Psychological and Behavioural Science

FamilyTime:

How to help smartphone users reduce problematic smartphone behaviour

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Abstract

Smartphones have become a pervasive feature of our society and everyday lives. Although they provide us with numerous conveniences and advantages, problematic smartphone use is associated with adverse consequences. Against this background, this essay aims to address how to help users reduce problematic smartphone behaviour, defined as a habit-driven behaviour. Families are chosen as a specific target. Existing interventions are limited in their effectiveness as they do not successfully address the habitual nature of problematic smartphone behaviour. This paper analyses smartphone habits through the lens of Installation Theory which provides a framework to conceptualize the environmental, psychological, and social cues that elicit and reinforce behavioural patterns of a habit. Accordingly, the newly designed application, *FamilyTime,* is built upon theoretical recommendations of how to address the environmental, psychological and social cues in the installation in order to curb problematic smartphone behaviour.

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1. Introduction

Smartphones have become an integral part of our everyday lives. According to the global mobile consumer survey (2018), 87% of the UK public owns or has access to a smartphone and 91% of them use it on daily basis. This is far more than any other device (see Appendix A), with an average usage per day of 148 minutes and 2,617 touches. Given this usage level, users have expressed concern (see Appendix B). In the UK, 39% of users perceived themselves to be overusing their phone, 43% of those in relationships felt their partner overused their phone, and 56% of parents believed their children were overusing their phones (Deloitte, 2018).

Undoubtedly, smartphones provide instant access to individuals and systems for personal and work purposes (Geser, 2004). However, smartphones are capable of abstracting people from their surroundings, especially when overused (Salehan & Negahban, 2013). The most self-reported symptoms of overuse are distraction, compulsion to check (Deloitte, 2018) and nomophobia, and the reliance on smartphones to complete basic tasks (King, et al., 2013). Consequently, social relationships are affected by preference of smartphone use to personal contact (De-Sola Gutierrez, Rodríguez de Fonseca & Rubio, 2016). Since overuse has dangerous consequences as stress and depression (Thomée, Härenstam & Hagberg, 2011), the World Health Organization has considered problematic mobile phone use a potential public health issue (Billieux, Maurage, Lopez-Fernandez, Kuth & Griffiths, 2015).

Against this background, this essay addresses the question of how to help users reduce problematic smartphone behaviour so as not to jeopardize their relationships and well-being. We focus on families who themselves aim to decrease their smartphone use. Thus, instruments like questionnaires that explicitly measure problematic smartphone behaviour (Billieux, 2012) are not needed. We target families for the following reasons. First, common goals within a group increase the likelihood of changing behaviour (Crown & Rosse, 1995). Second, families have a vested interest in their children's wellbeing (The Children's Society, 2012). Third, children in western countries get their first smartphone between ages 6 to 12 (Nielsen, 2017). At this age, the implications of smartphone overuse are especially severe since children's prefrontal cortex are not fully developed, resulting in a lack of self-control (Tarullo, Obradovic, & Gunnar, 2009). Fourth, parental problematic smartphone use increases the risk of children developing this behaviour themselves (Park & Rang Park, 2014).

Additionally, we focus on smartphones as a specific generation of mobile phones that have been enriched through various applications and computational features (Gökçearslan, Mumcu, Haşlaman & Çevik, 2016), accompanied by a high frequency of notifications (Van Velthoven, Powell & Powell, 2018). Moreover, we put an emphasis on social usage (i.e. online interaction with others) since it is the main contributor to problematic smartphone behaviour and accelerates the habit development (Li & Chung, 2006; van Deursen, Bolle, Hegner & Kommers, 2015).

To provide a well-founded answer to the research question, the essay is structured as follows: chapter 2 introduces the specific terminology, and chapter 3 is dedicated to the analysis of stakeholders. We outline the theoretical framework to analyse the nature of the problem in chapter 4, before shifting to the intervention rationale in chapter 5. Against this background, we propose the application, "*FamilyTime*" as our solution for problematic smartphone behaviour in chapter 6. Chapter 7 serves to discuss the implications and limitations and chapter 8 concludes.

2. Terminology: Problematic smartphone behaviour as a habit

Currently, consensus on the nomenclature of problematic smartphone usage is lacking (Wang, Lee, Yang & Li, 2016). Although the term "smartphone addiction" is widely used (Gökçearslan et al., 2016), it is not included in the Diagnostic and Statistical Manual of Mental Disorders, 5th Edition as a behavioural addiction. Other scholars have termed it "problematic smartphone usage" due to the atheoretical nature of the term "mobile phone addiction" (Billieux et al., 2015, p.460), and highlighted the habitual nature of smartphone usage (Oulasvirta, Rattenbury, Ma & Raita, 2012).

For the purposes of this essay we opt for the term problematic smartphone use and define it as 1) a repetitive, habit-driven behaviour, 2) associated with negative outcomes, 3) characterised by a lack of awareness, control and conscious intention (Lally, Wardle, & Gardner, 2011). We conceptualize problematic smartphone behaviour as habit-driven instead of addictive behaviour for two reasons. First, it is premature to categorise smartphone overuse as a pathological addiction given the lack of empirical evidence to support this (Walsh, White, & Young, 2010). Secondly, speaking of problematic smartphone use as an addiction may cause researchers to apply interventions for pathological addictions, which can lead to non-relevant

treatments (Billieux et al., 2015). Furthermore, such terminology could unnecessarily restrict the availability of theories through which the problem can be viewed, whereas our definition allows for a broader range of psychological theories to be used in our analysis.

3. Stakeholder analysis

The issue of problematic smartphone behaviour of families in the UK involves several stakeholders that differ in their willingness and power to address the issue. Here we give an overview of the major stakeholders and their role and motivation to reduce said behaviour.

As the producers of smartphones, **phone technology companies** hold large claim to the issue. Producers of smartphones such as Apple and Samsung, have a direct interest in consumer interaction with their product. Given the rise of negative behaviours linked to their products, it is within their interest to help users build healthy long-term relationships with technology (Salkever & Wadhwa, 2018). Currently, Apple is developing a range of features called 'Digital Health' to bring awareness to users' relationships with technology. However, there is a direct link between these features and a motivation to increase iPhone sales, given their availability only on latest versions (Perez, 2018).

Furthermore, **application companies** are a major stakeholder in problematic smartphone usage. This especially applies to application companies that rely on social usage which is the main contributor to the problem. Since the business models of application companies are built upon the habit-forming features that hook people on to their product, they are unlikely to act upon problematic smartphone behaviour.

In contrast, the **Center for Humane Technology** (2017) is made up of experts in the field of technology who use their own experiences in creating habit-forming tech, to now reverse its effects. As they have a direct interest in decreasing problematic smartphone behaviour and the capabilities to successfully launch a technology-based business, they can play a role in supporting an intervention. We will refer back to this in the discussion.

UK government is trusted to set policies in order keep the public safe. Apart from banning the use of mobile phones while driving (Billieux, 2012), smartphone-related

interventions are not widespread. The UK's National Health Services announced plans to launch its first "internet addiction centre" to provide treatment to gaming addicts (Marsh, 2018). However, gaming as a form of digital addiction (Billieux, 2012) is different from our focus on habit-driven smartphone behaviour with an emphasis on social use, so this intervention is not directly related to our study. Another stakeholder to consider is the **behavioural insights team** of the UK government that runs a web platform called "Good Habit Lab," which helps companies improve employee health and wellbeing. Although this unit has not yet explicitly focused on individual smartphone habits, its expertise in behavioural science can help test the effectiveness of our solution. We will refer back to this in the discussion.

The main stakeholder is the general population of **smartphone users** that engage in problematic smartphone behaviour and are willing to decrease it. All smartphone users, including those with regular usage, are at risk for developing problematic behaviour, given the numerous and heterogenous pathways (Billieux, 2012). Since habits are formed within the individual as part of a larger social group, the problem is best addressed at both levels. As previously stated, we specifically focus on **family units,** as they can be considered to be the most motivated social group to make a change.

4. Problem analysis: Problematic smartphone behaviour through the lens of Installation Theory

As stated above, we define problematic smartphone use as a habit-driven behaviour. Smartphones have the potential to induce new habits like the "checking habit" in which individuals briefly inspect their smartphone for incoming content (LaRose, 2010). Habits are automatic behavioural responses to cues, developed through repetition of behaviour in consistent contexts (Lally & Gardner, 2013). Habits can be useful in making unconscious decisions, thus leaving decision-making facilities available for newer, or more challenging situations. However, they can also become pervasive and maladaptive, interfering negatively with daily life (Van Deursen et al., 2015).

Installation theory provides a useful framework to conceptualize the settings that elicit and reinforce the behavioural pattern of a habit (Lahlou, 2018). Installations are specific, local, and societal settings in which behaviour is channelled. Installations

consist of three layers that, as a bundle, funnel behaviour: the physical, embodied, and social layer (Lahlou, 2018). Within the setting of an installation, individuals often perform behaviours that they did not consciously decide to perform. In the case of smartphone usage, behaviours can be reinforced into habits through cues within a given installation surrounding the device.

4.1 Physical layer

The physical layer of an installation encompasses the objective material environment (Lahlou, 2018). In the case of problematic smartphone behaviour, the physical layer consists of 1) the smartphone device itself, including notifications, 2) its physical proximity 3) and an unstimulating environment.

First, smartphones provide physical cues in the form of notifications that span several sensory modalities (i.e. visual, auditory, somatosensory), which tempt the user to "clean" these cues by checking their phone (Bayer, Campbell & Ling, 2015). Moreover, the smartphone interface maintains the same layout including the arrangement of applications. Consequently, the smartphone's familiar environment coupled with the checking of notifications contributes to habit-formation. Secondly, smartphones are portable devices that are typically kept within reach: in pockets, bags, or users' hands. This facilitates an immediate, oftentimes unconscious, response to notifications (Van Velthoven, et al., 2018). Thirdly, when disengaged with the environment, the smartphone is a convenient stimulus to escape boredom (Pielot, Dinger, Pedro, & Oliver, 2015).

4.2 Embodied layer

The embodied layer encompasses the subject and her competencies (e.g. skills, representations) (Lahlou, 2018). In the case of smartphone usage, the embodied layer consists of users' 1) skills to operate their smartphone, 2) motives and rewards to use their smartphone, and 3) bounded willpower.

First, the skills to operate a smartphone and use it competently are quickly acquired as smartphones are designed to be "frictionless" during usage (Shelley, 2015). This contributes to the automaticity of habits which goes hand in hand with a lack of awareness. Secondly, Billieux and colleagues (2015) argue that people are motivated

to use their smartphones to instantly satisfice the urge to seek reassurance and connect with their social networks. Furthermore, the concept of loss aversion should be considered in the context of motives for smartphone use. Losses loom larger than gains of an equivalent amount (Kahneman and Tversky, 1979). In the case of problematic smartphone behaviour, this has been referred to in a colloquial sense as “fear of missing out” (FOMO) which facilitates habitual checking behaviour (Elhai, Levine, Dvorak, & Hall, 2017).

A user can develop “FOMO” if believing that they are missing information. In this way, quick micro-rewards of information can become goals in themselves and compete with higher-order goals (e.g. more productive time use). When goals are in competition for attention, the more immediate reward will win out unless the individual is reminded of the long-term goal and actively resists the short-term (Fishbach, Friedman, & Kruglanski, 2003). Short-term rewards can be expected to often win out due to bounded willpower (Mullainathan & Thaler, 2000). This concept is especially important in the case of habits since it contributes to their formation. The further the automaticity of a habit is developed, the more the locus of control is shifted to the environment (Verplanken & Orbell, 2003).

4.3 Social layer

The social layer of an installation encompasses societal norms (Lahlou, 2018). In the case of problematic smartphone usage, the social layer consists of 1) the norm to be reachable, 2) peer pressure and 3) the imitation of others.

Firstly, it has become a social norm to be connected online; there is an expectation of constant reachability (Bayer et al., 2015). Secondly, smartphones enable us to maintain relationships and remain connected to groups, networks and organizations. Designed to integrate into all aspects of users’ lives seamlessly, smartphones serve as a platform for social activities (e.g. group messages, access to social networking sites). Not taking part in these activities can result in exclusion both online and offline (Salehan & Negahban, 2013). Thus, habits are further fueled trough peer pressure (Becker, 1991). Thirdly, according to social learning theory, individuals develop behavior patterns from observing their social surroundings. If the behaviour produces rewards, it becomes internalized to be repeated (Bandura, 1977). Social imitation of behaviour is important for this study as children are especially susceptible to imitate

problematic smartphone behaviours. Specifically, children with parents who exercise problematic smartphone usage are more likely to develop problematic smartphone habits themselves (Park & Rang Park, 2014).

5. Solution analysis: Intervention rationale

Having identified the facilitators of problematic smartphone use within the layers of installation theory, we will identify shortcomings of previous interventions and key ingredients necessary in a successful intervention. Corresponding to the structure of the problem analysis, the ingredients are grouped into the three layers of installation theory.

5.1. Shortcomings of existing interventions

Existing interventions for problematic smartphone use can mainly be categorized into informational campaigns, digital detox and technological applications.

Informational campaigns attempt to raise awareness for problematic smartphone use. The “Look Up” poem[1] for example aims to inspire people to use their smartphone less by narrating a scenario that actually never took place due to the protagonists looking at their smartphone. As the campaign is emotionally appealing, it can temporarily change the attitude towards the behaviour. However, influencing users’ intention is not enough to break habits, as they are constantly reinforced and mostly performed unconsciously (Webb & Sheeran, 2006). This intention-behavior gap renders one-off interventions like informational campaigns ineffective. This is reinforced by the fact that people with strong habits possess confirmation biases which reduces the influence of counter-habitual information (Verplanken & Wood, 2006).

Besides informational campaigns, a second existing intervention is a digital detox which means refraining from using digital technologies for a certain amount of time (Van Velthoven et al., 2018). Empirical data suggest a lack of effectiveness of this intervention type (Van Velthoven et al., 2018), as the same habitual cues will remain and enforce the habit once the detox has ended.

[1] Look Up - A Poem That Will Inspire You to Put Down Your Smartphone (2014). https://www.youtube.com/watch?v=pPQ08Sjjq1Y

A third existing intervention are smartphone applications (e.g. ForestApp, Moment) that attempt to reduce problematic smartphone usage. However, theoretical grounding and empirical data on these apps are lacking (Hiniker, Hong, Kohno & Kientz, 2016). Moreover, most of these apps focus only on physical cues of notifications. To the best of our knowledge, there is no application that addresses all three layers of the installation, nor one that explicitly targets families.

5.2. Ingredients of an effective intervention

In order to identify ingredients for an effective solution, each subchapter will include a recap of the facilitators of problematic smartphone behaviour within the layers of installation theory. For each layer, we will then derive theoretical recommendations for our application *FamilyTime*.

5.2.1 Physical layer

As highlighted in the problem analysis, the main driving forces of problematic smartphone use within the physical layer are the smartphone device (notifications and layout), its physical proximity and an unstimulating environment.

An effective intervention should firstly guide smartphone users to actively manage their notifications in order to get rid of excessive physical cues that lure them into using their phone (Kushlev, Proulx, & Dunn, 2016). This includes regaining control over notifications and applying counter-notifications that can raise awareness for unconscious use, to overcome the intention-behaviour gap (Lally & Gardner, 2013). In order to counteract habit-formation caused by stable arrangement of applications, the familiar interface of the smartphone should be randomized. Secondly, an intervention should keep in mind that the physical proximity of the smartphone itself is a physical cue and thus encourage intentional placement of it. Thirdly, an unstimulating environment lends itself to smartphone use in order to escape boredom. Although these situations cannot be prevented, a reminder to not use the smartphone may help to disrupt the habit (Lally & Gardner, 2013). Ideally, the reminder would shift attention to a more rewarding offline activity, preventing further checking behaviour (Pielot et al., 2015).

5.2.2 Embodied layer

As highlighted in the problem analysis, the main driving forces of problematic smartphone use within the embodied layer are the frictionless use of the smartphone, motives and rewards, as well as bounded willpower.

Firstly, frictionless use promotes the automaticity of behaviour, which can lead to a lack of awareness for that behaviour. Consequently, people tend to underestimate their smartphone use (Van Velthoven et al., 2018). Self-monitoring tools can address this issue. Furthermore, self-monitoring tools provide a basis for the formulation of goals and can highlight potential discrepancies between desired and actual behaviour (Lally & Gardner, 2013). To address bounded willpower and ensure new behaviour is developed, this self-monitoring should be an ongoing process.

In order to assure repeated action, users need to be satisfied with the new behaviour (e.g. offline activities). Many aspects of problematic smartphone habits (e.g. informational value and reassurance) result in immediate micro-rewards (Verplanken & Wood, 2006). Since these micro-rewards cannot be completely removed, an effective intervention should provide short-term rewards for decreased usage. These rewards also address bounded willpower by counteracting the tendency to favour micro-rewards of using your smartphone over higher order, long-term goals. Bounded willpower can further be addressed by defaults to funnel better behaviour, with the user always having the option to manually change preset options. To address loss aversion, attention should be shifted towards positive outcomes of alternative behaviours(Jager,2003).

5.2.3 Social layer

Within the social layer, the norm to be reachable, peer pressure and social imitation of behaviour have been identified as key facilitators of problematic smartphone usage.

Given that the reachability norm is well established within our society (Bayer et al., 2015), attempting to break it goes beyond the scope of this paper. Instead, we attempt to shift the focus to the reciprocal accountability norm. Accountability means that a person is explicitly or implicitly expected to justify his or her actions towards others

(Lerner & Tetlock, 1999). In the context of goal setting and commitment, the human desire for reciprocity is a crucial part of behavior change interventions (Dolan et al., 2012). Additionally, social support as a behavior change technique (Prochaska & Velicer, 1997) will be important for an effective solution, given the fact that peer pressure (Becker, 1991) and social imitation (Bandura, 1977) are facilitators of problematic smartphone use. Families constitute the first microsystem of children's ecological environment and thus strongly influence their socialization and behavior patterns (Bronfenbrenner, 1979). Directly linking the smartphone use of children and parents and making them collectively responsible for goal attainment can initiate social support and trigger the reciprocal accountability norm.

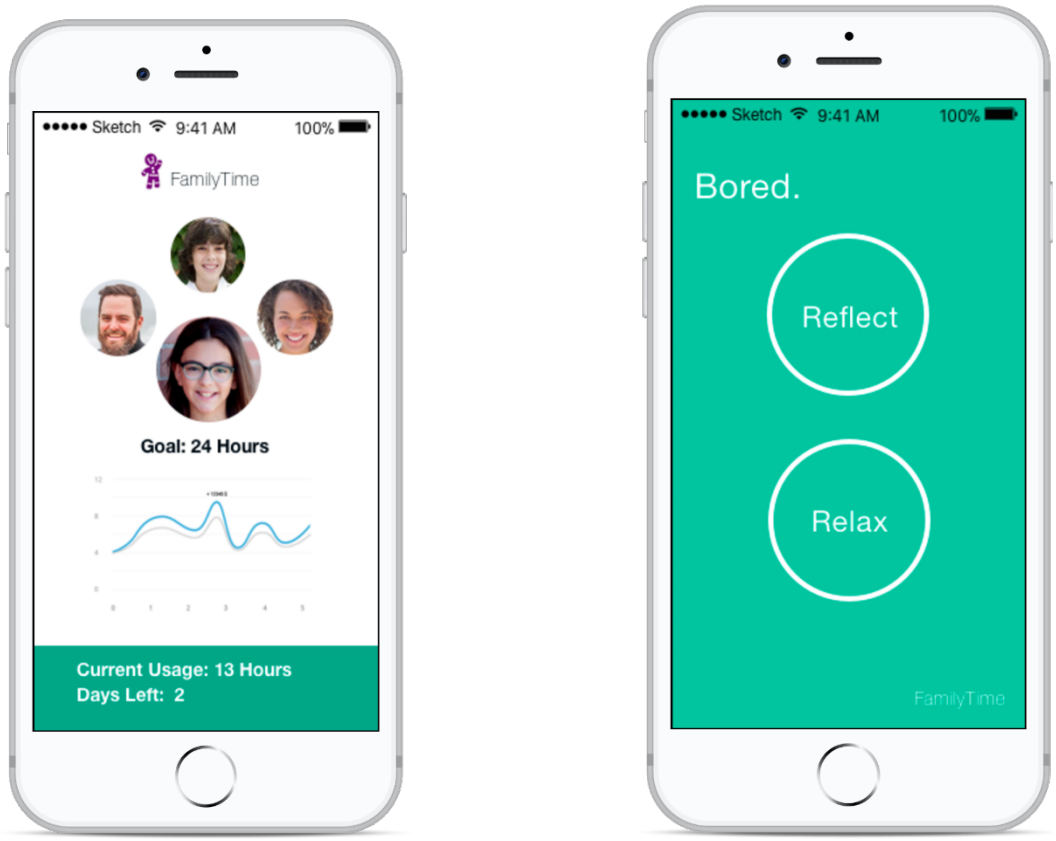
Additionally, gamifying the goal of reducing smartphone usage by including a competitive component can encourage behaviour change (Almarshedi, Wanick, Wills, & Ranchhod, 2015). This can reduce resistance among children and make the activity something fun instead of imposed by parents (Nucci, 2005). Although gamifying is important, it should be considered that rankings can backfire when people see they are behaving better than others (Dolan, et al., 2012).

6. Proposed solution: *FamilyTime*

Keeping in mind our analysis of a successful intervention that addresses all layers of an installation, we have designed a smartphone application called *FamilyTime*. Our App is targeted towards family units who want to curb problematic smartphone behaviours.

FamilyTime as an application centers around three core ideas corresponding to the layers of installation theory: 1) empowering users to manage changes to their phone's environment, 2) raising users' awareness and help set usage goals, and 3) providing a social support space to do this. *FamilyTime* monitors each family member's phone usage, and presents their collective progress on the homepage. Because every member is tied to the group number, everyone is collectively held accountable for the group reaching its weekly goal, and ultimately, a reward. The magnitude of recommended rewards is directly correlated to the magnitude of decreased phone time (i.e. more time away from the phone means bigger reward). Separate from the usage

statistics, *FamilyTime* also has a range of features (see Appendix C) designed to help each family member break problematic smartphone behaviour.



FamilyTime Homescreen

FamilyTime Bored Mode

Figure 1: FamilyTime layout example

Firstly, within the physical layer, users must regain control over triggers in their environment in order to break habits. Accordingly, one feature of *FamilyTime* is the 'App Control Center,' a centralised place for users to not only manage notifications for all their apps, but to also choose extra options such as 'Mix App,' which rearranges the locations of all the apps on the phone to counteract habitual use. 'App Disrupt' is another feature that sends a notification when the user spends longer than 10 minutes on apps they label as problematic. A default is set to social applications, since we have identified social usage as a heavy contributor to problematic smartphone behaviour in the introduction. These disruptions serve as reminders to bridge the intention-behaviour gap.

'Pickup Reminder' promotes intentional placement of the smartphone by sending reminders after a high frequency of pickups to place the smartphone in a less

convenient place (e.g. not beside you). The App Center also houses ‘Phone Lite’ and ‘Phone Blackout’ features. In Phone Lite, the user can choose to be blocked from particular apps, default to social apps, initially set for 4 hours. In ‘Phone Blackout,’ the user can choose to be blocked from using their phone entirely outside of emergency calls, with default set to 1 hour. As referenced previously, an unstimulating offline environment is a common trigger to reach for the smartphone. In the ‘Bored Mode’ feature, users can choose between tapping into a relaxing picture with gentle movements (e.g. ocean waves), or a meditation question to reflect on. This can shift the users’ senses from unconscious to more intentional usage.

Next, we move to the embodied layer. In this context, the App makes group goals and usage statistics salient on the homescreen. This is meant to highlight gaps between desired and actual behaviour. We kept short-term, attainable goals in mind when designing the Weekly Usage Goal, which we will discuss in more detail in the next paragraph. This ensures that users with bounded willpower are frequently rewarded for their healthy behaviours. This is especially important in forming and maintaining new behaviours within children (Cheng, Siu & Leung, 2006). Additionally, the App plays into the loss aversion tendency by awarding rewards in the form of kudos and suggested offline activities that use the same amount of time that was saved by being off the smartphone (e.g. a 2-hour family outing awarded for 2-hour phone usage decrease). This highlights the more rewarding activities that can compensate for smartphone usage. And for users who want an in-depth explanation for the science behind the features and problematic usage, we include a ‘Learn More’ option within the respective features.

While the App is designed to make breaking and forming new habits fun and engaging for the entire family, we aim to avoid dependence on the intervention itself through the ‘Off-App Goal.’ This is a long-term target for the family to stop using *FamilyTime*, with the idea being that they would have broken their smartphone habits by then. *FamilyTime* will make a recommendation between 2 - 8 months based on the family’s usage (Lally & Gardner, 2013). However, in order to not discourage groups who are off track on the goal, the time frame can be adjusted. This will act as a renewed goal commitment, and again address the intention-behaviour gap.

Finally, the following features aim to address the social layer. The key differentiator of our App to existing solutions lies in the social accountability of connecting family

members' usage. Ultimately, the family strives towards a shared goal and members are responsible for their own usage towards the goal, which strengthens family members' feelings of belonging and support in reaching their goals. Not only does this create a support system in the offline world, but it relieves the pressure of at least one social group from the norm of reachability. In order to keep the App enjoyable, we have introduced competition modes. 'My Challenge Mode' gives the user levelled challenges that promote better phone behaviour, starting with basics (e.g. sleep, with your phone in another room). When completed, the user is rewarded with a positive emoticon and kudos, and unlocks the next level of challenges. 'We Challenge Mode' allows one family member to challenge another to a direct challenge and set the stakes (e.g. lowest screentime, particular app usage, or phone checks).

Every week, the Head of Family (which rotates among the group), sets the Weekly Usage Goal that each member is held to. This serves to avoid resistance among children by giving everyone an opportunity to lead the group, limiting the authoritative features of our App. *FamilyTime* will make a recommended weekly goal, which the Head of Family can accept or change. If no goal is set that week, then a default of 5% below the previous week's goal is set.

Equally important, we have excluded further features in designing the App. In line with the principles set out by the Center for Humane Technology (2017), we ensure that our App does not have any scroll pages, which leads to unconscious use, and does not contain advertisements, which leads to attention drain. We further exclude rankings due to potential backfiring effects (Dolan et al., 2012). We also exclude conventional school-age restrictions such as school or bedtime restrictions. Our intention is to prevent resistance to the App that can come through imposed rules (Nucci, 2005). And finally, to ensure that healthy habits are formed in a lasting manner, we limit extrinsic motivators (e.g. monetary rewards) that jeopardize a newly formed habit once removed (Ryan & Deci, 2000).

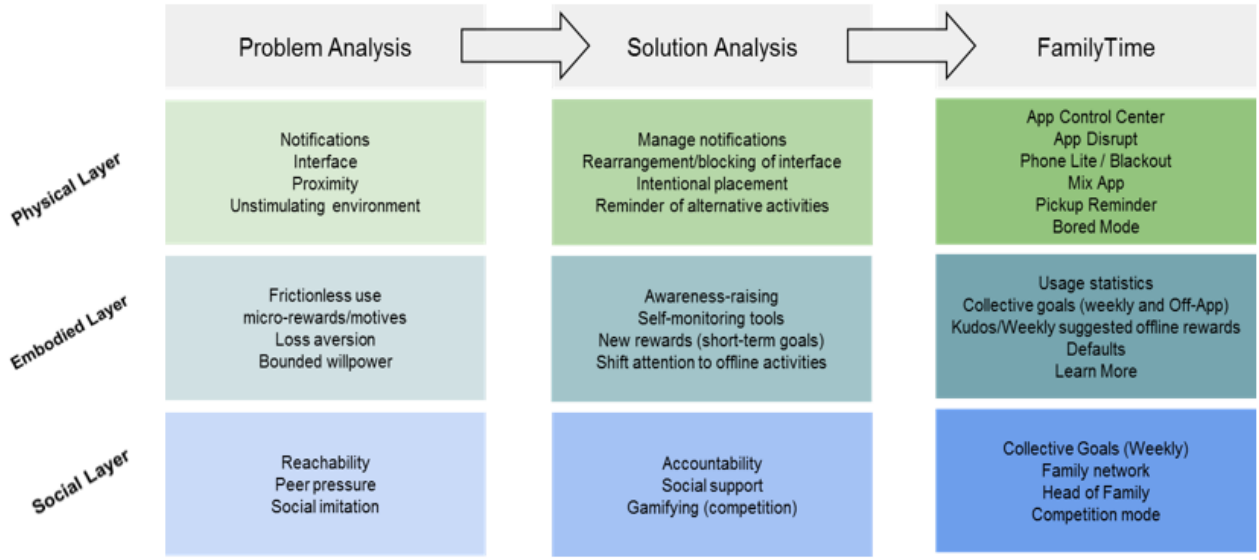


Figure 2: Summary of linkages between problem analysis, solution analysis and proposed solution FamilyTime[2]

7. Discussion & limitations

This essay addressed the question of how to help users reduce problematic smartphone behaviour in order to not jeopardize their relationships and their own well-being. We defined this behaviour as habit-driven and analyzed it within the framework of Installation Theory by identifying cues in the physical, embodied and social layer. Based on the analysis of these cues, we derived recommendations for an effective intervention, which led to the design of *FamilyTime*. As a smartphone application, *FamilyTime* provides a tool for families who are motivated to reduce problematic smartphone behaviour. *FamilyTime* 1) enables users to manage changes to their phone's environment, 2) raises user's' awareness and help set usage goals, and 3) provides a social support space to do this.

Some limitations of this research must be addressed. First, we acknowledge the seeming contradiction of designing a smartphone application to curb problematic smartphone behaviour. Ideally, existing smartphone applications and the smartphone itself should be designed in a way that do not lead to problematic behaviours. However,

[2] This graphic is simplified in that the layers of installation theory are represented separately. In fact, they overlap: For example, notifications are part of the problem in the physical layer. At the same time, counter-notifications can serve to address lack of awareness (embodied layer). Similarly, collective goals are part of the embodied and social layer in our solution. Thus, this graphic must be understood as heuristic tool, designed to show the linkages between the problem analysis (Chapter 4), the solution analysis (chapter 5) and *FamilyTime* (chapter 6).

following our stakeholder analysis, it is not reasonable to expect that smartphone technology and application companies will act, because their success relies on the continued sale and usage of their products. Against this background, it is reasonable to develop a smartphone application to address cues in all layers. Moreover, we attempted to design our application in a way that shifts attention from the smartphone towards offline activities.

Secondly, in addition to the theoretical analysis already laid out previously, our intervention overlaps with further behaviour change theories like nudging (Thaler & Sunstein, 2008) and the transtheoretical model of behaviour change (Prochaska & Velicer, 1997) which both lay out numerous principles for behaviour change to be effective. However, not all of the principles can be simply applied to habit-driven smartphone use. Therefore, we refrained from using these theories as the framework for our theoretical analysis.

Thirdly, smartphone usage is a social phenomenon deeply embedded in contemporary society. We acknowledge the scope of the problem and the limited effectiveness that an intervention as *FamilyTime* can have on the general population. Therefore, our intervention focuses specifically on families, which we expect should increase its effectiveness. To measure actual empirical effectiveness, the next step would be to test *FamilyTime* with a Randomized Control Trial (Haynes, Service, Goldacre & Torgerson, 2012), partnering with the Behavioural Insights Team, as mentioned in our stakeholder analysis. Testing *FamilyTime* against no application usage or usage of another application would allow us to determine its contribution to less smartphone usage and higher well-being.

Additional next steps include marketing *FamilyTime* and expanding involved stakeholders. One way to market *FamilyTime* is to work together with informational campaign makers and the Center for Humane Technology. While informational campaigns alone will not change habit-formed behaviours, they can raise awareness and interest in our application. As *FamilyTime* gains momentum in the market, we can target other stakeholders to further expand the App's user base. Additional features can support this. For example, the 'Neighbor Network' and 'School Sponsorship' features would allow for expanded networks to use the application and compete for lowest usage.

8. Conclusion

To conclude, problematic smartphone usage forms an important problem area that demands attention (Salehan & Negahban, 2013). Families have been chosen as a specific target since they are motivated to curb problematic smartphone behaviour and form groups in which this behaviour can be readily tackled (Crown & Rosse, 1995). Problematic smartphone usage is a habit-formed behaviour which is reinforced by cues in the physical, embodied and social layer of an installation. (Lahlou, 2018). The *FamilyTime* application can be an effective intervention as it is based on theoretical recommendations on how to address these cues. *FamilyTime* should be empirically tested using a randomized control trial, followed by an effective marketing strategy. If proven to work and successfully marketed, *FamilyTime* could help people to reduce problematic smartphone behaviour, resulting in a more balanced and satisfied way of living.

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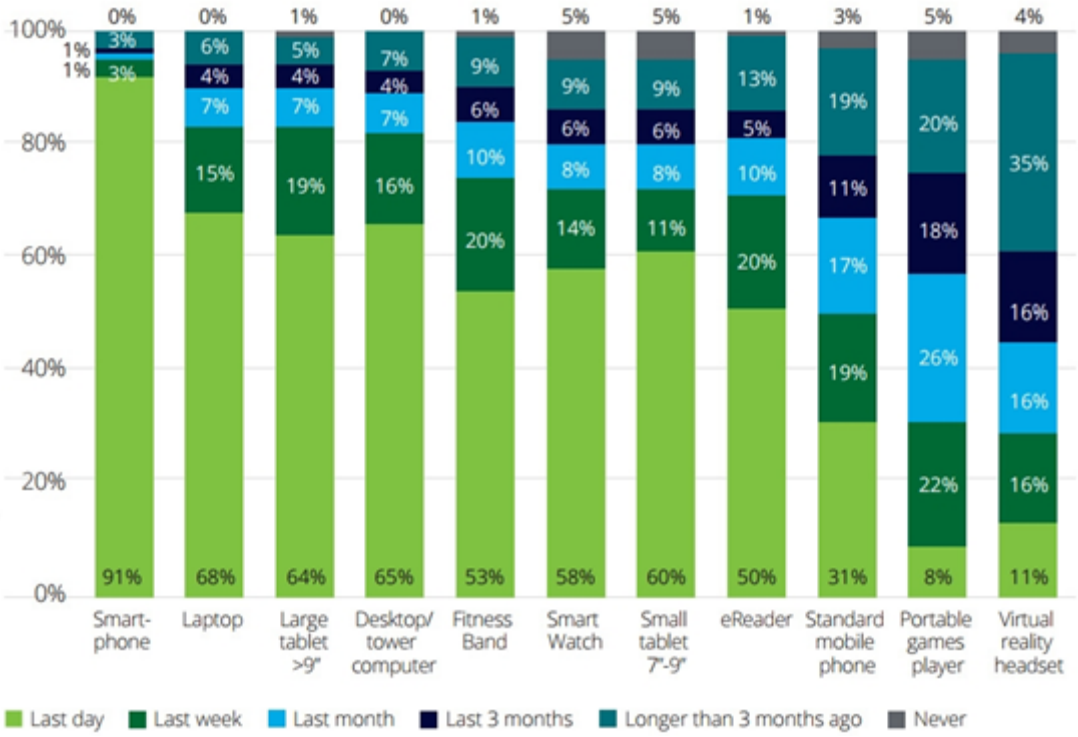
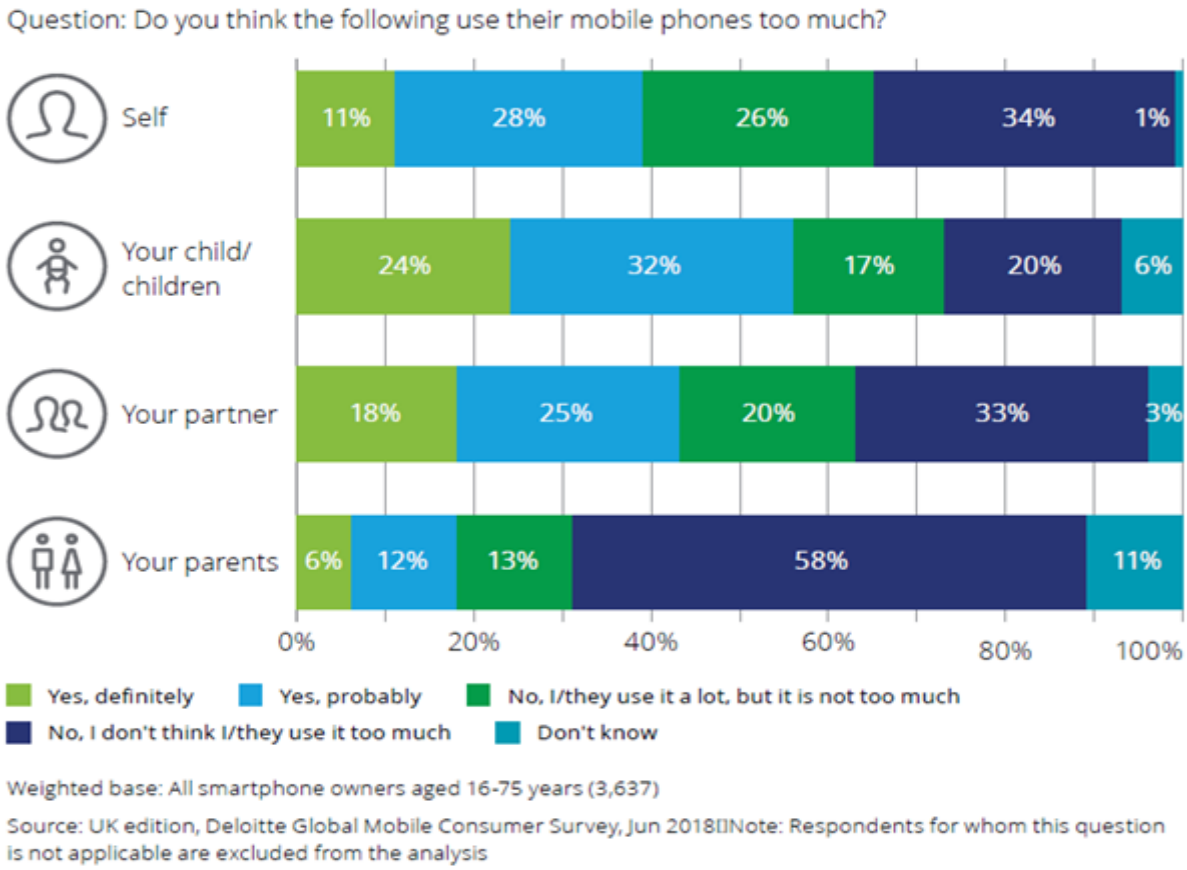
Appendix

Appendix A: Frequency of usage by device



Source: Deloitte (2018)

Appendix B: Perception of extent of smartphone usage



Weighted base: All smartphone owners aged 16-75 years (3,637)

Source: UK edition, Deloitte Global Mobile Consumer Survey, Jun 2018Note: Respondents for whom this question is not applicable are excluded from the analysis

Source: Deloitte (2018)

Appendix C: FamilyTime Features

Category	Description
Environment Control	**App Central** is the control center that allows an individual to manage their notifications and alerts for all of their apps. It is also the access point for additional app features.
	Mix App rearranges the locations of your apps, preventing unconscious use by redesigning your phone's environment. Can be used manually or the app will periodically rearrange the apps on its own. Managed through App Central.
	App Disrupt allows user to choose certain apps which will be disrupted after a certain amount of time (default: every 10 min) with a pop-up notification to disrupt unconscious usage. Notification will say "time's up" and have an option to exit the app or stay. Recommended apps will default to social networking sites. Managed through App Central.
	Pickup Reminder alerts the user after a high frequency of phone pickups to place their phone in an area further away.
	Phone Lite allows the user to block certain phone apps and all their notifications for a set amount of time (default: 4 hours).. Managed through App Central.
	Phone Blackout allows the user to block all phone apps and notifications except for emergency calls for a set amount of time (default: 1 hour). Managed through App Central.
	Bored Mode lets user choose between tapping into a relaxing picture with gentle movements (e.g. ocean waves), or a meditation question to reflect on.

Awareness-raising & Goal-setting	The **Homescreen** opens up to the Family Network, highlighting each family member, as well as key statistics such as: 1) this week's Head of Family, 2) group usage and goal for the week.
	Usage Statistics available on an individual and group level. Shows daily, weekly, and historical progress on screentime and number of phone checks (i.e. number of times the phone is picked up and unlocked). Option to track specific app screentimes (e.g. Facebook).
	Learn More provides short reads on problematic phone behaviours, habit formation, and tips for promoting mindful phone usage.
	Off-App Goal sets target date for the family to stop using FamilyTime, with the idea being that they would have broken the habit of problematic smartphone behaviour by the end point. The time frame can adjust as needed, requiring the entire group to accept or reject the new recommended target to act as a renewed commitment to the goal.Families are reminded of this long-term goal regularly (every two weeks) and in the case of a premature deletion of the app.
	Weekly Group Usage Goal & Reward will be set by the Head of Family each week. The default setting will be 5% below the previous week's usage, but can be adjusted as desired.
Social Accountability	**Family Network** is made up your family members on the app. The app collects the group's collective usage, with each member being able to view their own contribution as well.
	Head of Family allows each group member to take the lead on the app on a weekly rotating basis. The Head of Family determines the group's weekly usage goal, reward, and can award stars to any member of their choosing.

Competition	**My Challenge Mode** gives the user leveled challenges that promote better phone behaviour, starting with basics (e.g. make a call instead of texting your friend, sleep with your phone in another room). When completed, the user is rewarded with a positive emoticon and kudos, and unlocks the next level of challenges.
	We Challenge Mode allows one family member to challenge another to a direct challenge and set the stakes. Options between lowest screentime, particular app usage, or phone checks. Challenges can last for an hour or up to a week.
Future Features	**Neighbor Network** is made up of other Family Networks that you add into your "Neighborhood" which allows you to view each other's weekly collective usage. You may add up to 5 other families to ensure small networks. You can also opt to turn on location settings and add families in your area that you may not know personally.
	School Sponsorship allows schools to reduce problematic smartphone behaviours with their students. An administrator can organize a school-wide competition for lowest average phone usage by family and have access to Family Network statistics for all participating families. The admin will set time frame for the competition and award prizes of their choosing.