Master's Thesis

GreyZone: Promoting Smartphone Non-Use

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STUDENT REPORT

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Abstract:
High smartphone usage is an ongoing tendency in modern society and has been consistently rising over the years. Current strategies for achieving non-use or reducing use of smartphones have been shown to be successful, however these solutions are mostly software-based.
In this thesis, I have investigated if and how provocation can be utilised to make a viable solution to reduce smartphone usage. Specifically, the focus was on investigating the provocative aspects, conceptual, functional, aesthetical, and material and how they contribute to making reflections of one's own smartphone usage. For that purpose, a provocative interaction design, GreyZone, was designed and constructed, which is a physical box limiting smartphone usage to a maximum of one hour per day.
To evaluate GreyZone, a longitudinal study was conducted with six participants for three weeks. Of these participants, three of them were provided a provotype and a diary to document their daily experiences with GreyZone. The main findings from the study show that two participants made reflections of their current and their intended smartphone usage while one participant found the provotype too provocative and therefore quit the study. Three participants reported having reduced their smartphone usage, which was especially social media usage.

SUMMARY

A smartphone is intended for making everyday living easier, however, this entails an expected social norm of constant availability and causes disadvantages of not having access to one. The expectation that one should be constantly available can result in a habitual behaviour which further increases smartphone usage. There are various non-use strategies that can be utilised in order to reduce smartphone usage, however, studies have reported that people often fail to sustain their usage changes over a longer period. Moreover, from investigating current solutions, I found that most, if not all, of the proposed solutions for reducing smartphone usage are software-based.

In this thesis, I adopted the Research Through Design methodology and provocation through design in order to design and construct GreyZone, a physical provotype that only allows one hour of smartphone usage per day. GreyZone was designed with the aim of provoking reflections by challenging users' smartphone practices, which was done by utilising provocation expressed through the conceptual, functional, material, and aesthetical aspects.

I conducted a three-week longitudinal study of GreyZone. The participants were two families, where three of the participants were selected to use GreyZone. The selected users were instructed to fill out a page on their diary each day during the study of their most memorable experience with GreyZone. Moreover, I conducted weekly interviews with each of the families where the aim was to make the participants elaborate on their experiences during the week to potentially make them reflect about their practices.

From analysing the interviews, diaries, and the data from GreyZone, three themes were identified, Desired Changes in Practice and Reflections of Usage, Perceived Provocation, and GreyZone Problems. The findings showed that four of the participants reflected on their smartphone practices as a result of having GreyZone in the household. Moreover, two of the participants selected to use GreyZone, reduced their smartphone practices which was often their social media usage. One of the participants decided to quit using GreyZone after one day due to finding it too restrictive.

This thesis contributes to the HCI research field in three ways. First, I found that a physical provotype is a promising alternative to software-based solutions in promoting non-use of smartphones. Second, is that the perceived provocation of a design depends on by how much an individual's current practices are challenged. Third, frustration and satisfaction prompts can be utilised to be informed about the perceived provocation from an individual.

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1. INTRODUCTION

In the recent decades, smartphone usage has significantly permeated and appears as an integrated element in everyday living. A smartphone is a ubiquitous interactive device and can be converted into being an attractive phenomenon causing the countless opportunities it is technologically capable to deliver, beneficial for everyday living. In modern society, a smartphone is habitual and time demanding among people [1].

Although a smartphone is a self-selected device to own, the decision-making is indirectly associated with external factors, such as social norms and digitalisation. Owning a smartphone, followed by frequently interacting with it, has directly transformed into being an expected social norm, due to the specific external requirement regarding constant availability associated with this modern technological society [2]. The present highly increasing digitalisation indirectly forces peoples to provide a smartphone and simultaneously persuades them to increase the number of interactions followed by hours spent which led to supporting smartphone overuse. Not owning a smartphone leads to technological complications and disadvantages regarding lack of accessibility of e.g. personal information or to deliver required data. Concrete scenarios currently occurring in everyday living are among other communications related activities; identity verification through a random password generator reaching the user using text messages, specifically required before entering educational systems at Aalborg University, or the NemID application associated with E-Boks, a mandatory national service system containing information between citizens, companies, and state-related factors. Oppositely, it is clearly supporting the fact that a smartphone is a multifunctional device capable of making everyday living easier.

As previously mentioned, plenty of technological advantages contribute to simplify everyday living, but it is necessarily not without consequences. Peoples' intensive engagement with this prevalent smartphone is problematic in social contexts as it contributes to excluding them from physical, mental presence and intimacy as well as visually and emotionally experiencing their physical surroundings momentarily. Similarly, this intensive engagement has an impact on the smartphone user's individual quality of living. An unhealthy relationship to the inorganic device primarily is caused by the disturbance from external and internal sources; incoming data such as notifications and the user's own mental urge to interact with the smartphone, respectively. These external and internal sources of disruption are time demanding as they interrupt routines and delay daily processes which can entail lacking productivity and sleep disturbances. Furthermore, these sources contribute to conflicts or frustrations in social contexts as it affects people's mental presence as their primary focus is aimed at their smartphone. In general, they can reduce the quality of concentration intensive practices [2]–[4]. Another event which contributes to unnecessary overuse is the iterative behavioural pattern known as getting '*caught in a loop*'. Initiating interaction is frequently followed by another as a trigger triggering the user to continue interacting with the smartphone resulting in further time investment [2].

In contrast to the fact that a majority of the smartphone users lack managing their own self-control and time-structuring of their smartphone usage, there is an inner desire to convert smartphone overuse into limited time of usage from the users themselves [4]. Instinctively, smartphone users are adopting existing common non-use strategies, such as intervention software or physical separation, into practical usage aiming at reducing their current smartphone usage. According to Lee et al., these coveted non-use strategies are limited to only functioning within a short-term period as users are commonly discarding them and returning to their usual habitual behavioural patterns [4].

This thesis aims at promoting smartphone non-use by exploring and constructing the provocative provotype, *GreyZone*, which is innovatively an incremental design suggestion, by adopting the methodology Research Through Design (RTD) and the method of provocative interaction design [5]. RTD is selected for the in-depth exploration as the motivation is to promote and study non-use by designing and constructing a mobile physical interaction design. The focus of this research is aimed at investigating how the participants critically reflect on their own smartphone use practices within natural settings using an interactive provocative design solution. The provocative interaction design method contains the provocative aspects; *conceptual*, *functional*, *aesthetical,* and *material*. Bardzell et al. highlight these aspects as an approach to construct an interaction design aiming at challenging and influencing people's current practices, routines, or norms, leading to constructively communicating design critiques regarding the design solution [5], [6].

1.1. Research Question

The main purpose of this thesis is to encourage the participants to reflect on their smartphone usage and by utilising provocation, encourage them to reflect on their intended smartphone engagement before they act upon them. To evoke reflections of and to potentially challenge current smartphone practices, I have constructed the interactive design, GreyZone which was designed by adapting provocative elements. These reasons lead to the following research question:

To what extent and how does GreyZone support reflections on smartphone usage practices? And what are the experiences of using this in daily life?

2. BACKGROUND

This chapter contains an in-depth elaboration of theoretical and methodological approaches, shortly presented in the previous chapter, Introduction, primarily regarding smartphone non-use and use of provocation within RTD. During my pre-thesis, "*Promoting Smartphone Non-Use*" my co-author and I conducted semi-structured interviews in which findings are initially explained as these are potential for this thesis and substantiates the necessity of conducting a longitudinal study.

2.1 Pre-Thesis Work

The findings from three semi-structured interviews conducted during my pre-thesis project repeatedly highlighted that smartphone overuse leads to dissatisfaction regarding either own or others' smartphone usage. The main coincidences and similarities appearing in the analysis were structured into the following overall categories; *High and Frequent Usage, Desire for Changes in Current Usage, Desire for Keeping Elements in Current Usage, Conflicts in Internal Social Contexts, Impulsive Behavioural Tendencies, The Smartphone's Control over the User* [7].

In the category *High and Frequent Usage*, the individual self-estimated average usage was calculated to an average of 3.66 hours daily. In comparison to the research by Lee et al. published in 2017, the average self-estimated smartphone usage of 4.47 hours was similar, which supports that it is not a random coincidence occurring among the selection of participants in my pre-thesis [4]. Supportive to the high usage, in an investigation by Oulasvirta from 2012, the average smartphone usage was self-estimated to 2.7 hours on a daily basis. This shows an increase of 1.77 hours within a decade, which indicates smartphones overuse is progressively increasing [1]. However, the accuracy of the self-estimated average usage can be discussed since it is prone to recall errors [8]. This combined with the fact that people have a tendency to underestimate their own smartphone usage could suggest that the actual numbers are higher [3], [4], [9], [10].

In addition to spotting similarities and tendencies by asking predefined open questions, observing both facial and verbal expressions promoted an impression of frustration and dissatisfaction regarding both own and others' usage in social contexts. The social dissatisfaction, also connected to the *High and Frequent Usage*, was primarily expressed within the impact on the atmosphere, e.g. in scenarios where attention and interaction is needed or desired from the other individual. Another tendency causing smartphone overuse was the frequent notifications received or expected from applications and functionalities. Notifications appeared as a disrupting element leading to *Conflicts in Internal Social Contexts,* as half of the participants were either consciously or impulsively reacting to notifications, promoting negativity to the atmosphere in social context. Another behavioural pattern for a majority of the participants was the physical placement of the smartphone itself. In terms of distance, the

smartphone was primarily placed right at hand or they perceived their smartphone as a wearable. This decision signalised that they either perceive the smartphone as a necessity for everyday living or it was an incorporated habitual behavioural pattern.

Supportive to a smartphone's contribution to an easier everyday living, the participants strongly identified their main activities as; communication, entertainment, and other smartphone advantages which entailed attractiveness to the participants and highlighted the beneficial sight of owning a smartphone [7].

An outcome from the interviews signalled as a *Desire for Changes in Current Usage*, involves a desire to minimise the number of hours which was often expressed in relation to social media. A participant mentioned the experience of getting 'caught in a loop', specifically by scrolling down the Facebook feed endlessly to pass time. Additionally, this participant perceived this interaction as being unnecessary, not providing any value and being a waste of time. Regarding *The Smartphone's Control over the User*, the frequent reactions and attention to notifications were also highlighted as undesirable.

> *"Stop reacting to notifications, it is unnecessary that the notifications appear, I check my phone like an empty fridge to see if there is anything new and to be the first*".

Regarding *Impulsive Behavioural Tendencies,* another unconscious tendency, was the behaviour of picking up the phone impulsively without any purpose.

The desire of changing current usage does not only involve own smartphone usage but is additionally related to the other participants' usage. As mentioned in the *Introduction*, the norm regarding expectations to others' usage were frequently promoted in all three interviews. For instance, a participant expected constant availability from others, specifically the ability to reach them by calling or other communicative applications. Although there is a general desire to minimise the current individual usage, there are also circumstances where the smartphone appears as an attractive element. Shortly, there is a *Desire for Keeping Elements in Current Usage*, for instance there are elements they perceive relevant for their everyday living, which are practical and not time demanding such as setting an alarm or using payment applications.

2.2 Non-Use of Technology

Technology and the users' interaction with it, plays a central role within the field of Human-Computer Interaction (HCI). In recent years, investigating non-use has piqued a significant interest from researchers and designers alike within HCI. Non-use is, by Fuschberger et al., considered as an activity, as discarding technology usage is an action taken by the user, either consciously or unconsciously [11].

Although the simple definition of non-use is the absence of use of a technology, the action of not using a technology, the term encompasses more than just the absence. As Satchell and Dourish express, "*Non-use is, often, active, meaningful, motivated, considered, structured, specific, nuanced, directed, and productive.*" [12]. It encompasses that there are differing

reasons and approaches in which people practice non-use of technology and can explain the relationship between humans and technology [12].

A theory called the diffusion of innovation, explains to which rate an innovative technology is adopted by people as well as when non-users become users [13]. Furthermore, it implicitly assumes that those non-users eventually will become users to some extent. This view of technology innovation perceives non-users as either future users, non-existing or irrelevant [12], [14]. A number of papers dispute this binary view of users and non-users as they instead view them as being more complex. The binary view causes several illogical cases which describes a person as either just a user or a non-user. A concrete example is when an individual, after having used a technology for a period, decides to discontinue their usage for a while and eventually resumes it. Another example is an individual who has access to a computer through a public library and uses it on a monthly basis. In these cases, and plenty others, it is difficult to place the individuals as either a user or a non-user as it is often temporary and can change at any given time. As Baumer et al. state: "*a given individual is neither a user nor a non-user, but rather constantly (re) negotiates dis/engagement with the technology*" [15].

As previously mentioned, a smartphone is intended for making everyday living easier, but this entails an expected social norm of constant availability and causes disadvantages of not having access to one. It is evident that practicing non-use of a device, intended for making everyday living easier, could certainly make various daily activities more taxing and laborious. In comparison, Lee et al. state that it is not always feasible to practice complete non-use of smartphones [4]. The findings in a study by Kim et al. [16] and my pre-thesis supports this theory as the participants desired changes, in addition to a desire for keeping elements in their current usage. On these matters, as well as that engagement of technology is constantly renegotiated, I prefer to focus on *temporary non-use* of smartphones.

Smartphones are designed to be accessible and uncomplicated to use and can provide quick gratification to the user. This instant accessibility of the smartphone can be a gateway to acquiring a habitual behaviour [1]. Moreover, my pre-thesis findings indicated that the majority of the participants checked their smartphones out of habit several times within short time periods.

As mentioned, there can be several reasons why people wish to limit or entirely stop their usage of technology, likewise, there are several approaches people can take in order to reduce their smartphone usage. In a study conducted by Lee et al., several frequently used non-use strategies for smartphones were identified; *altering smartphone settings, intervention software, physical separation, mental efforts,* and *downgrading*.

Although it was reported that the various non-use strategies were to some extent effective, the users often failed to sustain the reduction over a longer period [4], [10], [17]. There are elements of the non-use strategies that can challenge the sustainability of not using smartphones. Concrete examples are temptations to use smartphones, lack of self-control and external sources such as requirements to use a specific technology [18]. An observation in my

pre-thesis, was despite the participants' desire to limit their current smartphone usage, they continued in their usual routines, which is an example of '*lagging resistance*' [18].

The non-use strategies can be divided into software- and physical-based solutions. The software-based solutions described in the following section utilise the strategies; altering smartphone settings, intervention software, downgrading, and mental efforts. On the contrary, physical-based solutions can presumably mostly benefit from utilising the physical separation strategy.

Software-Based

There are several existing studies that investigate solutions that utilise the intervention software and altering smartphone settings strategies which either visualises usage, gives warnings, or restricts access [16], [17], [19]–[23]. In a study by Hiniker et al., they deployed and investigated an intervention software that gives warnings called MyTime, which is an application that enables the user to set a timer for selected applications. When the time limit has been reached, the user is given the option to either close the application they were using, dismiss the warning, or use the application for a couple of more minutes. Their results show that only 6% of the users chose the option to close the application when the time limit had been reached [23]. These findings indicate that utilising only warnings or visualisations of usage are not adequate to discourage smartphone usage. A study by Kim et al. [16] supports these findings as they have reported restrictive mechanisms (e.g. denying access) were more effective than less restrictive mechanisms (e.g. warnings) in limiting smartphone usage. However, they also report the more restrictive mechanisms drove the users to feel more frustrated and pressured due to difference in usage contexts.

Kim et al. utilise inconvenience interaction design in their study of the effects of increasing the interaction cost of selected applications [20]. By using their solution, the user must complete a task before the selected application can be launched where the task can have varying workloads. Their results show that the task with the highest workload (30-digit input task), discouraged about 47.5% of usages, whereas the task with the minimal workload (press a button), discouraged about 13.1% of usages. These findings illustrate that increasing the workload, even a minimal amount, can reduce usage as the smartphones are no longer instantly accessible.

There are other studies that have investigated how non-use of smartphones can be promoted within social settings. An example is Lock n' LoL that enables co-located users to have their smartphones locked and their notifications muted to minimise the social disruption [21]. If necessary, users can ask for explicit permission through the application to use their smartphone unrestricted, which was often discouraging them in the first place. This application lessened the instant accessibility to the applications and thereby also lessened the impulsive interactions and habitual patterns. In a study by Bruun et al., it was investigated how provocation could be utilised to promote non-use of smartphones within family settings with young children [22]. They deployed Pup-Lock, an application that could be utilised by anyone in the household,

including the children, to lock down every smartphone in the household for a 30-minute period. Overall, it made the users reflect on their smartphone usage and spend more time together as a family during the study. Although there was an option to unlock their smartphones, none of the users utilised that option.

Physical-Based

Although there are many solutions and studies of smartphone non-use that are software-based, these solutions are partially counter-intuitive since the restrictive software is commonly an application that is on the actual device that people wish to restrict the use of. These software-based solutions *can* be adequate in circumstances where the users want to restrict usage of specific applications and not every smartphone interaction which was shown in the studies by Kim et al. and Hiniker et al. [20], [23]. However, the software-based solutions entail that the instant accessibility to the smartphone is still present, which is the element that often made the users habitually check their phone in the first place [7]. Another area of interest that could be examined and is presumed to have a lack of research in, is utilising physical elements in promoting non-use of smartphones. Although the digitalisation pressures us to be more digital, I consider it important that we as designers do not completely look away from physical elements and that we should not be afraid to deviate from the digital norm to make physical designs.

Lee et al. propose that temporary non-use could be supported by utilising *inconvenience interaction design* among other guidelines. Inconvenience interaction design is described as a design guideline with the intention to make a design inconvenient to interact with by increasing the physical, cognitive, temporal load or several simultaneously [4].

The research into non-use of technology and specifically how smartphone non-use is currently being promoted, illustrates that utilising inconvenience interaction design can be more effective in reducing usage than simply visualising or giving warnings of overuse. Therefore, I have decided to investigate how to utilise inconvenience interaction design through provocation in order to construct a physical design that promotes temporary non-use of smartphones.

2.3 Provocative Interaction Design

When the research field of an area of interest is either lacking or non-existing, which in this case is promoting smartphone non-use, a methodology called RTD can be utilised. In RTD, the design artifacts precede the research, i.e., the designs that are constructed and investigated are not based on current theory, however they contribute to the research field of promoting smartphone non-use. A possible research output of RTD is to create a design that either challenges or changes the current state of doing things, which thereby creates new situations and practices that can be investigated and produced knowledge of [24].

Since there is a lack of solutions integrating physical elements in promoting smartphone non-use and a lack of studies investigating these design possibilities in everyday living, I was

motivated to investigate this area utilising the RTD methodology in order to contribute to the research field of promoting smartphone non-use through an interaction design. To that end, I will utilise provocation, which is an approach within the field of RTD, as provocative designs can impose dilemmas onto users and make them reflect on and possibly change their practices.

Mogensen has explored how provocation can be utilised when developing systems and has suggested *provotyping* as an approach [25]. Provotyping was proposed by Mogensen in 1991 as a term entailing provocative prototypes. The objective of provotyping is not to guess a possible solution to a given problem, but rather to provoke current practices. A provotype provokes people to reflect and question current practices by making them experience them in new ways. The focus when adopting a provotyping approach is to further change of current practice, which can lead to creating and discovering new knowledge that contributes to the research field [25].

Mogensen suggests the concept of *provocation through concrete experience* as a contrast to detached reflection that is often the outcome of other approaches. I.e., he proposes that instead of reflecting *on* practices, we can make people experience current practices in new ways with provotypes [25]. Dunne and Raby believe that when utilising provocation to challenge current practices in everyday life, the provocativeness of the provotype should be balanced, as if it is too provocative, the users will reject it, and if it is not provocative enough, it will go unnoticed and fail to provoke reflections [26].

According to Bardzell et al., a provocative design can consist of the aspects conceptual, functional, aesthetical, and material. These provocative aspects can be promoted and expressed by designing and constructing a provotype, appearing as a tool contributing to RTD [6], [25]. The four provocative aspects are fundamentally assumed as essential parts of promoting provocation in RTD. Table 2.1 presents an elaborating explanation of the aspects [5], [6].

Provocative Aspects	
Aspect	**Explanation**
Conceptual	The conceptual aspect involves the considerations and decisions regarding the design idea.
Functional	The functional aspect involves how the design functionally works.
Aesthetical	The aesthetical aspect involves how the design visually looks.
Material	The material aspect involves the physical components the design consists of.

Table 2.1: *Explanation of Bardzell et al.'s provocative aspects.*

These aspects are necessary to consider in the study as: *"provocative design refers to design approaches that operate in a design space where asking questions is as important as solving a problem"* [27], specifically due to their influence on the construction of the interactive provotype. The aspects can work as a guideline when making decisions by separating the provocation in each part of constructing and designing, as well as how to balance the provocativeness across the aspects. The aspects of a design can be manipulated to make the design more inconvenient to interact with by increasing the physical, cognitive, or temporal load and thereby making it more provocative. Bardzell et al. explain that these aspects are utilised in an interaction design, for instance a provotype.

As previously expressed, the aim for this thesis is to promote non-use and reflections of smartphones through provocation. The motivation for reducing smartphone engagement is that it is either strengthening or promoting behavioural patterns related to smartphone overuse. Prolonged engagement with smartphones is a tendency primarily occurring due to the smartphone users' ambivalent relationship to their own smartphone usage. Integrating provocation when creating a technological design solution is beneficial as it can contribute to making people question their current practices regarding smartphone usage. In addition, integrating provocation as the main element might influence everyday living [5], [6].

3. GREYZONE

This chapter describes how the physical provotype was designed and constructed in order to promote temporary non-use of smartphones. This will be in terms of the reflections and reasonings behind the design choices, how it facilitates provocation, how it was constructed, and how it works.

In my pre-thesis, I proposed *Miniature Hardcase* as a possible solution based on the interviews I conducted with the participants and the conducted research into related works and related theory. Miniature Hardcase was designed as an off-device physical solution to hide the smartphone from view, which can be seen in figure 3.1. Another aspect was that the design had a specified limit of smartphone usage per day. This was to provoke the users to reflect and decide when and what they wanted to use their smartphone for in their limited time [7]. In this project, I have worked further with and improved on the Miniature Hardcase concept.

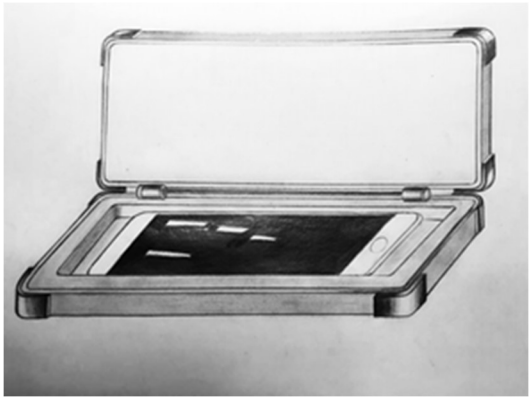

Figure 3.1: *Miniature Hardcase, a proposed solution to promoting temporary non-use in my pre-thesis* [7].

I embraced design authorship when designing the provotype, which was also recommended to do by Raptis et al. when working with provocative designs [5]. I.e., the provotype was not explicitly designed to solve the users' need, but rather was designed out of my curiosity and intuition as a designer.

3.1 Facilitating Provocation

As mentioned, the purpose of this thesis is to investigate how a provocative design can encourage people to reflect on their smartphone usage and challenge their current smartphone practices. To do this, I have designed and constructed *GreyZone*, a physical provotype that challenges smartphone practices by limiting the user's daily smartphone usage.

The name GreyZone was chosen due to it imposing a dilemma onto the user where they have to renegotiate with themselves on whether to use the smartphone or not, i.e. being in the grey zone.

To guide my decision-making in relation to facilitating provocation, I have focused on the conceptual, functional, aesthetical, and material aspects.

3.1.1 Conceptual Aspect

In terms of conceptual provocation, I focused on challenging the norm that a smartphone is instantly accessible and available every hour of the day. GreyZone deviates from the norm that the majority of, if not all, non-use solutions are software-based. As GreyZone is a physical provotype, it makes it more inconvenient to gain access to the smartphone and thus eliminates the instant accessibility by having a physical barrier between the smartphone and the user. Moreover, making a physical provotype that is considerably larger than the actual smartphone challenges the transportability of the smartphone. This is due to the size of GreyZone not fitting into a normal sized pocket and thus making it more inconvenient to carry around.

3.1.2 Functional Aspect

In terms of functional provocation, the smartphone users are faced with a dilemma to use their limited daily usage or save it for later in the day. This way, the users are forced to reflect on their intended usage before gaining access to the smartphone.

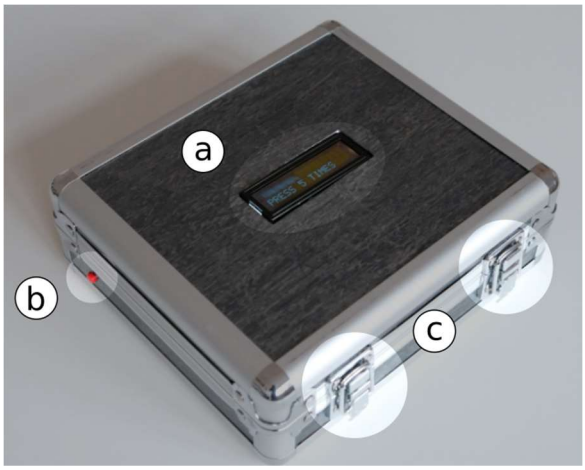

Figure 3.2: *GreyZone: a) LCD screen to display status of time left, b) emergency button, and c) closing mechanism.*

Figure 3.3: *Inside of GreyZone with foam padding on upper lid and platform on bottom to hide the electronic components.*

GreyZone allows one hour of smartphone usage per day, which is up to the user to decide when and how to spend the limited time. A screen on top of the provotype display the remaining time of the day (figure 3.2a). If the time limit for the day is reached, an audible alarm is activated whilst the smartphone is out of the provotype and it locks the smartphone in when the

smartphone is inserted and the box is closed (figure 3.2c). After going over the daily limit, the users can only gain access again by pressing the emergency button (figure 3.2b) which allows 10 minutes of usage without the alarm. GreyZone has three states it can be in, *phone in* – where a smartphone is inserted and the box is closed, *phone out* – where the box is open and the smartphone is accessible, and lastly *emergency* – where the alarm and lock are disabled for 10 minutes.

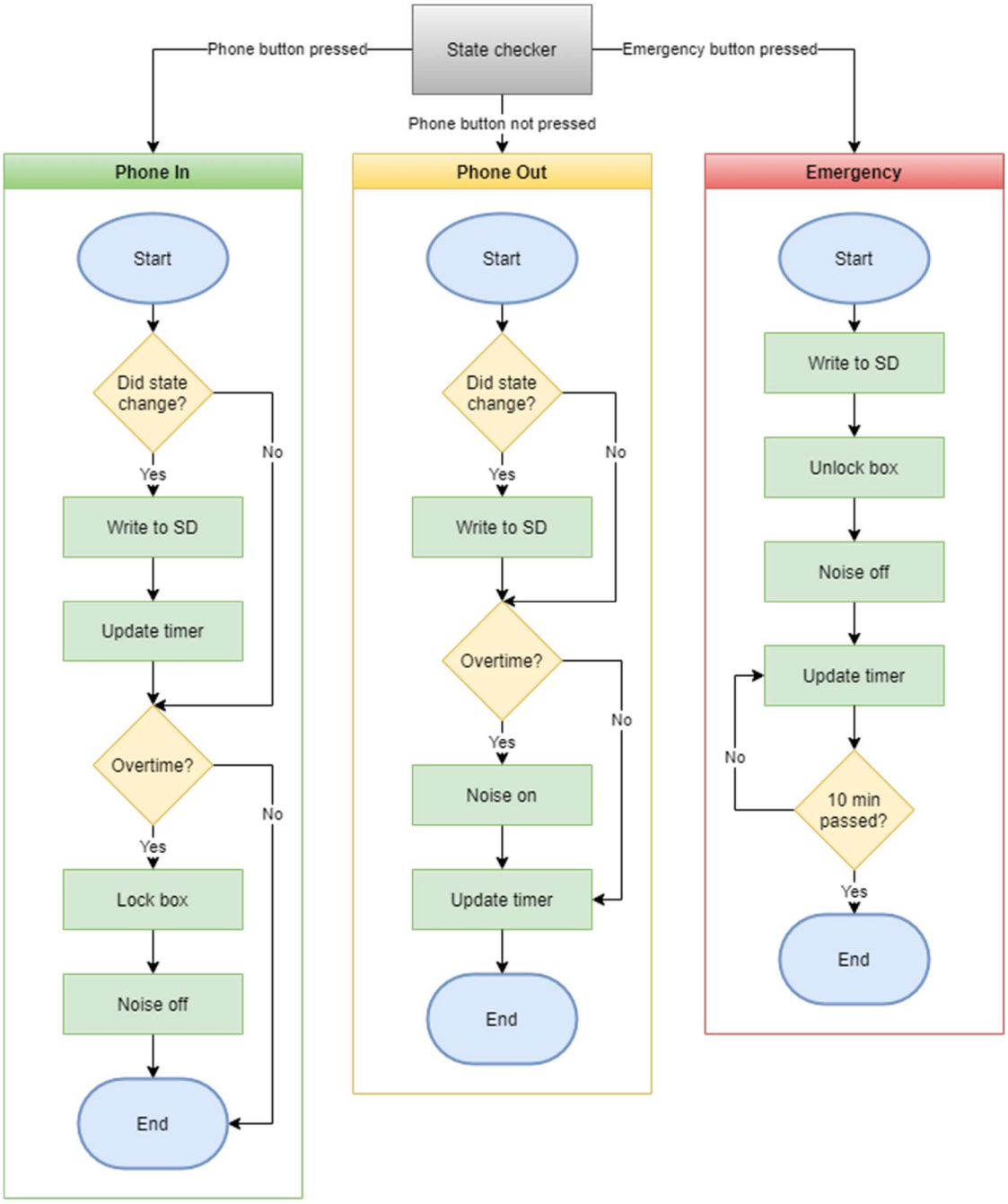

Figure 3.4: *Flowchart over the three states GreyZone can be in; phone in, phone out, and emergency.*

Figure 3.4 describes these three states in depth. Restricting the time limit to one hour per day is presumed to reduce the habitual and impulsive smartphone patterns uncovered in my pre-

thesis. The one hour limit was decided on based on the participants' self-estimated smartphone usage shown in table 4

3.1.3 Aesthetical and Material Aspects

In terms of aesthetical and material provocation, I wanted to challenge the norm that most non-use solutions are software-based by designing and constructing a physical artifact. Moreover, a physical artifact conceals the contents, hiding the smartphone from view when inserted. The size of the provotype is comparable to the size of the early mobile phones which reduces the transportability. A red button was chosen for the emergency button and placed on the left far side of GreyZone as the aim with it was not to draw attention to it. For the actual box, I opted for using a microphone case due to its size and sturdiness. For displaying the time, I opted to use a simple LCD screen that was installed inside the lid of the box so the timer could be seen on first glance.

3.2 Construction of GreyZone

GreyZone was constructed by using a microphone case (211 x 186 x 71 mm) and drilling holes for the emergency button, LCD screen, and the charger cable. In terms of the hardware, I used an Arduino Uno with a real-time clock (RTC) module (figure 3.5f) to keep track of the time and day accurately. Moreover, I used a mini speaker (figure 3.5g), an emergency button (figure 3.5d), an LCD screen (figure 3.5b), and a button to check whether a smartphone was inside the box (figure 3.3a). The locking mechanism was 3D printed and a servo was attached to it (figure 3.5c). The Arduino Uno was powered by a power bank which was estimated to last approximately a week when fully charged (figure 3.5e). The bottom hardware components were concealed with a wooden platform, where the top components were concealed using foam, which was cut to fit, see figure 3.3. The hardware components and the wooden platform were attached using epoxy glue and the foam was glued with super glue.

In terms of the software, it was programmed in C++ using the Arduino IDE and several open-source libraries to be able to use the hardware components. Due to the current COVID-19 pandemic, I have not had access to any workshop facility and was therefore not able to construct some parts of the provotype on my own. Therefore, the locking mechanism was 3D printed by an acquaintance who owned a 3D printer, and the electronic components were soldered and assembled following my instructions by another acquaintance who had soldering equipment.

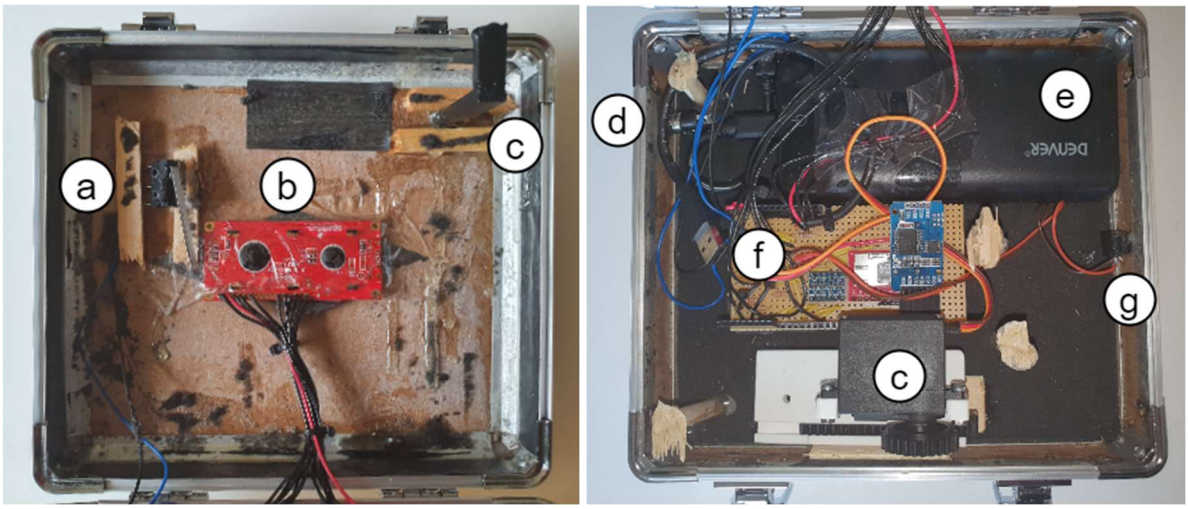

Figure 3.5: *Internal components of GreyZone: a) phone sensor, b) LCD screen, c) locking mechanism, d) emergency button, e) power bank, f) Arduino Uno with an RTC module, and g) mini speaker.*

4. LONGITUDINAL STUDY

The purpose of conducting this study was to explore to which extent GreyZone supports critical reflections on smartphone usage in addition to the experiences associated with using the provotype in natural settings. The frame for this thesis is a longitudinal study including a field study spanning three weeks with two families, where one or more of the family members used the provocative GreyZone. This chapter describes how the longitudinal study was conducted in terms of the participants, the field study design, and the collected data in addition to the reasonings behind the taken choices.

4.1 Field Study

This section describes how the field study was conducted. A field study was chosen to gain insight into the reflections that are made when GreyZone becomes a part of the participants everyday life, in addition to how it affects their everyday practices.

4.1.1 Participants

For the field study, I chose to recruit two out of three families who were interviewed in my pre-thesis. This was on the grounds that participant data was already acquired and could therefore be utilised, which consisted of their self-estimated smartphone usage and their usage goals. Based on the results from the data analysis of the interviews, three members from the two families were selected to use the provotype in the study. The participants using the provotypes will hence be referred to 'as *provotype users'*, likewise the participants not using the provotype will be referred to as '*other family members'*. When discussing both the provotype users and other family members, they will be referred to as participants. Table 4.1 shows the participating families, their ages, their occupation, the ones selected to use the provotype, and their daily self-estimated usage.

Family A consists of a senior couple, P1 and P2 who live together. P1 owns a personal smartphone which she also uses for work. She has a habit of checking work related emails when she is at home. P2 has a habit of checking his smartphone, even when eating which he perceives as annoying. Both of them have expressed that they regularly use their smartphones for doing tasks and are dependent on it since it makes everyday living easier such as when parking, grocery shopping, and paying in stores. Although there were times where they desired changes in their own current usage, they did not express any desire or need to change each other's usage since it did not significantly affect them. P1 used her smartphone for work, therefore it was deemed unsuitable to have her use the provotype since it could obstruct her work life. In family A specifically, an interesting observation will be if there are any effects of P2's provotype usage on P1's usage.

Family B consists of four members; two parents and two teenagers. P3 uses her smartphone to listen to music and on various social media platforms. She has expressed that she did not want any changes in her current usage since she appreciates the connection with others through social media. P4 also uses her smartphone to listen to music and on social media platforms, but to a lesser degree than P3. She mentions a desire to reduce her social media usage as she had a habit of getting 'caught in a loop'. Although P5 has the highest smartphone usage in the family, she did not express any desire to change her own usage. P6 has a personal smartphone which he also uses for work. He mainly uses it to listen to music and read the news. He has previously been dissatisfied with his own usage, which lead him to take action to minimise it such as disabling notifications. The selected members of family B to use the provotype are P3 and P5 since they were the ones to cause frustrations to the other family members due to their higher usage. Moreover, I selected one parent and one teenager to see if there is a difference in their experiences with GreyZone and how they handle situations. Additionally, an interesting observation will be if P4 gets the motivation to start reducing her own usage when two members in the family have GreyZone.

Family	Segment	Age	Gender	ID	Provotype User (P)	Occupation	Current Daily Usage (hours)
A	Senior Couple	58	F	P1		Urban planner	2-3
		60	M	P2	P	Environment technician	1.5
B	Family with Teenagers	15	F	P3	P	Elementary school student	2-3
		19	F	P4		High school student	1.5-2
		50	F	P5	P	Self-employed daytime carer	5
		53	M	P6		Environmental economist	1

Table 4.1: *Participant overview.*

4.1.2 Study Design

As mentioned, the field study spanned three weeks, where three participants of two families used the provotype. At the beginning of the study, the selected provotype users were provided a provotype and the purpose of the study was introduced to them. Moreover, the functionalities of the provotype were explained and they were encouraged to contact me in case of problems or questions with either the provotype or the study. Figure 4.1 illustrates the timeline of data acquisition.

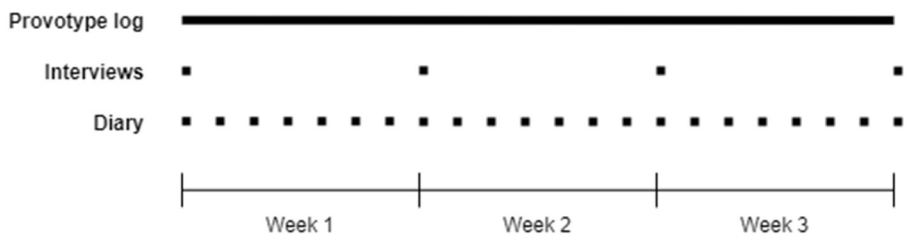

Figure 4.1: *Timeline of the data acquisition.*

Figure 4.2 shows the package provided to each of the three provotype users which contains a booklet diary, booklet manual for GreyZone, a pencil and GreyZone. The pdf versions of the diary and the manual for GreyZone can be viewed in the appendix. As the purpose of the study is to promote non-use of an electronic device, it was considered inappropriate to make the manual and the diary available electronically. Therefore, the booklets were only provided in printed formats.

Figure 4.2: *Package for the provotype using participants.*

4.1.3 Data Acquisition

In the field study, data was acquired from the interviews, the diary entries, and the provotypes. The rationale for acquiring data from four different sources is to gain both quantitative and qualitative data to analyse and compare. The qualitative data gives insight into the participants' thoughts and reflections while the quantitative data provides factual numbers illustrating how their smartphone usages have been affected for the duration of the study.

Qualitative Data

The qualitative data was acquired from the interviews and the diary entries. The responses from the interviews were documented in writing. In addition, the interviews were video recorded. At the end of the field study, the filled-out diaries were gathered for further analysis. Although the contents of the diaries were routinely discussed in the weekly interviews, it was desired to analyse the participants' diary entries, specifically their answers to how frustrated and satisfied they were, in relation to the other data as they were not commonly mentioned in the interviews.

The provotype users were instructed to fill out a diary at the end of each day during the study. These diaries were used for gathering self-reported data and were constructed utilising the Day Reconstruction Method [28]. This type of survey method was chosen for this study in order to keep the labour intensiveness required to a minimum. The entries were concerning the most memorable experience of the day with GreyZone, whether it was negative or positive. They were asked to give the experience a title, write when and where it happened, what they were doing, with whom, and what they felt using two affect descriptors. The descriptors, *frustrated* and *satisfied*, could be answered from 0 - *not at all*, to 6 - *very much*. Lastly, they were given the option to elaborate on their experience of the day. The purpose with having the provotype users fill out the diaries, was to document experiences which could then be discussed at the weekly interviews.

During the field study, weekly interviews with both families were conducted. It was valuable to have the whole family participate in the interviews, including the other family members, since GreyZone's effect on all of the participants could be investigated. Moreover, the other family members could contribute with information, in case the provotype users failed to mention them as well as helping them reflect on their experiences. In addition, it was desired to gather information on what reflections the participants made, both the GreyZone users and the others. The weekly interviews were semi-structured where the content was based on the prior week's diary entries. The aim with the interviews was to convert their daily experiences into reflections about their smartphone usage.

Due to the copious amount of data to analyse and considering the interviews were already documented in writing, the recorded videos were not transcribed in verbatim. However, the videos were revisited to uncover and document potential new perspectives or insights. The interview transcripts and the interview guide can be seen in the appendix.

Quantitative Data

The quantitative data was acquired from the provotype. For the duration of the field study, the provotype continually logged data into the SD card when the state changed between *phone in*, *phone out*, and *emergency*. The data consisted of which state it entered and the current date and time. Moreover, at the end of each day, it logged either how much time was left or how much the time had gone over the daily limit.

From the logged data, their smartphone usage could be analysed in depth, specifically when in the day they used their smartphones, how frequently they used it, and how long each episode was.

4.1.4 Data Analysis

When analysing the acquired data, the thematic analysis method was utilised where the themes were derived and identified from the data [29].

Both the quantitative and qualitative data were split into two groups based on the families and the datasets were then analysed one by one following a qualitative data analysis procedure consisting of six phases taken from [30]. Table 4.2 presents the utilised analysis procedure and describes each phase.

Since it was one person analysing the data, it was important to be systematic and thorough throughout the process. The software NVivo [31] was utilised when coding the data as it ensures a coding consistency and increases the validity. These procedures help in organising and making sense of the entire dataset in addition to supporting in insight generation.

Analysis procedure	
Phase	**Description**
Familiarise with data	This phase consists of reading and watching the dataset associated with a family which includes; provotype data, diaries, and interviews with the purpose of getting into the users' mindset.
Generate initial codes	This phase consists of systematically coding the entire dataset and combining relevant data.
Search for themes	This phase consists of searching for themes based on the initial codes and grouping them together within themes.
Review themes	This phase consists of reviewing if the themes work with the data.
Define and name themes	This phase consists of refining the themes in an iterative manner.
Produce report	This phase consists of analysing and reflecting on the themes and codes to gain insight and thereafter produce findings.

Table 4.2: *Description of the analysis procedure.*

5. FINDINGS

This chapter contains the results from analysing both the quantitative and qualitative data that were gathered in the field study. P2 used GreyZone for a total of 18 days, P3 used it for 21 days, and P5 for one day due to quitting using the provotype, which will be elaborated later. P2 experienced several problems with the provotype and had to, on three separate occasions, get the provotype fixed by me. P3's provotype had soldering issues which caused the screen to display odd characters. Since Family B lived inconveniently far away, the provotype could not be fixed on-site and had to be sent back for repairs.

	P2		P3		P5	
Day of study	**Frustrated**	**Satisfied**	**Frustrated**	**Satisfied**	**Frustrated**	**Satisfied**
	4	2				
	6	1				
	1	4				
	5	1				
1	4	2	6	0	6	0
2	1	1	6	0		
3	5	5	0	0		
4	0	0	5	0		
	6					
	6	1				
5			6	0		
	0	6				
6			4	0		
7			4	4		
8			4	2		
9	4	2	6	0		
10			6	0		
11			6	0		
12	3	4	3	3		
13			6	0		
14			2	4		
15			3	3		
16			1	5		
17			4	2		
18			6	1		
19			6	0		
Total	**45**	**29**	**84**	**24**	**6**	**0**
Average	**3.46**	**2.41**	**4.42**	**1.26**	**6**	**0**

Table 5.1: *The provotype users' frustration and satisfaction of their daily experiences with GreyZone. Answer options for both frustration and satisfaction ranged from 0 - not at all, to 6 - very much.*

Table 5.1 shows the provotype users' answers to the affect descriptors, frustrated and satisfied over the course of the study. P2 occasionally filled out his diary when the provotype went in for repairs, which explains why some of the cells in the *Day of study* column are blank. From the table, it can be seen that P2 had lower frustration and higher satisfaction on average compared to the others, where P5 had the highest frustration and lowest satisfaction.

Some of the provotype data were discarded since they were conflicting with the interview and diary data and deemed to be inaccurate, most likely due to technical issues. It should be noted that there is a risk the presented provotype data might also be inaccurate.

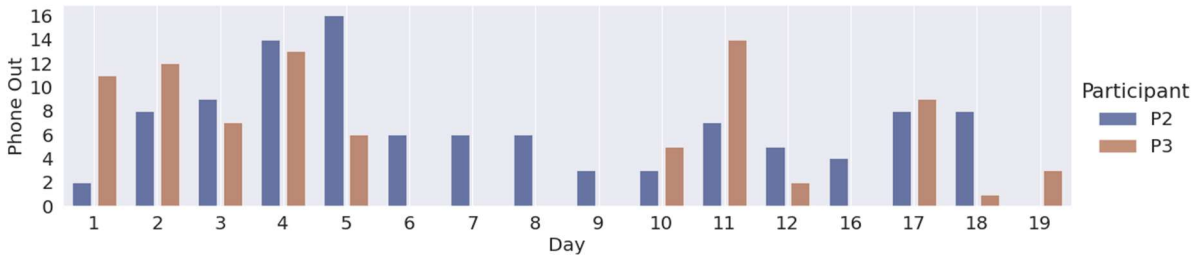

Figure 5.1: *How many times the participants took their smartphones out of GreyZone.*

Figure 5.1 shows the number of times the participants have taken their smartphones out of the provotype for each day in the study. This data was acquired by investigating the number of times the phone sensor had been triggered with a buffer of approximately 5 seconds. The buffer time was included due to the participants occasionally opening and closing the provotypes more than once to ensure their smartphones were inserted correctly. It can be seen that during the first few days of the study, P2 tended to take their smartphones out more often compared to later in the study.

Figure 5.2 shows the participants' remaining usage time per day. It can be seen that P2 often had more than 2400 seconds (40 minutes) left, but also had three days where he exceeded the usage time limit with more than 1200 seconds (20 minutes). P3 on the other hand, tended to be closer to the actual usage time limit.

The blank values in both figure 5.1 and 5.2, are due to either having no logged data on that day or the data having been ignored due to suspected inaccuracy.

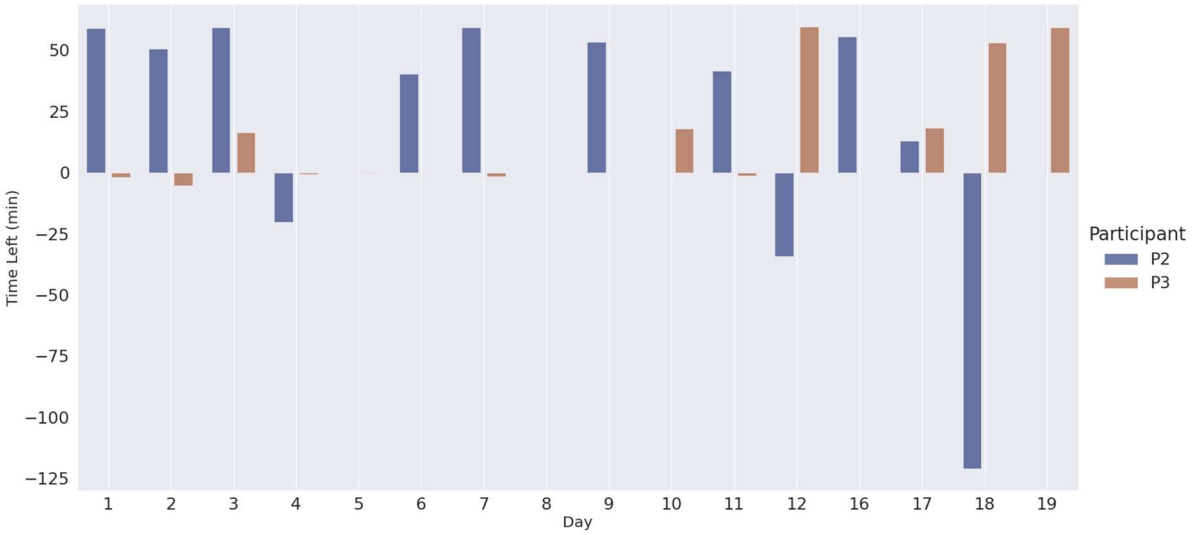

Figure 5.2: *The participants' remaining usage time. It is in the negative axis when the participants have exceeded the daily usage limit.*

The qualitative data from the diaries and interviews were structured into themes which were identified during the data analysis. These themes are desired changes in practice and reflections of usage, perceived provocation, and GreyZone problems. These findings will be covered in the following sections.

5.1 Desired Changes in Practice and Reflections of Usage

In general, there were both desired and undesired changes in the provotype users' smartphone practices from using GreyZone. In this section, these changes in practice will be presented in addition to the reflections the participants made.

Both participants from Family A and P3 expressed that they reduced their smartphone usage. Although they still use their smartphones in their everyday life, they minimised their smartphone interactions where they "*don't pick it up all the time*" and "*don't have to look at it all the time*" which they all find positive. Specifically for P3, she mentioned that GreyZone has "*changed the way I did things*" in relation to navigating since she "*got more independent*" from her smartphone by not using Google Maps.

In 2.1 Pre-Thesis Work, it was mentioned that the desire for changes in current usage often was expressed in relation to social media usage. P1, P2, and P3 mentioned having reduced their social media usage and as a result feel they have more time. P3 perceived herself as not as "*addicted*" to social media in the last interview although she has previously described herself as a "*social media freak*". Moreover, both P1 and P3 expressed that reducing their smartphone usage, specifically social media, has given them unexpected "*serenity*" in their everyday lives.

I put it in the box, and it gave me so much serenity and I didn't expect that. (P3)

Although there were mostly positive reflections on reduced social media usage, P3 mentioned having difficulties since social media was the only way she could communicate with her friends during the days she had home education.

The only way I can communicate with my friends is through social media, so I think it has been the hardest that I can't contact my friends quickly. (P3)

Although P3 had other electronic devices, she mentioned that her smartphone was the only device she used to access social media. Both P2 and P3 reported that their usage on other electronic devices were unaffected by the study, whereas P5 moved her usual smartphone usage onto a tablet instead.

Three of the participants expressed that some functionalities and applications should not count as regular smartphone usage since they are "*more okay than others*". Moreover, P5 in particular justified her smartphone usage to "*not count*" as actual usage because "*what I use my phone for is not social media"*. In contrast, the three participants agreed that social media usage 'counts'.

Since GreyZone is a physical provotype that encloses the smartphone, the instant accessibility of the smartphone is eliminated. P2's minimised access to his smartphone has affected his smartphone practices where he reflected on where he usually puts his smartphone.

I don't have to have that phone laying next to me all the time, not even when we are visiting someone or are somewhere else. (P2)

After beginning with the study, P2 and P3 began to perceive the other family members' usage as high. Which might or might not have been the same, but they "*notice it a lot more*". Moreover, P3 also observed other people in public where she "*counted every single person using phones or other electronic devices and it was almost everybody except two percent*". These observations of other people's high smartphone usage made P3 reflect on her own practices and made her want to "*stand out from others*" because she did not want to be "*one of those who is always on social media*".

The other members from both families observed that the provotype users' smartphone usage (P2 and P3) had been reduced. However, in Family C, the other family members, apart from P5 when she used the provotype, did not report in having reflected on their own practices or having made changes to their smartphone usage practices. In contrast, the other family member in Family A, P1, reflected on her own smartphone practices together with P2.

In addition to reflecting on their current smartphone practices, Family A reflected on what would happen when the study was over.

What's interesting is that when it is over with registering, what happens then? Has it affected my usage? (P2)

Family A have expressed multiple times that they wish to continue with their reduced usage since it is "*positive*" they are "*not addicted*" and because it gives "*serenity to do it that way*".

5.2 Perceived Provocation

In relation to the conceptual provocation of GreyZone, there were mixed findings. As mentioned, one participant (P5) decided to quit using the provotype after one day with the provotype. This was due to her feeling too restricted in her everyday life since she listened to music and audiobooks from her smartphone with headphones when doing household chores and had frequent phone conversations with her family throughout the day. She tried to adapt to GreyZone by moving her smartphone practices onto a tablet, but the size of the device made it too inconvenient for her. P3 experienced difficulties in adapting to GreyZone, which was because the time limit was "*not enough*". Throughout the weeks, her difficulties in adapting subsided and her reflections of smartphone practices increased. P2 experienced the least difficulties in adapting to GreyZone and the one hour daily limit among the provotype users although he experienced some undesired restrictions in his everyday life. These undesired restrictions included not being able to bring GreyZone when exercising and its inconvenience when e.g. grocery shopping.

These findings of the provotype users' difficulties in adapting to GreyZone can be compared to and are supported by the findings in table 5.1 where it can be seen that P5 experienced the most frustration, P3 in-between, and P2 the least frustration over the duration of the study. In addition, these findings are also supported by the participants' self-estimated usage hours per day, mentioned in 2.1 Pre-Specialisation Work, indicating that when the new way of doing things is too different from their current practices, they feel more frustrated and less satisfied.

Due to the eliminated instant accessibility of smartphones when using GreyZone, Family A began to reflect on the topic. Moreover, both Family A and P3 reduced their social media usage and expressed they did not feel "*addicted*" as they did before the study.

In terms of functional provocation, there was the intended dilemma I wanted to impose on the provotype users, which was to either use the limited time they have or set it aside for later use. This was due to wanting them to reflect on their intended usage before taking their smartphones out of GreyZone. The provotype users, P2 and P3, reflected on their smartphone practices because of GreyZone.

P2 had no difficulties with the daily one hour limit of smartphone usage and adapted to it quickly and has mentioned staying under the limit the majority of the study. P3 experienced more difficulties in adapting to the time limit, which was because she often used her smartphone when relaxing at home.

There was an unintentional dilemma that arose due to the size of GreyZone, which was to either compromise on safety by not bringing the smartphone or 'use' time by bringing the smartphone, which will be elaborated later. This led to GreyZone having unintended use cases, where they either left the box and smartphone or took the smartphone out of the box for safety reasons even though they were not using it.

An instance where P2 had taken his smartphone with him when exercising, led to an interesting outcome since the alarm went off while P1 was home.

Today when I was out running, the alarm started four times and [P1] pushed it every once in a while. (P2)

This led to P1 to interact with GreyZone by pressing the emergency button to silence the alarm. Moreover, P3 mentioned that she had been alerted by her father (P6) that "*the box is noisy*" to get her to silence it. This indicates that GreyZone's alarm not only affects the provotype user, but also those in the vicinity. Lastly, the alarm often made P3 frustrated because it disrupted her current activity.

In terms of the material provocation, both P2 and P3 expressed the size of GreyZone to be inconvenient. Since GreyZone was several times larger than their smartphones, it could not easily be transported and P2 expressed feeling restricted in his safety due to it.

The third day I was out running and I usually always have my phone on me in case I fall or injure myself, it's for safety. I have considered taking it [the smartphone] with me, but I'm not even using it. (P2)

He faced a dilemma on whether to bring his smartphone and 'use' his daily limit when exercising or leave his smartphone in the box and compromise on his safety. In the subsequent interviews, P2 mentioned that he would take his smartphone with him when exercising even if it meant going over the daily time limit, which can explain the exceeded usage time of more than 20 minutes in figure 5.2. Likewise, P5 faced a similar dilemma – to compromise on safety or inconvenience herself with the box by bringing it.

I don't know other's phone numbers and what if something was to happen? I had to consider taking it with me or not. (P5)

In like manner, P3 expressed being inconvenienced by the size of GreyZone when transporting it. P3 usually carried her smartphone with her everywhere in her pocket, but with GreyZone it was no longer possible which she described as "*weird*". If there were instances where it was too inconvenient to take GreyZone with her, she would simply leave her smartphone.

In relation to GreyZone being a closable box, the provotype users mentioned that they were unable to charge their smartphones when it was inside the box since the charging cable stood in the way of closing the box. This meant that the provotype users were only able to charge their smartphones when they were using it.

There was an instance where P2 missed a call due to the smartphone being inside GreyZone and not being able to hear it. Moreover, he mentioned that he occasionally checks whether someone has contacted him or written messages which he should answer. This could indicate that GreyZone blocks, or at minimum reduces, the volume of the smartphone and thereby suppresses smartphone-initiated interactions.

There were no mentions of the aesthetic aspects of GreyZone, either positive or negative. This suggests that the aesthetic provocation was too minimal since it failed to provoke reflections.

5.3 GreyZone Problems

As mentioned, each provotype user experienced problems with their provotypes. P2's provotype had the most problems since it went in for repairs three times and had a reoccurring error which I was unable to permanently fix. The error was that the provotype would suddenly turn off on its own, mostly at night, which was not due to it needing charge since it was plugged in. P2 would turn the provotype back on when it happened. After having sent out Family C's provotypes, it was discovered that P3's provotype had soldering issues which could not be fixed on-site and therefore needed to be sent back. P5's provotype had issues in turning on, but after a few hours of charging, it functioned properly. Since P5 stopped being a provotype user after one day, it was decided that P3 could use that provotype instead of waiting hers to be fixed and sent back.

As mentioned, parts of the logged data from the provotypes conflicted with the qualitative data and were therefore presumed to be unreliable. An example of the conflicting data is the logs showing no usage on certain days, where the participants had mentioned using their smartphone on that day either through the diary or interviews. This was likely due to a technical issue, which was only discovered when analysing the logs.

Another problem that was discovered from the logs, was that the RTC module reset twice on P2's provotype and once on P3's provotype. This meant that the provotype's scheduled reset time might have shifted from midnight to an unknown time. However, the provotype users seemed unaffected by it, since P3 made no remarks and P2 mentioned only noticing it once.

Lastly in relation to problems with the provotypes, it was accidently discovered that the lock mechanisms were defect in the middle of conducting the field study. This meant that when the participants had gone over the daily limit and inserted their smartphones into the provotypes, the provotypes would not lock.

6. DISCUSSION

In this chapter, I will discuss some of the findings from the study in relation to working with provocation as well as suggesting possible improvements.

Since there were problems with every provotype that was handed out to each participant, preventive measures could have been taken such as conducting a pilot study. Although the provotypes were tested before being delivered to the participants, the tests only covered assuring that the provotypes entered the correct state when conditions were met. By conducting a pilot study, the provotypes could be tested the way they were going to be used in the field and likely the errors could have been revealed and fixed before starting the field study.

In relation to the lock mechanism, it can be discussed whether or not it has affected the findings and how, but my assessment is that the malfunctioning lock mechanism is most likely not a considerable influence since the provotype users mostly kept their usage under the time limit or did not exceed the limit considerably.

GreyZone was sent out to two families where three participants were selected to use the provotype. These provotype users had similarities and also differences in how they experienced having used GreyZone. Moreover, GreyZone provoked reflections on smartphone practices on the other family member in Family A, however, Family B did not report making reflections. It could be interesting to investigate GreyZone with more families in order to observe how they experience GreyZone and what happens when their smartphone practices are challenged.

The decision to make the time limit be one hour per day was based on the participants' self-estimated usages. From the findings, it was observed that there was a possible correlation between the frustration and how much the time limit with the provotype deviated from their usual usages. Since one participant's current practices were challenged too much, she rejected it and quit using the provotype. These findings illustrate that the provocativeness is perceived differently depending on the individual and how much their current practices are challenged. This leads to my recommendation that the individual should be considered when making decisions on the provocative elements of a design. From my experiences of working with provocation, I believe that using frustration and satisfaction prompts as a measure, can be informative for exploring how provoked users feel.

There were no findings in relation to the aesthetical provocation of GreyZone. A possible explanation for this could be that people might not explicitly voice their opinion without being prompted, especially if it is negative. A solution for this, is to questions them specifically on their opinions and thoughts regarding the visual look.

Since there were many provotype problems that the participants experienced, especially P2, there is a chance that it might have been unintentionally provocative. From the findings, it was found that Family A were often worried about the provotype's well-being, which occasionally caused P2 to feel more frustrated, not because of having his smartphone practices challenged,

but being worried about the study itself. This could indicate that P2's average frustration might be lower and his average satisfaction higher than what was shown in table 5.1.

The findings from the study showed that the size of GreyZone inconvenienced the participants, where it introduced an unintended dilemma of compromising safety or 'using' the limited time for one of the participants. A possible solution could be to reduce the size of GreyZone in order to make it easier to transport and be less restrictive, e.g. when exercising. This would eliminate the unintended dilemma and since the provotype still reduces the accessibility, I presume that it will not have a significant effect on their smartphone usage while using the provotype. Another possible solution is to introduce supplementary devices such as smartwatches which makes it possible to make emergency calls which can increase their safety. Moreover, it opens up the possibility for using the supplementary device for doing some practical tasks.

From the findings, it was also found that it was inconvenient to charge the smartphone while it was inserted in the provotype. This could be solved by making a hole in the provotype for the cable to fit through. However, this opens up the possibility of using the inserted smartphone to e.g. listen to music by wearing headphones, on the other hand, it was already possible to do so by wearing wireless headphones. A hole for the charging cable is presumed to also increase the audible volume from the inserted smartphone. By ensuring that the provotype does not suppress the smartphone volume, it is presumed that the increased checking behaviour seen in P2 due to not being able to hear incoming interactions, would be reduced.

In this thesis, I chose to focus on promoting non-use of smartphone devices. There are other electronic devices that offer most of the same functionalities as a smartphone, e.g. computer or tablet. Since the focus is to make a physical-based solution, it was decided that the scope of this thesis would be on only smartphones. The findings from the study showed that both P2 and P3 mentioned their other electronic device usages were unaffected by the study. Regarding P5, she moved her usual smartphone practices onto a tablet. An interesting observation could be to also monitor the provotype users' other electronic devices usage to investigate the actual effects.

7. CONCLUSION

In this thesis, I investigated if and how provocation can be utilised to promote smartphone non-use. This was done by designing and constructing a physical provotype, GreyZone, informed by my pre-specialisation project and related research. GreyZone is a provocative box that limits smartphone usage to a maximum of one hour each day, which imposes a dilemma to the users on whether to use their limited smartphone time or save it for later.

A longitudinal study was conducted to see the extent of how GreyZone supports reflections on smartphone practices. This was in addition to investigating what the experiences were when using GreyZone in everyday life. Two participants from two families used the provotype in a period of approximately three weeks. Although three participants were selected, one of them quit using the provotype due to feeling too restricted in her everyday life.

The findings from the study showed that the provocative GreyZone made the provotype users and one of the other family members, reflect on their smartphone practices by challenging them. Overall, the two provotype users reduced their usage, especially their social media usage. Moreover, Family A expressed an interest in continuing their reduced smartphone usage after the study is finished.

The work in this thesis demonstrates that physical provotypes are a promising alternative to software-based solutions in promoting non-use of smartphones. Moreover, is that the perceived provocation of a design depends on by how much an individual's current practices are challenged. Lastly, it demonstrates that frustration and satisfaction prompts can be utilised to be informed about the perceived provocation from an individual. These findings contribute to the HCI research field.

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