying their features for setting goals neither did they properly support the feature many users applied manually, which is counting the amount of times a particular application was accessed. Furthermore the intervention apps were not capable of an appropriate support of the context related non-use. An intervention application aiming to help users to reduce smartphone overuse should include more than alarms and notifications as means.

Furthermore two study participants expressed having had troubles coming up with clever goals and one of them even wondered if there is a golden standard for smartphone use; some sort of a pre-set guideline for strategies that could be of help for a user. Half of the participants wondered if their total usage time was normal and how much time other people usually spend on their phones.

Based on that, the first suggestion for an intervention application is to include a guideline into an intervention application. This guideline could first of all cover scientific findings on "bad" smartphone use, which could help users to see

themselves in it and to reflect on their habits. While connecting the role of boredom and fear of missing out to overuse, the advantages of boredom and solitude to self-reflection and creativity can be highlighted. In line with that the guideline could emphasize the impact of overuse on other people and on the social connectivity. Thirdly, the guideline can help the user to identify wasteful usage and suggest strategies and best practice cases for avoiding it. At last, the guideline could lead the users into defining effective goals. Including guidelines does not mean to locate a long text under a certain button of the application but can and should be inserted into the intervention app in an appealing and persuasive way.

Involving other people into the process has been successful and helpful for certain participants of the study and according to the study by Ko et al. (2015) the social support is even more critical than self-monitoring. Hence, the second recommendation is to include social support features in some way into the intervention application.

The third recommendation is to include a diary feature into the intervention application. Writing a diary can be experienced as stressful but it can support the reflexion and means for self-evaluation. Enabling the user to write own use diary can help to see usage patterns and can better visualise the correlation between smartphone overuse and mental wellness of the user.

The combination of the application based and the non-application based approaches showed, even if not originally intended, the benefits of such a combination. Hence, the last and the most important learning and recommendation is when creating any intervention application that aims to support person's mental or physical wellness it should be done in a way that teaches the user behaviours outside the application instead of making the users dependent on the application. That builds on Stawarz et al. (2015) proposal to include into applications habit formation features that will enable long-lasting results instead of relying on reminders and self-tracking features alone that teach users to rely on the technology.

## 5.4 Strengths of the study

To the strengths of the applied method counts first of all the possibility to test technology use and strategies for non-use in real context of use and in real life situations. Hence the study contributes to the scientific field of cultural studies.

The advantage of the open design of the study offered the participants the chance to come up and test own non-use strategies but it also emphasised aspects where people need help in order to limit their smartphone overuse.

The strength of testing different non-use methods within both the application based and the non-application based approaches showed that the effectiveness of

persuasive features may differ from person to person and from users' awareness stage of the problem.

The study contributes to the research field in so far as the here presented results can be useful for researchers, who intend to create an application with the aim to reduce smartphone overuse or other intervention applications for behavioural change. The current study can hence be seen as a pre-study and a ground for a design process.

Furthermore this work provides a new critical look at intervention applications based only on technology for behavioural change and hopefully inspires for a new approach in designing intervention technology that will support users to learn behaviours without being fully dependent on the technology.

## 5.5 Study limitations

This study has several limitations in regards of applied methods and the hence produced results.

To complement the subjective perception of the participants regarding the smartphone use and the effects of the intervention, it could have been of interest to not only interview the participants themselves but also their partners. The view of the partners could have offered another and deeper level into the results and probably provided a better understanding for the role of the social component.

To support the participants with additional means for reflection it could have been of benefit to track daily stress levels experienced during the intervention study. It could have helped to identify a possible correlation between the stress level and the level of smartphone usage.

As mentioned before, the results of the current study are not representative due to the small and on the base of convenience recruited sample. Furthermore the applied explorative research methods do not allow a generalisation of the results.

To mention at last is the disadvantage of applying two intervention applications instead of one, which complicated the evaluation of the application based approach as the experience with the intervention application might have depended on the used application. However, due to the challenge of recruitment it was not possible to exclude people based on the smartphone system they are using.

## 5.6 Ethical implications of the work

For the current research the participants were recruited for interviews and for an intervention study. The same persons who participated in the pre-study interviews were later recruited for the intervention study. All participants signed a consent form

before the first interview took place and where informed about the reasons for the two interviews and that their information is going to be used only for the research purpose without revealing their identity. They were also informed and asked for permission to be audio recorded and their respective decision was respected by the researcher. They were also informed that all recordings are going to be deleted by the end of the research project and that their quotes might be anonymously used in the paper.

The participants were fully aware when the audio recording during the interviews started and finished and could stop the interview at any point. Any private information that did not matter for the study but was mentioned during the interviews was not transcribed neither used in the thesis.

As the topic of the research handled overuse of a technology that could go in hand with a pathological addiction, the researcher deliberately restrained from any judgement or comments on the participants' overuse level in both interviews and in the thesis. The interest of the research was focused rather on the subjectively perceived overuse than on the pathology, therefore no measurements of the dependency levels were taken.

The participation in the study was not compensated in any way and based purely on personal interest of the participating person.

Before the intervention study started all participants were encouraged to raise any questions or concerns they might have regarding the study. They were fully informed about the study setup and the expectations on them. It was of high importance for the researcher to make sure the participants feel safe, respected and well informed.

The information gathered during the intervention study such as the use of the intervention application has not been collected by the researcher. The returned cards that were used during the study do not contain any sensitive information neither do they reveal participants' identity. They are going to be carefully disposed when the research is finished.

The intervention study itself has been deliberately designed in a way to minimally interfere with participants' normal life.

All the information gathered during the study is handled with maximal care and accuracy in order to display it as honestly as possible to the reader.

## 5.7 Future research

One interesting perspective for future work is to actually build an intervention application based on the findings of this study including features described in section



5.3 and to test the short and long term effects. This proposal would include the habit formation features proposed by Stawarz et al. (2015).

Furthermore it would be of interest to combine the personally experienced stress levels with the extent of technology use, especially smartphone use in order to see if there are deeper correlations.

Also of interest would be to design a study where users would devote themselves to a very limited smartphone usage and to compare their mental state, ability to focus, stress levels to a control group.

Although the TTM was not included as one of the main theories for building up the empirical part of the work, the study results imply a possible correlation and difference between which persuasive features are relevant and effective depending on person's awareness stage for the problem. Further research in this area would be needed to underpin those findings. Other researchers e.g. Ludden & Hekkert (2014) find it already useful to match the intervention design to the current stage of the user according to the TTM in order to create solutions that will be more appealing to the users.

The lack of common use rules for smartphones can be one part of the problem as they create frustration, feeling of disrespect and irritation. It is of interest to further discuss and analyse in how far it is and in how far it should be the role of the technology itself to create common social rules for its usage.

Coming back to the in the beginning mentioned incident with the senator McCain playing poker at a Syria debate, one can say that common social norms for an appropriate smartphone behaviour are indeed missing and it might take time until they are formed and accepted. In how far technology should be built in the way proposed in Sherry Turkle's book, "instead of encouraging us to stay connected as long as possible, would encourage us to disengage" (Turkle, 2015, p. 44), remains however one more question to be answered in the future.

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# Appendix 1: Pre-study interview questions

- What kind of smartphone do you have?
- Can you please describe what you use your smartphone for? (Activities, Apps)
- In which situations during the day do you use your phone? (Starting in the morning)
- Which apps on your phone would you describe as “a good use of time” and “a bad of time”?
- In which situations do you feel using a smartphone is inappropriate?
- Have you ever experienced neglecting your surrounding while using your smartphone?
- How do you prioritize smartphone activities compared to real life activities? Do you have the feeling other people have the same priorities as you?
- Have anyone ever commented/criticized on your smartphone use? Or have you ever done it? Can you describe the situation when it happened? How was the reaction?
- Have you ever used an application that allows you to monitor your phone use? If yes, which one?
- Have you ever tried to reduce your smartphone use? Describe what you have tried.
- How has it gone for you when reducing your smartphone use? Why?
- Why do you think it is easy/difficult to reduce smartphone use?
- How do you feel about the amount of time you spend on your phone?
- Have you experienced situations when you interact with / check your phone without any particular purpose?
- Describe an activity on the smartphone or an app that leaves you feeling drained of energy, unproductive or dissatisfied
- If you would change one thing about the way you use your smartphone, what would it be?
- Describe social rules that you follow for not using smartphone.
- Do you break those rules sometimes?
- Why do you think it is easy or difficult to follow those rules?
- Describe how the smartphone use impacts the social interactions in general.
- Describe how the smartphone use impacts the social interactions especially when meeting other people?
- Can you imagine your life without your smartphone? (if no, why?)

# Appendix 2: Pre-study survey questions

**What do you use your smartphone mostly for?**

Please choose your most used apps

- ☐ Payment & Banks apps
- ☐ News apps (like BBC etc)
- ☐ Maps/navigation
- ☐ Travel apps
- ☐ Shopping
- ☐ Alarm
- ☐ Clock
- ☐ Weather
- ☐ Calender
- ☐ Games
- ☐ Calling
- ☐ Sms
- ☐ E-Mail
- ☐ Social Media (Facebook, Twitter, YouTube, Instagram...)
- ☐ Viber, Skype, WeChat, WhatsUp, SnapChat etc
- ☐ Taking pictures
- ☐ Educational apps
- ☐ Book tickets/activities
- ☐ Browsing around
- ☐ Music
- ☐ Time killing
- ☐ TV apps
- ☐ Other:

**In which situations do you find using a smartphone is inappropriate or impolite?**

Multiple choices are possible

- ☐ In cinema/theatre
- ☐ In meetings
- ☐ At work in general
- ☐ Talking on the phone in public
- ☐ In general when interacting with another person
- ☐ When eating with other person(s)
- ☐ While listening to a presentation
- ☐ Answering a call while a person is talking

- ☐ Checking the phone without purpose
- ☐ While walking
- ☐ Other:

**Have you ever used an application that allows you to monitor your smartphone use?**

- ☐ No, I have not
- ☐ Yes, I have

**Which application have you tried?**

**Have you ever tried to reduce your smartphone use?**

- ☐ Not on purpose
- ☐ Yes, I have

**Have you done any of the following?**

Multiple choices are possible

- ☐ Sometimes I put my phone on mute
- ☐ Sometimes I leave my phone out of reach
- ☐ Sometimes I switch my phone off
- ☐ I regularly disable internet
- ☐ I deleted addictive game(s)
- ☐ I deleted social media app(s)
- ☐ I deleted other time-consuming apps
- ☐ I take periodically breaks from my phone
- ☐ I don't check emails on weekends/vacation

**How challenging do you find it to reduce smartphone use?**

	1	2	3	4	5	
very easy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	very hard

**If you change one thing about the way you use your smartphone, what would it be?**

- ☐ I would use it in general less often
- ☐ I would stop all notifications
- ☐ I would remove some app(s)
- ☐ I would not check it without purpose

- ☐ I would try to use a particular app less
- ☐ I wouldn't want to change anything
- ☐ Other:

### Has anyone ever criticised your smartphone use?

- ☐ No
- ☐ Yes

### How was your reaction on the critique?

- ☐ I agreed with the critique but didn't change anything
- ☐ I agreed with the critique and tried to change my habit
- ☐ I found the critique unfair because other people use their phones even more
- ☐ I completely disagreed with the critique
- ☐ Other:

### Which rules do you follow for not using smartphone?

- ☐ No phone in the sleeping room
- ☐ No phone at dinner table
- ☐ No purposeless checking
- ☐ Phone is on mute at work/in school
- ☐ I hardly check it when I am with another person
- ☐ Phone is on mute when I meet other people
- ☐ I have no rules

### Do you break those rules?

- ☐ No, I hold to them
- ☐ Yes, sometimes
- ☐ Most of the time
- ☐ Other:

### What are the positive impacts smartphones have on social interactions in general?

### What are the negative impacts smartphones have on social interactions in general?

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## Appendix 3: After-intervention interview questions

Tell me a bit how the challenge has gone for you during the last five weeks.

Let's discuss the goals that you set for yourself.

- Would you say you set goals that were easy or difficult to achieve?
- Did you believe from the beginning you will achieve them?
- Have you set any goals that you didn't expect to achieve? Which goals were those?
- Which goals were more motivating, easy or difficult ones?
- Which goals have you achieved better the easy or difficult ones?
- Which of the goals you set were more important to you? Have you achieved them?
- How did it feel when you broke your rules?
- What benefits do you see with reducing the smartphone use?

App

- In how far did the app help you to achieve your goals?

Non app

- How did your goals differentiate when you used app versus when you used your own strategies?
- What was helpful for you during the non-technological approach to achieve your goals?
- Describe your strategies/methods for not using your phone
- Was it difficult to come up with strategies?
- Which role did your partner or other people near to you play in this study?
- How did they react regarding your goals and new behaviour?
- How did your strategies affect people around you?
- Were other people annoyed or maybe on the contrary inspired by what you did?
- Have you used any of the cards? Which ones and how? In how far has it helped you?

General

- Will you continue using the app?
- Will you continue using some coping strategies for non-using the smartphone? Which ones?
- What was most helpful for you to achieve your goals?
- Was it difficult to stay focused on your goals?



- If you would compare which of the two approaches did you personally find more helpful in reducing the smartphone use?
- How did you use the calendar?
- Have you used the calendar to reflect on your progress? Has it helped you to keep track?
- What is the value of monitoring your behaviour?
- Have you become more aware of how other people use their phones?
- Have you experienced a change in your stress level?
- Do you use the time of your day better?
- Do you have a better control over your time now?
- Do you feel that you have now more time for things that you really want to do?
- Has your opinion regarding what is smartphone overuse changed?
- Would you say that you managed to reduce your smartphone use?

## Appendix 4: Weekly survey

### *Group A, week 1-2*

This weekly survey includes 5 questions about the smartphone challenge.

Please write your first name

Describe your goal(s) for reducing your smartphone use for the last week.

How difficult was it to fulfil those goals?

	1	2	3	4	5	
very easy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	very hard

Describe actions you took to fulfil your goal(s), e.g. using app functionalities / changing daily routines

Will you change anything in your approach for the upcoming week?

- No, I stay with the same approach
- Yes, I will try something else to see if it works better
- Yes, I will try something else because the current way does not work for me
- Other:

Please write your comments or thoughts regarding the challenge or your progress.

---

### **Group B, week 1-2**

Please write your first name

Describe your goal(s) for reducing your smartphone use for the last week.

How difficult was it to fulfil those goals?

1   2   3   4   5

very easy   ☐   ☐   ☐   ☐   ☐   very hard

Describe actions you took to fulfil your goal(s) (e.g. changing daily routines)

Will you change anything in your approach for the upcoming week?

- ☐ No, I stay with the same approach
- ☐ Yes, I will try something else to see if it works better
- ☐ Yes, I will try something else because the current way does not work for me
- ☐ Other:

Please write your comments or thoughts regarding the challenge or your progress.

---

### **Group B, week 3-4**

Please write your first name

Describe your goal(s) for reducing your smartphone use for the last week.

How difficult was it to fulfil those goals?

1   2   3   4   5

very easy ☐ ☐ ☐ ☐ ☐ very hard

Describe actions you took to fulfil your goal(s), e.g. using app functionalities / changing daily routines

Please write your comments or thoughts regarding the challenge or your progress.

---

### ***Group A, week 3-4***

Please write your first name

Describe your goal(s) for reducing your smartphone use for the last week.

How difficult was it to fulfil those goals?

1   2   3   4   5

very easy ☐ ☐ ☐ ☐ ☐ very hard

Describe actions you took to fulfil your goal(s) (e.g. changing daily routines)

Please write your comments or thoughts regarding the challenge or your progress.

---

### ***Appendix 5: Letters to participants***

## Hello Participant

Welcome to the “Smartphone Challenge” Study! It is a great pleasure to have you on board. The study consists of two parts: one where you use an app and one where you use a non-technological approach. Each part takes 2 weeks with one week break inbetween where you don’t do anything for the study.

### STUDY SET UP

- 1) First you are going to use an app for two weeks (week 9-10).
- 2) Then there will be a break for one week. Please don’t use the app anymore.
- 3) After the break you open the envelop II and find there instructions for the second part.

### THE APP

During the next two weeks you are going to test an app called **QualityTime**. Please download the app from the PlayStore. Please allow the app to have all accesses it asks for. The app has a few features; try them out and see which ones work best for you.

### CALENDAR & PEN

The calendar shows the four weeks of the study and a break of one week inbetween (Challenge break). You find empty stars and speech bubbles. Please rate the success of each day when it comes to fulfilling your smartphone goals by filling out stars (zero to five). You can also add a short comment into the speech bubble. Place the calendar somewhere visible (e.g. on your desk or at the fridge door) so you don’t forget to fill it out.

### IMPORTANT TO DO

- a. Have at least one weekly goal that is related to the reduction of your smartphone usage.
- b. Fill out the daily rating in the calendar.

### WHAT CAN BE A SMARTPHONE GOAL?

A goal can be anything from reducing the frequency of using an app to stopping checking your phone. You can have one or several goals but please stick with your goals for at least one week.

### ENVELOP II

Please open the envelop II on the date written on that envelop.

Have fun :)

## Hello Participant

Now it is time for the last part of the study. During the next two weeks you will define your smartphone goals (old or new ones) and find your own ways how to reach them. You can use the cards that you find here for help and inspiration.

### CARDS

You find several cards in this envelop. It is up to you to use them.

- You can use them for instance for writing down your goals and making them this way more concrete and visible.
- You can define rewards you want to get once you reach your goals. Alternatively you can define punishments for breaking rules or for not reaching goals.
- You can engage people around you into your goals by making others aware of what you want to reach and how other people can help you.
- It can be helpful to imagine what you would be able to do with the time you will gain when you use your phone less.

### CALENDAR & PEN

The calendar shows the four weeks of the study and a break of one week inbetween (Challenge break). You find empty stars and speech bubbles. Please rate the success of each day when it comes to fulfilling your smartphone goals by filling out stars (zero to five). You can also add a short comment into the speech bubble. Place the calendar somewhere visible (e.g. on your desk or at the fridge door) so you don't forget to fill it out.

### IMPORTANT TO DO

- Have at least one weekly goal that is related to the reduction of your smartphone usage.**
- Fill out the daily rating in the calendar.**

### WHAT CAN BE A GOAL?

A goal can be anything from reducing the frequency of using a particular app to stopping checking your smartphone. You can have one or several goals but please stick with your goals for at least one week.

Have fun :)