Supporting Desired Relationships with Modern Technology like smartphones

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ABSTRACT
This study explores how design can support adults aged 20 to 30 years old in developing desired relationships with their smartphone. While awareness of excessive smartphone use is growing, many existing interventions rely on avoidance-based strategies, which are often ineffective. Using behavioural theory and working closely together with the target group, two studies were done on how confrontation-based strategies, social interaction and goal setting can effectively support behaviour change. This led to the design of *'TapOut'*, a design research artefact. The outcome is five design insights for future designers, who are interested in design for behavioural change related to modern technology: involving the target group, enabling personalisation, showcasing goals and progress, reflecting patterns, and using AI tools transparently if relevant.

Author Keywords
Behaviour Change; smartphone Use; Digital Well-being; Co-design; Design Research

INTRODUCTION
My grandmother (84 years old) noted how "*everyone is looking on their machine all the time*", wondering what there was to see in that box. She revealed an unavoidable and clearly perceivable truth in our modern technology-driven world: people spend a lot of time - about 3 hours and 46 minutes (worldwide global average in 2024) [4] - on their smartphone daily.

Most people underestimate their screentime and are ashamed of their own behaviour; about 70% of Americans interviewed in 2021 about their smartphone screentime stated their usage had a negative effect on their mental health [4, 26]. To counter these behaviours, manufacturers and designers create new tools to control screen-time by displaying or restricting time spent; people try to curb these habits often without any luck. This research explores how design can help people constructively change behaviour to support a desired relationship with modern technologies, such as smartphones.

This study starts with a literature review focussing on behaviour change models, historical background and societal context of smartphone (over)use. Two studies are done with the target-group of adults from 20 to 30 years old. The first study has an exploratory character, leading to the design research artefact called '*TapOut*'. The second study evaluates this design. Both studies create a design advice for designers of behaviour interventions related to technology.

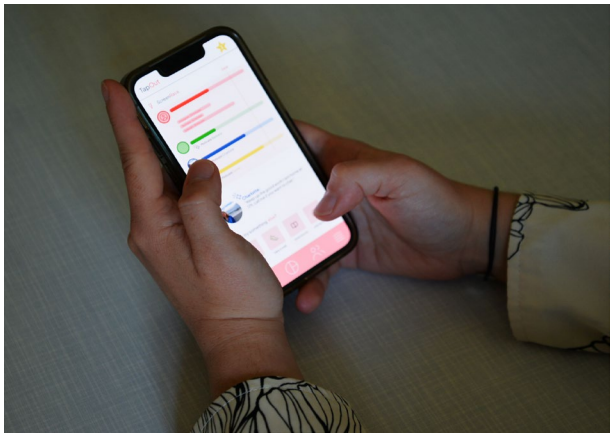


Figure 1. Interaction with the design research artefact 'TapOut'

This states the importance of involving the target group early, creating more valuable and accepted outcomes which can also be supported by enabling personalisation of a design. Additionally, showcasing goals and progress can help users stay motivated, and reflecting patterns can aid in understanding own behaviours, creating more suitable goals. Finally, if AI tools are relevant for the design, they should be integrated keeping an eye on transparency and communicating to a user how, what and why data is used.

RELATED WORKS

Historical Background

smartphones have been a part of our modern technological society for over thirty years now. As the first smartphone was introduced by IBM in 1994, user composition slowly shifted from businessmen to all people. Mass adoption by consumers started around 2007, with the introduction of the iPhone [14]. With this wide adoption of the smartphone technology and the shift of user group, the smartphone itself evolved as well. Introducing social next to functional applications, the smartphone became more than just a high-tech portable aid, bringing both positive functionalities to the table like connectivity, but also the danger of no longer being able to live without a mobile phone [3].

The UK Post Office recognized this in a YouGov study in 2008 by introducing the term 'nomophobia', short for 'NO MObile PHone phOBIA' [11]. The term is widely used in psychology studies, categorizing it as an anxiety disorder and containing many clinical characteristics. However, nomophobia is yet to be recognized in the Diagnostic and Statistical Manual of Mental Disorders (DSM) [2, 3]. This means treatments for nomophobia are not yet directly targeted.

Regulating behaviour

Especially social media seems to spark more and more discussion in our society. In 2024 the World Health Organization (WHO) investigated social media use by adolescents in Europa, Central-Asia and Canada. It was noted that social media and digital gaming can benefit this user group, as they can interact and stay involved with peers. It might however create a risk of addiction, which in turn disrupt essential activities like real-life interactions. [1]

Therefore, the WHO recommends policymakers all over the world to promote a healthy balance between online and offline activities through, for instance, regulation [1]. Consequently, the Dutch government launched a new regulation for preliminary schools and high schools to prohibit smartphones completely [24]. In June 2024 the Ministry of Education, Culture and Science found that this regulation had an overall positive effect, as students had become more social and had more concentration [16].

However, these types of interventions by the government are not targeted towards current adults, born before the mass adoption of the smartphones from 2007 onwards. They were introduced to the technology throughout their adolescence and not at birth, meaning people who were born between the year of 1995 and 2005 had access to smartphones and were restricted by themselves or their parents, but not by governments or other products to aid their behaviour. Therefore, this study focusses on (young) adults between 20 and 30 years old, and their behavioural relationship with smartphones in 2025.

Consumer behaviour and coping strategies

To help this target group, self-regulation might be an answer. As the smartphone has proven to be useful in area of for example connecting to others online and managing tasks like a calendar, it forms a new danger to mental health with risks like social anxiety. Mick and Fournier (1998) organized literature on paradoxes like these in eight main categories (table 1) Additionally, their study reveals that technology paradoxes and their emotional effects can be overcome by connected consumer coping strategies (table 2). Strategies that people developed themselves to self-regulate. [15] As the mobile phone started playing a bigger role in the daily life of people in the late 90's, they found that people already dealt with this new technology through consumption avoidance. For example, not possessing a mobile phone or leaving it at home when not wanting to be interrupted called.

Table 1. Eight central paradoxes of technological products, adapted from Mick & Fournier (1997) [15]

Paradox	*Description*
Control / Chaos	Technology can facilitate regulation or order, and technology can lead to upheaval or disorder.
Freedom / Enslavement	Technology can facilitate independence or fewer restrictions, and technology can lead to dependence or more restrictions.
New / Obsolete	New technologies provide the user with the most recently developed benefits of scientific knowledge, and new technologies are already or soon to be outmoded as they reach the marketplace.
Competence/Incompetence	Technology can facilitate feelings of intelligence or efficacy, and technology can lead to feelings of ignorance or ineptitude.
Efficiency / Inefficiency	Technology can facilitate less effort or time spent in certain activities, and technology can lead to more effort or time in certain activities.
Fulfils / creates needs	Technology can facilitate the fulfilment of needs or desires, and technology can lead to the development or awareness of needs or desires previously unrealized.
Assimilation / Isolation	Technology can facilitate human togetherness, and technology can lead to human separation.
Engagement/Disengagement	Technology can facilitate involvement, flow, or activity, and technology can lead to disconnection, disruption, or passivity.

Table 2. Eight central paradoxes of technological products and connected coping strategies, adapted from Mick & Fournier (1997) [15]

Paradox	*Connected coping strategy*
Control / Chaos	All avoidant and confrontative strategies
Freedom / Enslavement	All avoidant strategies, partnering and mastering
New / Obsolete	All avoidant strategies and mastering
Competence/Incompetence	All avoidant strategies and mastering
Efficiency / Inefficiency	All avoidant strategies
Fulfils / creates needs	All avoidant strategies
Assimilation / Isolation	All avoidant strategies
Engagement/Disengagement	All avoidant strategies

Additionally, they found confrontive strategies in peoples' behaviour while dealing with other, at the time more common, technologies. They concluded the latter are the more effective strategies. [15] Looking at current products, designs and solutions, most are based on consumption avoidance rather than confrontive strategies (appendix B).

To make sure confrontive strategies are not ignored, as proven to be more effective, it is relevant to consider them for future designs with a similar goal. To avoid this exclusion in this study, the technology paradoxes will be identified where relevant and a coping strategy implemented in the design solutions accordingly.

Desired relationships through behaviour change

As awareness about smartphone use and screentime rises in The Netherlands, even health insurance companies start campaigns to help people regulate their own behaviour [22]. Most of the strategies suggested and available tools are based on self-regulation. Looking at behaviour change models like the transtheoretical behaviour model, six stages can be identified: precontemplation, contemplation, preparation, action, maintenance and termination or relapse [17]. As most of these products target users that are already convinced, they want to change their behaviour, these are often focusing on the action and maintenance stage.

This focus will be applied in this study as the objective is to aid people in developing a desired relationship, not convince them to change behaviours. Involved participants are therefore interested in changing their behaviour. To keep the study, open to unforeseen findings, at least one participant will not be interested in changing their screentime, behaviour, or relationship with their smartphone. Additionally, the designs will be analysed through the Fogg-Behaviour-Model (FBM), increasing the likeliness of success. FBM identifies three essential elements in preforming a target behaviour; motivation, ability, and triggers [6]. A balanced combination of these factors will increase the likelihood of a person performing behaviour.

For this study, the focus will also be on social cohesion and behaviour related to smartphones, as behaviour change is greatly influenced by social interactions, especially in the context of addiction. A study in 2018 on the relationship between social interaction and substance use shows that participants that had more positive interactions were less likely to fall back into old substance use behaviour [23]. smartphone addiction has similar effects on the brain to drug addiction [18], and symptoms are also comparable [8].

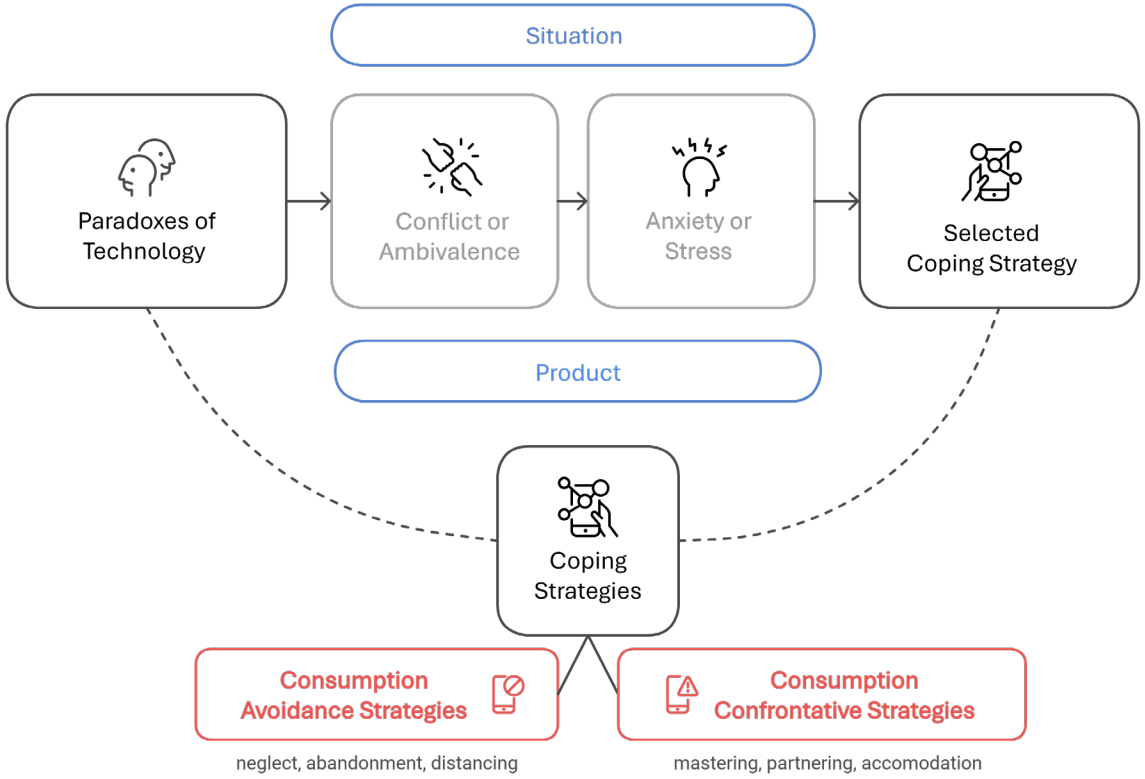


Figure 2. Overview of the implementation of coping strategies by consumers when encountering paradoxes of technology, adapted from Mick & Fournier (1997) [15]

Analysing the symptoms related to social interaction and cohesion in specific, we find people experience things like a weak or non-existing social life, fear of missing out (FOMO), isolation from loved ones and a feeling of lack of connection [7]. To influence behavioural changes positively, social support can have a substantial effect through enhancing self-efficacy, creating accountability, providing resources creating social networks, fostering positive norms and encouraging persistence [19]. So, to counteract the previously mentioned symptoms, the designs created during this study will focus on increasing positive social interactions and support.

Research focus and goal

Building on the historical, behavioural, and design-related insights as described before, this study focuses on how design can support (young) adults aged 20 to 30 years old develop a desired and intentional relationship with modern technology, especially smartphones. As awareness in society on excessive phone use is growing nowadays , it has become an inspiration for developers, designers and even governments. Offering 'solutions' that use avoidance-based strategies, like blocking, limiting or removing access completely. However, these strategies are more directed towards adolescents or people who already experience more severe addiction-symptoms, while they ignore the complete context of phone use and are not sustainable.

This research addresses that gap by focussing on adults who grew up with smartphones but were never guided to form healthy digital habits. Aspiring to support those who are interested or invested in changing their ways, by design that targets the action and maintenance stages of behaviour change. To do so, not only avoidance-based strategies but also confrontive coping strategies, as defined by Mick & Fournier (1997), will be considered and implemented where relevant. These strategies will be combined with behavioural models such as the Transtheoretical Model and the Fogg Behaviour Model, to create design that involves a balanced amount of motivation, ability, and effective triggers. Additionally, the study emphasizes on the role of (positive) social interaction, to fulfil a supportive role in design. Seeking more sustainable and effective behaviour change by integrating social cohesion in the whole design-process.

This leads to the research question: *'How can design support adults between 20 and 30 years old create personal desired relationships with modern technology like smartphones?'*

APPROACH

This research is an educational design research project throughout six months. For this project, the reflective transformative design process (RTD) [9] was used together with the mixed perspectives approach [21]. This way it was possible to go back and forward between the first-, second-, and third-person perspective, and create a continuous cycle of gaining, applying and reflecting on knowledge. Also, with this choice empathizing with the user throughout the process, validating (design-)choices and knowledge, and enriching the design outcomes was ensured. Every step in the process was deliberate and directly linked to a perspective.

The process consisted of two studies. The first study was a contextual exploration, to gain understanding from multiple perspectives in the context of smartphone (over)use. The second study used the outcome from the first study to create a research-artefact, to help answer the research question. Findings from both studies were then discussed and combined in a design advice for future designers. Sharing insights on how design can support desired relationships with modern technology, like smartphones.

STUDY 1. CONTEXTUAL EXPLORATION

The first study aimed for a deeper understanding of the context gaining insights to create a suitable design research artefact for the second study.

The contextual exploration started off by exploring personal experience. To determine what relationship adults in the target group currently have with their smartphones, various participants were involved. They were interviewed and invited to design interventions, forming inspiration for the design research artefact.

Participants

The eight participants involved in this study were adults between the age of 20 and 30 years old, living in The Netherlands. They owned a smartphone and used it daily. Six participants were interested in, or actively trying to change their behaviour related to their smartphone use. Two participants were uninterested, creating a different perspective. Participants were evenly divided in designers or design-students and non-designers, to ensure less biased outcomes.

Method

Personal Diary Study

To explore the context from a first-person perspective and recognize own behavioural patterns, the researcher kept a personal diary on their smartphone behaviour. A small booklet (appendix C) was filled every day throughout a week to create insights on feelings, behaviour and activities.

Interviews & Co-design

Gathering more in-depth insights on the context and moving on to a second-person perspective, interviews and co-design sessions were set up. In these sessions participants formed pairs, who were friends. This set-up was chosen based on Sleeswijk Visser et al. (2005), revealing that participants might feel more comfortable talking about the topic [20]. In this case, the topic of smartphone use or addiction might be perceived as a taboo, so this setting seemed suitable.

This also enabled the participants to mention behaviour they recognized of each other or other people (they knew) or talk about shared memories and experiences. Additionally, participants could help each other during the co-design sessions and come up with more personal and creative ideas. To help the process of designing in-context and add to the comfort of the participants, the sessions took place in one of the participants' homes.

First an interview was done, to create an in-context quantitative and qualitative dataset on the topic and functioning as sensitization to prepare the participants for the co-design session. The interviews consisted of questions with eight topics related to smartphone usage (appendix D, E), allowing the participants to answer per person or have a discussion. Depending on their answers and discussion the interview took about thirty minutes to one hour to complete.

Then, participants were guided through the co-design session (appendix D, F; figure 3, 4, 5), partly based on their answers to the questions in the interview. They were asked to make up a scenario they recognized in their own lives in which smartphone usage played an apparent negative role, so that they could make up 'solutions'. If nothing came to mind, they were provided with a scenario, or the researcher reminded them of something they mentioned during the interview.

Each pair wrote down three or more different scenarios and ideated on how a tool, feature or 'magic solution' could support the way they wanted to use their smartphone in these scenarios. They wrote or drew the scenario on A4-paper and used sticky notes to express their ideas (figure 3). After this, they were provided with various craft-materials to create several low-fidelity prototypes (figure 4). These designs were then named by the participants and photographed (figure 5).

After the sessions the interviews were analysed using the technological paradoxes and emotional effects to recognize any existing coping strategies in participants behaviour. Other interesting comments or discussions were noted. The designs created during the co-design sessions were categorized. Finally, one of the designs was chosen based on its potential to become a successful design intervention, using the FBM. The design was then further developed to use during the next phases in the design process.

Results

Types of smartphone users

Through the personal diary, a pattern of use was discovered which was linked to emotion, location or other activities during the day. This raised the question which smartphone usage patterns existed and what reasons people had to use their smartphone to begin with. Although there is no consensus in literature about types of smartphone users, Wenz and Keusch (2021) suggested most users can be categorized as: broad non-social media, broad non-commercial, basic general, social media and information, and camera users. Each of these users has their own pattern [25] (appendix G). Later in the research, participants can be categorized by these types of users, to ask them more directed questions.

Effective goal-setting and shared goals

Another finding was that screentime goals were set but rarely achieved, suggesting there was awareness and an incentive to change behaviour, but no suitable goals. This raised questions about how to support effective goalsetting. Locke & Latham's (1991) widely adopted goal-setting theory focuses on how to reach goals. Lunenburg's (2011) review analyses goal-setting theories like this and others developed over the past decades, resulting in a framework for motivation through goal setting.

Figure 3. Participants creating scenarios and making up ideas, during one of the co-design sessions.

Figure 4. Participants crafting low-fidelity a prototype together, during one of the co-design sessions.

Figure 5. A participant shows their low-fidelity design for the photograph, during one of the co-design sessions.

Both studies conclude that an effective goal should be specific, challenging yet attainable, and accepted by the individual. To keep a person motivated, they should stretch their abilities yet be realistic. Additionally, goals are most effective when they are intrinsic, not externally imposed. This increases individual acceptance and commitment. Regular feedback and performance evaluation further strengthens motivation, which can be achieved with, for example, targets, deadlines and progress indicators, creating a learning curve. [12, 13]

As this study aims to support behaviour change through social cohesion, it is relevant that Lunenburg (2011) states that group goals can have a great impact on individual goals. The perception of sharing a goal with a team-member, having compatible goals or even sharing group goals makes reaching individual goals easier. It gives people the impression of contributing to a team-effort, which results in greater individual satisfaction. [13, 10]

Interviews with target-group

The interviews done before the co-design sessions, created a quantitative and qualitative dataset (appendix H). Relevant results are shown below.

The screentime of participants ranged between two to six hours. Two out of the eight participants were aware of the time they spend on their smartphone; the others were not aware. When checking their screentime in their phones, the group of people that was not aware responded with negative words like *"a little scary", "wrong", "horrible"* and *"unnecessary"*. In this context, no correlation could be found between awareness of screentime and amount of screentime. It should be noted that the two participants who were not interested in changing their smartphone behaviour, had the highest screentime of all participants involved.

Multiple participants acknowledged using strategies to control their smartphone usage or manage their screentime. When asked if they set goals for themselves, the answer was always no. However, four participants said they used the settings of their phone to set a limit on how long they used a particular application. Out of this group, only two people said they never used their phone more than the limit. The other participants admitted it was for example *"easy to press a button, to surpass the restriction"* or *"wanted to finish a video I was watching when the limit popped up"*.

Relating this back to the coping mechanisms recognized by Mick & Fournier (1998). The avoidance strategy through distancing was repeatedly mentioned, often mentioning an application that restricted the time spend on another application on their smartphone. One of the participants mentioned there was a 'solution' in their student-home which entailed that phones were never allowed at the dinner table – if you did there was a social consequence, showcasing self-regulation by a group of people. They emphasized on the fact that this probably caused them to use their smartphone less now that they no longer live in the student home and are more aware of using their smartphone in social situations.

Zooming in on the relationship participants currently have with their smartphone, a few topics re-occurred in the conversations. Intellectual activities on smartphones are more acceptable than scrolling on social media apps. One participant states for example:

> *"I feel like other people are often think 'oh look at her, she is on her phone all the time', while I am actually reading. So, I feel like that is a more intellectual activity. (...) No one ever says it; however I think they think that about me."*

This illustrates how affected people are by what their peers or other people think they are doing on their smartphone, when this is not publicly visible.

Another participant said something that was also recognized by multiple participants. Realizing more and more, how much time they lose, using their smartphone excessively:

> *"I saw this project where someone calculated how much time of their life they spend on their phone, and he concluded it was a quarter of his life. And I realized I am also staring at a screen for that much time. (...) You are awake, but you are wasting your time staring at a screen."*

This added to the statement that *"social media takes a lot of time, actually"* from another participant, who also explained how 'unsocial' social media has become and even influenced their offline interactions. Three out of four pairs of participants shared their worries and annoyances about their family who used smartphones a lot in their presence whenever they were visiting. Additionally, two pairs stated that they felt social media was not focussed on being social (anymore), but rather on keeping you distracted from the real-world.

A different perspective on this, came from two participants who shared their experience as exchange students, and explained how important their smartphone had become to connect with home. One of them stated:

> *"I prefer audio or video calls over messages. I'm really lazy when it comes to typing words, but it is also more personal. (...) I like to talk and express my emotions through words."*

They explain that (video)calling was one of the ways they felt really connected. Relating this to other participants, it was found that all the pairs discussed the importance of calling as a social interaction with friends and sometimes family. Participants never related this back to using their smartphone too much and three of them explicitly stated they did *"not do that enough"*.

Co-design sessions

During the co-design session various low-fidelity prototypes were created. Analysing the designs, four categories were defined.

1. Social connection to break behaviour

The designs created the possibility for the user themselves or another person to interrupt behaviour by for example calling (figure 6). Using their smartphone for (video)calling was repeatedly mentioned as an effective and accessible way of having a more personal social interaction. The designs in this category also included physically removing a friend from their smartphone and a more competitive approach, in which friends helped each other reach screentime goals.

2. Creating awareness of own/others behaviour

The ideas in this category ranged from creating awareness in a public setting or more intimately between friends. The designs all included reflecting on own or other people's behaviour. One design (figure 7) suggested for example publicly naming and shaming people who were walking down the streets and mindlessly scrolling by filming them and putting them on a huge billboard.

The other ideas in this category focussed more on helping people understand friends what you were doing online by reflecting this on the back of their phone or showing on a globe (representing the World Wide Web). Furthermore, the idea for gamification of screentime for friends reoccurred as it was also focused on creating awareness about behaviour among friends.

Figure 6. Interupting 'bad' or unwanted smartphone behaviour by replacing it with a phone-call.

Figure 7. Creating awareness by showcasing behaviour.

Figure 8. Online behaviour made tangible, to stimulate mindful and social interaction.

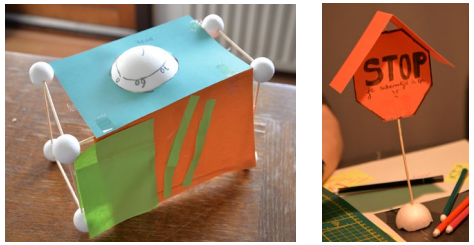


Figure 9. Interrupting 'bad' or unwanted smartphone behaviour physically.

3. Physicalizing of online behaviour

For this group of designs, physical representations were made to make online behaviour tangible. One of the participants made a globe (figure 5), presenting us with a physical variant of the World Wide Web and showing 'where' in this online world friends were.

The other ideas included a physical booklet to share memes with friends to avoid doomscrolling and a shared diary to replace an online social media relationship with friends.

4. Physical intervention on own/others behaviour

The ideas in this last category were focused on restricting yourself or others, by physically intervening in behaviour (figure 9). This entailed an idea for a vault which shows progress, the more time your phone or phones are locked inside the greener the box becomes. Another design was a warning sign which popped up whenever you exceeded your screentime limits or could be activated by others. Lastly, there was also an idea for a shell that grew on your smartphone whenever you used it more and more to slowly turn it into an unusable object.

Based on the Behaviour Fogg Model and Trans-theoretical Behaviour Model, the initial idea of an application to compete over screentime was chosen to further develop. As this concept allowed a focus on the action and maintenance stage of behaviour change through motivation and triggers. Also, implementation of goal-setting, Finally, the choice for an application was suitable for the target group, who used their smartphone daily already and allowed for a direct intervention on smartphone behaviour, as this was 'in the same place'.

Insights

From this study we learned that six smartphone user types can be recognized, and how social interaction can help effectively reaching personal or shared goals.

Some other insights were that people in the target group were sometimes aware of their use but struggled to translate this into behavioural change. Goal setting was almost always done through screen time limits, which were easily bypassed, making them ineffective. There was also recognition of the feeling of 'losing time' while using their smartphone, which indicates that there could be an interest in knowing and doing something different with that time.

Furthermore, the participants in this study indicated that they felt better if they did something productive on their smartphone and this was externally recognized. smartphones were generally seen as a negative influence on social interactions. However, (video)calling was recognized as a social activity and preferred over online social interactions.

STUDY 2. DESIGN INTERVENTION

The second study focused on a design research artefact, to facilitate a more in-depth review of a design intervention on smartphone behaviour tailored to the target group.

Based on the insights from the first study, a design research artefact was developed called '*TapOut'*. The design was used in a participatory evaluation with the target group. This activity created more design focussed insights.

Participants

The ten participants involved in this study were adults between the age of 20 and 30 years old, living in The Netherlands. They all owned a smartphone and used it daily. Eight participants were interested in, or actively trying to change their behaviour related to their smartphone use. Two participants were uninterested. Five of the participants were already involved in the first study, the other five were unfamiliar with the project. This divided the participants in involved participants and a group with fresh eyes, to ensure less biased outcomes. For that same reason, only three participants were designers or design-students.

METHOD

Design research artefact

Implementing insights from the literature and the previous study, a design research artefact was made through a first-person perspective by the researcher. The initial idea of an application with a competitive element was chosen to further develop and become '*TapOut'*. For this, a mock-up was designed with Figma, which focussed on elements aiding with goal setting, creating awareness about screentime data and give room for social interaction.

Participatory evaluation

Gaining insights on the design intervention from a second-person perspective, a participatory evaluation was set up.

The sessions consisted of a questionnaire (appendix I, J) and a one-on-one evaluation session. The questionnaire served a complementary role on the evaluation sessions, by revealing participants' behaviour, so that questions during the evaluation session could be somewhat personalized to reveal more in-depth information. The participants were therefore asked to complete the questionnaire a day before the evaluation session, also acting as a type of sensitization.

During the participatory evaluation sessions, which took about thirty to forty minutes to complete, '*TapOut'* was presented to a participant. The participant individually visited and interacted with the application either on their mobile phone or computer, whatever they preferred (figure 10). While visiting the application they were asked to talk out loud about their steps and speak their thoughts. The researcher observed their steps and took notes of interesting actions or remarks.

Figure 10. One of the participants during the participatory evaluation sessions.

When the participant concluded the exploration, the researcher asked questions related to the observations to better understand their thought-process while interacting. Then the researcher asked some pre-designed interview questions about the design to cover all elements in the application.

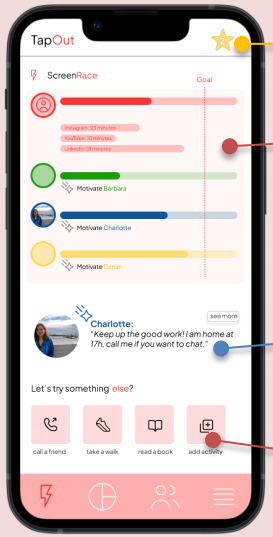
The final question of the interview was what elements they thought were irrelevant, replaceable or missing, inviting them to ideate further on the existing design. When they came up with something, they were asked to explain the function and if they wanted to draw what this element would look like.

Results

Design research artefact: 'TapOut'

The design created for this study was '*TapOut*'. On the next page (figure 11) the rationale details are explained.

Figure 11. Design rationale of 'TapOut'

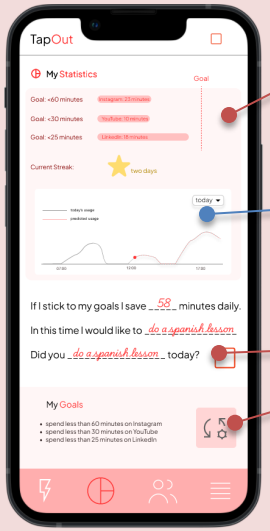


A 'streak' can help people stay motivated and track behaviour.

Screen Race showcases goals of others – the formatting is similar to games encouraging a goal. However, in the interview we want to learn whether this represents limitation goals properly.

Encouragement can form a positive reinforcement through interaction, to keep up behaviour, relating back to the accommodation strategy.

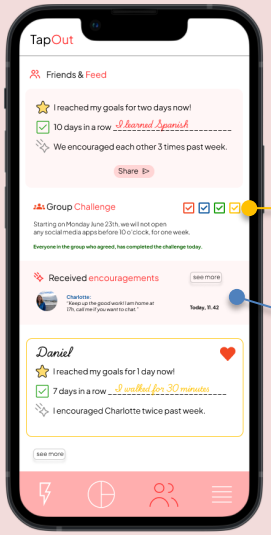
Replacement activities for smartphone behaviour might help with reaching goals and personalization.



Looking at personal data might give users insights, and a sense of control.

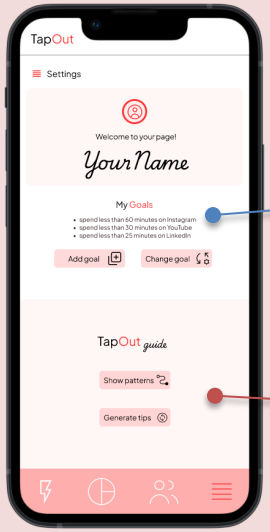
Reflecting data by predicting it, might help a user intervene in their own behaviour or create insights, relating back to mastering as strategy.

Insights in time management, and goals related to that time, gives a sense of control. In that way the user is partnering with the application.



Offering a shared goal, which can be personalized helps to create engagement and acocountability.

Showcasing other peoples' achievement gives a sense of social cohesion and create a path to encouragement.



A personal page helps create personalization, but should be undone from any unnecessary features to minimize distraction from goals.

Offers 'TapOut Guide', a AI tool to help give insights and support goal setting and tips for behavioural change.

Participatory evaluation

The evaluation sessions with participants created a quantitative and qualitative data-set (appendix K). The questionnaire revealed that none of the participants used their smartphone on a set time. Usage peaked for seven or eight participants in the morning, late afternoon, after dinner, and just before they went to sleep. Most participants were categorized as broad non-social media users and broad non-commercial users.

During the evaluation of '*TapOut'*, participants found all the buttons that were functional. The participants identified the application as *"nice", "useful", "clear", "peaceful"*. However, two participants mentioned that the although the app had a nice overview of all functionalities, it felt a little bit *"too full"*. One of them suggested making the pages scrollable to solve that.

Another suggestion was to make the layout customizable. Half of the participants was more interested in the data visualization and AI function of the app, while the other half preferred focusing on the social interactions within the friend group. The same was mentioned when discussing the 'try something else' function on the home-page of the app. One participant saw the opportunity of creating a habit tracker, which could present the data of other activities a user did than screentime.

The competitive 'screen race' element was liked and seen as helpful as it does not showcase peoples' personal goals but is more generalized. Seven of the participants suggested redesign in multiple ways. Mainly the representation of goals was confusing, and four people said they would prefer if the bar would empty instead of fill. Another suggestion was to create:

> *"A ball pit full of balls for the whole group. This makes it more playful and less confronting as well."*

Another participant suggested taking inspiration from application they used while studying, where they could grow a tree when their phone was not used while studying. One person also thought the group-size could be smaller, and said that one-on-one challenges *"would be more achievable for me."*.

Two participants were a little confused about the personal goal element, in which the 'time saved' was represented. They suggested that it should be clearer what data this number was based, offering transparency. Another participant suggested that there should be a weekly or monthly update on progress *"to keep me motivated!"*.

The TapOut guide was found to be useful, but one participant suggested it could be more interactive offering videos, audio or perhaps a meditation session. Four participants also mentioned that the guide should be more helpful in redesigning goals if someone did not reach their goal, adding to motivation. Also, one participant said that the TapOut guide could introduce you to the app, when using it for the first time, guiding you through all elements.

Finally, some comments were made on a possible notifications functionality. All participants agreed that push-notifications were suitable and would help keeping users motivated. However, it was also noted that these notifications should have a *"supportive and not too pushy"* character. One of the participants said it would be nice if this notification would be a reminder at peak-hours, to commit to the activity they made up in their goals to replace screentime.

DISCUSSION

The results from both studies show several reoccurring insights. First, awareness did not mean behaviour was changed. Although many participants expressed negative emotions when confronted with their screentime, this mostly did not cause them to act. This points out that there is a gap between self-assessment and action, highlighting the importance of a design that supports creating habits long term.

Secondly, avoidance-based strategies, like limitations and restrictions, are insufficient. Mick & Fournier (1998) mentioned that this strategy was less sustainable than confrontative techniques. This was reflected in the group of participants that used avoidance-based tools, often ignoring them.

They were however interested in a tool to keep them motivated and engage them in a social context, which leads to the third insight: social interaction aids motivation and engagement. The elements of friendly competition and encouragement were perceived as pleasant and motivating, matching the literature about social accountability [13].

Finally, smartphone activities had a perceived value. This value was either productive or non-productive, and participants were aware of what other people might think of their smartphone behaviour, influencing their emotions. Emphasizing on the importance of avoiding social punishment to change behaviour, but rather transparency and a supportive quality.

Limitations

As this research was done by a single researcher, there were some ability and time-constraints. Therefore, the group of participants was fairly small, and results could differ if this group was larger. The research also focused on Dutch adults between the age of 20 and 30 years old, which might have caused results to be culturally isolated.

Looking at the choice of a design research artefact, other or multiple designs could have been explored and could have led to richer insights. The biggest issue with the current design was that it could not be deployed in-context and used by real users. The evaluation could therefore have provided some questionable results, as participants could lie about or incorrectly predict their behaviour.

Due to circumstances, the expert review was not completed in time before the deadline of the report. It will be completed later on but could have given some insights into the design before evaluating it with the target group.

Design advice

A design advice was written based on the findings of this research to create valuable insights for future designers of behavioural interventions, and to answer the research question: *'How can design support adults between 20 and 30 years old create personal desired relationships with modern technology like smartphones?'*

1. Involve the target group

Involving participants within the user group throughout the design process ensures a design outcome that aligns with their needs, but also with their experiences. Designing with users instead of for users created more valuable and accepted outcomes.

2. Enable personalisation

By allowing users to tailor features or content of the design, they can express their preferences, needs and goals better. Making a modular design, gives them the ability to focus on the functionality or functionalities that matter to them, and creates commitment.

3. Showcase goals and progress

Strengthening motivation and giving a sense of control could be done by letting people clearly state their goals and show them their progress related to their behaviour. Stay away from punishing or negative statements, as this could lead to abandonment. Instead, focus on achievements and positive reinforcement.

4. Reflect patterns

Make sure the design helps the user to understand their own behaviour. This could be done through clear data-visualisation, reflective elements or feedback on behaviour. Generating suggestions for alternative behaviour, perhaps a more suitable alternative to their goal, can help users shift their focus and create achievable goals. However, be careful not to take away their autonomy, as this can cause the opposite effect.

5. Use AI tools transparently

Artificial Intelligence can be a powerful tool to support people. However, if implementation of AI is suitable for a design, this should have a clear function and confinements. Make it optional if possible, and let the user choose whether they want to use the tool. Refrain from intrusive or data-hungry AI models and be transparent about the data the AI tool uses to generate information, advice or support.

CONCLUSION

This research investigates how design can support adults aged 20 to 30, create a desired relationship with modern technology, like smartphones. Combining a literature review, contextual exploration, and a design intervention, insights are identified on how to do this effectively. The first exploratory study showed that adults in the target group interested in changing their behaviour, are aware of their smartphone usage, but focus on avoidance-based strategies when trying to change their behaviour. This often has insufficient effect. It was found that there is a need for a more engaging approach, using social interaction and clear goal setting.

These insights created the basis for the design of *'TapOut'*, a design that was evaluated in the second study of this research. This revealed that elements like goal setting, social accountability, and showing progress were identified as motivating and supportive. Personalisation and tools that reflect behaviour patterns, were also identified as helpful. However, features of the design should create positive reinforcement and stay away from judgement. If AI tools are relevant, they should be transparent to the user on how their data is used and respect autonomy while advising the user.

Although people have a complex, emotional and societal relationship with technologies like smartphones, there are ways to support them in changing their ways. Integrating confrontive coping strategies, behaviour models and involving the target-group in the design-process, can help create future interventions empowering people in changing their behaviour instead of punishing them.

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REFLECTION

In the second semester of my Master's program Industrial Design, I took two electives (DDM150 – User Experience Theory & Practice, DBM160 – Data-enabled Design) and was part of the New Futures squad to complete my M1.1 Design Research project.

Goals:

- Use a field approach and get in-context insights based on interest in behavioural changes;
- Practice making usable and valuable probe design, to gain confidence;
- Being mindful about apply knowledge from previous and current courses I am taking.

Hands-on in-context approach

User & Society; Math, Data & Computing.

Taking the Constructive Design Research-course (CDR) in the first semester inspired me to explore a different approach during my design research project by immersing myself more in the context of the user and society. I enjoyed the set-up of the CDR project; investigating how psychological theories could help prevent destruction of public research probes. I discovered the value of in-context research by immersing myself in the context through observation and using a field approach. As I had minor experience with this approach in past projects, I decided to take the course User Experience Theory & Practice to more insights in the 'how-to'.

During this project, these learnings came in handy as I could, for example, apply my new knowledge about co-design sessions immediately. I based steps in my co-design setup on literature that was introduced to me in the course, like Sleeswijk Visser et al. (2005) and applied the strategy I developed during the course. Additionally, the mixed perspectives approach was interesting to use during this research to better define what steps I should take, what activities were suitable, and being aware of my position as a designer towards the context.

As the course took place simultaneously with the first half of the project, it was sometimes complicated to adapt the project accordingly. This caused me to base the design-process on this new knowledge, while having to accept that I did apply theories one on one. Therefore, the codesigns could have been more structured. For the next project I would like to apply in-context and cooperative methods like co-design as they gave valuable insights throughout this project, but I would use a more structured approach as presented by Sleeswijk Visser et al. (2005) to focus more on the preparation steps rather than just the activity. Using sensitization on participants was somewhat done, however, this could be extended and create a group of participants that were more invested in the project as well.

The involvement of an expert for this project was less successful. As I had only one expert involved in the project, it was a big issue when they dropped out of the project. Although I recognize a missed opportunity, involving a new expert took time and was not achievable within the given time constraints. For the next project I would involve multiple experts from the start to avoid these types of issues.

Probe design

Math, data & Computing; Creativity & Aesthetics; Technology & Realisation

After my M1.1 project in Sensory Matters, I knew how to research, prepare, make, fail and reflect on producing a material, which was the goal of that particular project. Through that design process I learned to be less afraid of failure and welcome exploration and trial-and-error. So, for this research project I wanted to focus on creating valuable design probes, gaining more confidence in creation and deployment. To do so, I took the course Data-enabled Design (DED) in the last quartile of this semester. Exploring a new design process approach, but also improving probe-building skills.

As for this project, the focus was on digital wellbeing, I ended up making a digital prototype. My first intention was to deploy a real app in-context, however I learned that it was unnecessary to create a high-fidelity prototype to gain insights. The construction of the app was somewhat successful with the help from someone who was more experienced in building applications, but I realized that the prototype was overcomplicated and not suitable for deployment after all as it needed data-input about screentime that was not freely accessible in all phones. Therefore I chose to rebuild the app in a simpler form, creating a mock-up version, as this was sufficient to evaluate with my target user.

For future projects I will try to lower my expectations and if possible apply the data-enabled design approach, as this allows for short iteration loops and creation of simple probes for deployment. I learned throughout the DED course how to create simple probes, improved my data-visualisation skills and let me explore data as an creative driver. This gave me a new perspective and interest.

Future steps

Upcoming semester I will do a preparation FMP project and I would like to gain real-life design research experience by working together with a company that has an interest in ethics in their designs or design process. This relates back to my professional identity and vision, in which I emphasize on the importance of ethical considerations in design. Through this project and other learnings this semester, I am also invested in the design process involving behaviour change and in-context approach. Furthermore, I would like to explore the data-enabled design process to do more iteration cycles in my next project. For this I agreed to contact Mathias Funk from the Industrial Design Department, to help me find a suitable project topic, and if possible a company that wants to collaborate.