Are All Design Frictions Equal? Exploring Types of Frictions and their Perceived Value for Digital Wellbeing

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Much research on digital wellbeing has focused on interventions for digital self-control while less work explored design frictions (which deliberately aim to inconvenience users) despite their potential to more sensitively account for users' contexts. To address this gap, we identified five types of design frictions: cognitive, emotional, motivational, social, and physical for which we provided working definitions, and illustrated with design exemplars from the state-of-the-art. We also report workshops with 19 participants to explore these types of frictions and users' perception of their value for digital wellbeing. We conclude with four design implications for digital wellbeing including supporting design frictions at app level, supporting adaptive design frictions, sensitive design of emotional frictions, and balancing user's need for privacy in social frictions.

Keywords: Smartphone overuse, design frictions, meaningful use, digital wellbeing

1. INTRODUCTION

The significant health and societal implications of smartphone overuse, particularly among young adults (Abi-Jaoude et al., 2020; Csibi et al., 2021; Marciano et al., 2022; Wacks & Weinstein, 2021) has fostered increased research interest in digital wellbeing technologies.

Much HCI research on digital wellbeing has focused on interventions for digital self-control (Lyngs et al., 2019) such as mobile or web apps which support users to set lockout mechanisms, or time limits of use based on self-monitoring of their phone or apps. However, despite their adoption (Almoallim & Sas, 2022; Roffarello & De Russis, 2023) such interventions have been critiqued for taxing users, being short-lived, and most importantly, failing to account for users' context or motives of technology use (Roffarello et al., 2023).

Rather than relying solely on self-regulation, design frictions offer complementary approach to digital wellbeing. In particular, design frictions are intended to create friction in user experience, making users to stop and reflect before engaging in app use (Cox et al., 2016; Mejtoft, Hale, & Söderström, 2019).

In contrast to the much explored digital self-control tools (Almoallim & Sas, 2022; Lyngs et al., 2019; Roffarello & De Russis, 2023), research on design frictions is emerging, through intervention consisting solely of desing frictions, or as add-on frictions to augment digital self-control tool. (Lyngs et al., 2019)

Thus, the state-of-the-art in this space has focused on a rich range of design frictions. These include for instance small tasks such as entering a long set of digits in order to delay the interaction with the phone (Kim et al., 2019), or different modalities including visual such as dimming of the phone's screen (Mobifolio, 2022), or haptic through vibrations (Okeke et al., 2018) to deliver such frictions when users have exceeded the set time limit of using phone. Other work employed gamification to provide reward or punitive feedback for users remaining within the set time limit of using their phones or apps (Seekrtech, 2022).

Despite their variety, the exploration of design frictions remains limited, with most studies exploring one design friction as an intervention for digital wellbeing. Thus, we know little about different types of design frictions and their comparative exploration from users' perspective.

To address this gap, we engaged with the literature and identified five types of design frictions: cognitive, emotional, motivational, social, and physical for which we provided working definitions, and which we illustrated with design exemplars from the state-of-the-art. Then, we reported workshops with 19 participants to explore the feasibility of the identified types of frictions and users' perception of their value for digital wellbeing. Our work focuses on the following research questions:

- Are there multiple types of design frictions, and if so, which are those?
- How these design frictions can be defined and illustrated?
- What are users' perceptions of each type of frictions for limiting phone use?

Our paper makes three key contributions including advancement of the conceptualization of the friction construct through identifying five types: cognitive, emotional, motivational, social and physical frictions, rich accounts of users' perception of these different types of frictions, and four implications for design frictions to support digital wellbeing technologies.

2. RELATED WORK

Our work builds on previous research on digital wellbeing interventions, as well as design frictions.

2.1 Digital Wellbeing Interventions

Most digital wellbeing interventions are delivered through mobile apps which could be at the phone level, or app level (Almoallim & Sas, 2022).

Phone-level interventions are effective in reducing screentime as they prevent users from accessing any phone features. At phone level, a smartphone can be placed in different locations to prevent users accessing it. Phone-level barriers can also be implemented using location-based, cellular or Wi-Fi data to prevent users from unlocking their phone in specific areas such as school premises. Time-based locks, such as lockout mechanisms presented by J. Kim et al. (2019), automatically lock the user out of their phone based on self-defined daily use time limits.

App-level interventions target problematic apps rather than the entire phone (Roffarello & De Russis, 2019a). For example, the Let's FOCUS app periodically scans Wi-Fi fingerprints such as unique MAC addresses to determine the location of students on school premises: when the students are near classrooms, the app temporarily blocks distracting messaging and social media apps (Kim Inyeop, Jung Gyuwon, Jung Hayoung, Ko Minsam, & Lee Uichin, 2017).

Findings indicate that app-level interventions are perceived as more realistic and helpful alternative (Roffarello & De Russis, 2019a).

Interventions aimed to limit phone overuse rely on self-monitoring in order to raise awareness of phone overuse and change behaviour (Roffarello and De Russis 2019). They usually involve lock-out interventions to limit excessive or undesirable use(J. Kim et al., 2019; Kim et al., 2019).

Despite their large use, such digital interventions for digital self-control (Lyngs et al., 2019) have been critiqued as being rather simplistic, having arguably short lived effectiveness, and failing to account for users' situated context of phone or app use (Roffarello et al., 2023) and one approach of addressing these limitations are design frictions (Cox et al., 2016).

2.2 Design Frictions

Design frictions is a design approach where features are added to influence user behaviour. However, in contrast to traditional design aiming for smooth and engaging user experience, design frictions are intended to create friction in user experience, and inconvenience, by placing additional, mandatory interactions before users can use their phone or app as intended (Cox et al., 2016). As a result design friction-based interventions force users to spend more time and effort on irrelevant, unintended tasks before they can access the target app (Cox et al. 2016; J. Park et al. 2018). As a result, users may slow down and reflect on their habitual phone use (Mejtoft, Hale, & Söderström, 2019), so that may limit overuse (Cox et al., 2016).

While the synthesis of HCI research on design frictions has been limited, an exploration of previous work indicates diverse approaches to designing for frictions which we further highlight.

In their lock-out task app Kim et al. (2019) also employed design frictions to reduce unwanted usage by increasing the cost of interaction. More specifically, users are asked to enter a long code of digits shown on the screen in order to unlock the app. Their study outcomes show the effectiveness of the interventions for codes which were 30 digits long.

Other examples of design frictions include 'launcher' apps such as LessPhone Launcher, to reduce the functionality of home screens in order to discourage smartphone overuse (Lyngs et al., 2022), or the activation of screen dimming when a phone session exceeds a pre-set time limit (Almoallim & Sas, 2022; Mobifolio, 2022).

Beside visual modality, design frictions can also be delivered in other modalities in the form of inconvenient audio or tactile signals. Like all smartphone functions, sounds and vibrations are

specifically designed to delight and attract users' attention (Hynes, 2021). In contrast, drawing from negative reinforcement and nudge theory, Okeke et al. (2018) designed an app which triggers vibrations whenever users exceed their daily usage limit set for an app. The intervention was designed to be subtle and nudge the user into choosing to end the app session.

Other examples of design frictions involve digital awards or badges to motivate users to avoid engaging with their smartphone or specific apps for long periods. In this respect, the Forest app encourages users to focus on offline tasks by growing a digital tree while users avoid using the phone (Seekrtech, 2022).

In social settings, other people can act as a natural source of phone-level frictions by increasing users' social awareness and encouraging them to interact with others instead of their phone. For instance the Lock n' LoL (Ko, Choi, Yatani, & Lee, 2016) and NUGU (Ko et al., 2015) apps leverage social support to help groups of people limit their smartphone use together.

To conclude, design frictions could effectively complement the more rigid digital self-control interventions, albeit their exploration has been limited and fragmented, with most studies exploring one specific design friction. In contrast, there has been limited work focusing on the comparative exploration of different types of design frictions and what such types may be like.

3. FIVE TYPES OF DESIGN FRICTIONS

In this section we describe the rationale for the five identified types of frictions that we identified and provide illustrative examples of them reflected from commercial apps, and research prototypes described in scholarly work.

3.1 Rationale and Definitions

To identify various possible types of frictions, we draw from key mental operations much acknowledged in psychology research namely cognition, emotion and motivation (Pekrun, 2023). We also draw from health research on the effectiveness of therapeutic approaches prioritising these mental operations, and therefore their value for wellbeing.

Thus, substantial work has shown the value of cognition-based interventions for behaviour change particularly in mental health such as Cognitive Behavioural Therapy (CBT) (Cooper et al., 2017), emotions (Shiota et al., 2021; Van Cappellen et al., 2018) for example through affect-based interventions such as Compassion-focused therapy, and motivation (Oyebode et al., 2021) for example through the Stage Model of Behaviour Change (Prochaska, Norcross, & DiClemente, 2013).

In addition to the three mental operations to inform *cognition, emotion, and motivation frictions*, we considered also *social and physical frictions*.

The rationale for social frictions is the rich findings on the value of social support for behaviour change (Kelly, Zyzanski, & Alemagno, 1991; Ryan, 2009), albeit less work explored their value for digital wellbeing (Zhu et al., 2025). For physical frictions, we drew inspiration from HCI research on digital possessions and their impact on managing grief after the dissolution of significant relationships (Sas et al., 2016) for which users employed spatial distancing from problematic possession which they wanted to no longer see, storing them with remote trusted others or in less accessible locations (Sas & Whittaker, 2013).

To summarise, the rationale for the five types of frictions that we wanted to explore is based on main cognitive, emotional and motivational aspects underpinning them, while social and physical frictions relate to the context in which the frictions are experienced.

We now provide our working definitions for the identified types of friction. *Cognitive frictions* are small cognitive tasks which increase users' cognitive load demanding attention before using the phone or an app.

Emotional frictions are frictions which increase users' negative affect, usually with low arousal negative emotions such as mild frustration or discomfort, before engaging with the targeted apps whose use people would like to limit. These frictions are in sharp contrast with the prevalent focus on positive users experience (Eyal, 2014) which however can lead to addiction to problematic use (Elhai et al., 2016).

Motivational frictions are frictions which provide reward or punitive content for limiting phone overuse.

Social frictions are those which lead to increased cost of phone or app use in social context. *Physical frictions* are frictions which lead to environmental or physical barriers for reaching the phone.

3.2. Ilustrative Examples

To further extend their description, we now illustrate these types of frictions with design exemplars which we identified from the state-of-the-art, although the articulation of different types of frictions has been limited in previous work.

Examples of cognitive frictions include small cognitive tasks such as entering a random set of digits on the phone, whose value for making users stop before engaging in phone overuse has been

shown (J. Kim et al., 2019; Park et al., 2018). Such cognitive frictions may be used whenever the user launches specific apps whose use they aim to limit, and with the task challenge potentially increasing with the amount of time spent on that app. In addition to such examples from previous work, we could also imagine other cognitive frictions for example as short puzzles in different domains.

Examples of emotional frictions include micro interventions of screen dimming intended to make it more frustrating and uncomfortable for users to continue using the phone. Such dimming can be triggered for example by using a specific app, beyond the allocated time limit (Mobifolio, 2022).

Examples of motivational frictions include rewards or badges (Edwards et al., 2016) which users can earn after successfully keeping within use limit of their phone, or specific apps. Such rewards could take the form of growing tree as part of a virtual forest (H. H. Lee, 2021). Example of punitive feedback include wilting of a virtual tree when users fail to limit their use as previously set, or the collapse of a virtual town which has been built, if apps are used during the set sleep time (Seekrtech, 2022; You, 2020).

Examples of social frictions include those where some users may limit others' phone overuse such as apps for parental control supporting parents to limit their children's app use (Parental Control App by Screen Time Labs, 2022), Other example of social frictions harness social facilitation and consists of an app that allows people to limit phone use together (U. Lee, Lee, Park, Daejeon, & Korea, 2016). It provides synchronous social awareness of each other's phone limiting behaviour. This synchronous social awareness can arouse feelings of connectedness among group members and can mitigate social vulnerability due to smartphone distraction.

Examples of physical frictions include an app which leverages location to prevent for example phone or app use in specific places such as campus (I. Kim, Jung, Jung, Ko, & Lee, 2017). This uses Wi-Fi fingerprints to identify the location of phones so when they are at the classroom it will nudge them to enter a virtual classroom to limit use.

4 METHOD

This study aims to explore the feasibility of the identified types of frictions and users' perception of their value for digital wellbeing.

4.1 Sample

Participants were recruited through university flyers and mailing lists. The recruitment process targeted users younger than 40 years of age. The rationale for this is the popularity of smartphone use, and particularly the extensive smartphone use among young adults (Abi-Jaoude et al., 2020; Csibi et al., 2021; Lemola et al., 2015; Marciano et al., 2022; Ricoy et al., 2022; Sohn et al., 2019; Wacks & Weinstein, 2021).

The sample consisted of 19 participants with average age of 25, 70% male and 30% female. Most participants were students or university employees, most of them having Master's or PhD degrees.

4.2 Procedure

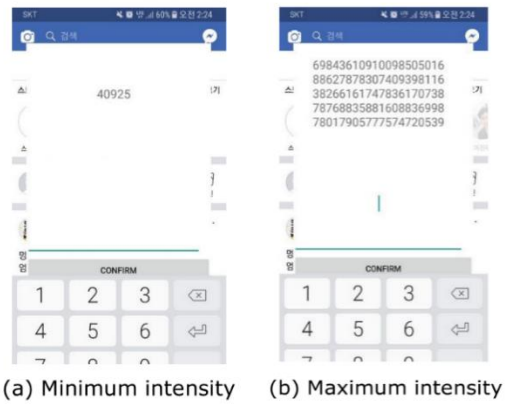
We run group workshops with 2 or 3 participants, which lasted about 1 hour, and included an introduction session where participants were introduced to the study aim and the key concepts of friction as minor barriers or interruptions aimed to discourage phone overuse, and to the five types of frictions, their definitions and examples as described in the above section.

In the second part, participants were encouraged to explore each type of friction through its design exemplars and to propose new ones. Here, they were asked questions about the perceived benefits, challenges, suitable timings, and trade-offs associated with each type of friction. For instance, they were asked: *"What is your overall feeling about each type of friction? Can you see any benefits? Any challenges? Would you prefer to use such friction? Can you think of other examples of this type of friction that may work better for you?"*.

The workshops were audio recorded, fully transcribed, and analysed using thematic analysis (Joffe, 2011; Terry & Hayfield, 2020).

4.3 Materials

Participants were introduced to each type of design friction, their definitions and illustrative examples, for which we also provided screenshots shown below: cognitive frictions (Fig. 1), emotional frictions (Fig. 2), motivational frictions (Fig. 3), social frictions (Fig. 4), and physical frictions (Fig. 5).



(a) Minimum intensity (b) Maximum intensity

Figure 1: *Example of cognitive frictions: entering a series of random numbers* (Park et al., 2018)

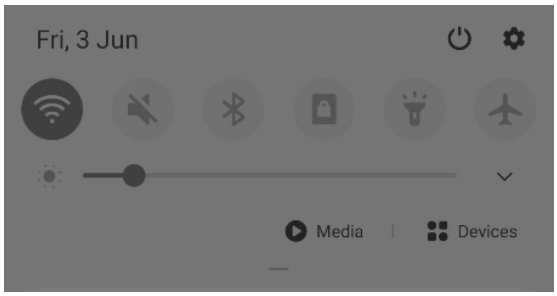


Figure 2: *Example of emotional frictions:* dimmed screen display as an emotional friction (Mobifolio, 2022)

Figure 3: *Example of motivational frictions: growing tree as part of a virtual forest* (H. H. Lee, 2021) *(left), and punitive feedback as a collapsed virtual town if apps are used during the set sleep time (Seekrtech 2022; You 2020) (right)*

Figure 4: *Example of social frictions: Lock n'LoL app helps group of users to collectively reduce smartphone use while focusing on other activities* (Ko et al., 2016).

5 FINDINGS

This section describes participants' perception of each type of frictions, and their envisaged value for digital wellbeing.

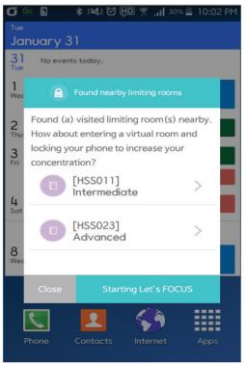


Figure 5: *Example of physical frictions: location app. An app which nudges users to enter a virtual classroom when when they are at specific places, such as campus* (Kim Inyeop et al., 2017)

5.1 Cognitive Frictions

Cognitive frictions force users to address a cognitively demanding task before continuing their target task. Before seeing the cognitive frictions examples, 5 out of 19 participants responded positively to the idea:

> "*I have to do like a hard math equation to get access to it. So, I do see quite a good potential*" [P4], while others believed its use may be appropriate "*where there's not any sort of purpose with the interaction*", such as "*scrolling forever with Twitter*" [P17].

However, 3 out of 19 participants, described cognitive frictions as outright "distressing", noting that "*more kind of gentle ways that you could discourage meaningless phone use*" [P12].

After seeing examples of cognitive frictions, participants seemed more open to them, described as "engaging" [P9, P15] and even "*fun, so I'd probably enjoy it*" [P3]. Maths questions were the preferred design frictions compared to general knowledge questions since the former can be easily answered by our participants.

> "*I would pick the math one because I feel like more general, I guess*" [P17], especially maths games such as Sudoku, "*because it's gamified, I guess it's more fun than just answering some random math question*" [P17].

However, cognitive frictions could also impede conversations [P3] and interrupt the "*flow of ideas*" [P3], while other participants suggested that social media apps such as Facebook, Instagram, and TikTok were deemed as suitable candidates for cognitive frictions.

The timing of cognitive frictions also emerged as an important factor, with participants indicating strong preference for preventive measures.

> "*Kill it before you open it. So I think that would be the best time to use that friction*" [P15]; "*That's the best time instead of, you know, halfway while I'm engaged and then something just pops up*" [P9].

5.2 Emotional Frictions

Emotional frictions mitigate traditional design practices that result in emotionally rewarding phone interactions: by causing minor, temporary emotional discomfort. Their aim is to encourage users to slow down, stay with the discomfort, and limit phone or app overuse. Before seeing examples of emotional frictions, participants reported strong negative views:

> "*It seems inappropriate that a friction would be negative and not something positive. It just seems quite dangerous or very questionable*" [P12].

Several participants (6 out of 19) acknowledged that they do not want to experience negative emotions, while fewer mentioned that such emotional frictions could also "*lead to doing good things*" [P11].

An important finding is that after seeing the examples we provided on emotional frictions, participants expressed strong preference for app-level interventions as "*it would be too extreme to lock the whole phone*" [P10]. They also mentioned messaging and social media apps as suitable candidates for emotional frictions, especially TikTok to prevent mindless scrolling [P3, P8, P12, P19].

5.3 Motivational Frictions

Motivational frictions employ positive and/or negative feedback to encourage users to avoid the phone or specific apps for set periods. Before seeing specific examples, participants already seemed familiar with this friction type, which some described as "*very helpful*" [P11] and potentially "*quite good*" [P3].

After seeing the provided examples, participants continued to perceive motivational frictions as positive, albeit their focus shifted to the feedback element. In this respect, positive feedback was strongly preferred as it can "*give people a really good mindset*" [P6] and transform negative experiences into positive ones [P15]. Others preferred a more pragmatic, goal-focused approach:

> "*prefer my motivational friction to be more geared towards my personal goals, more personalized*" [P5].

Negative frictions were largely dismissed since it may "*dissuade people rather than encouraging them*" [P5].

5.4 Social Frictions

Social frictions increase the cost of using the phone in social contexts by supporting users' social awareness and encouraging behavioural change. Initially, participants responded positively to social frictions:

> "*I'm positive at the moment about it. I think it might be just a kind of safer way to give frictions to people*" [P12];
>
> "*You might be able to compare how you're using your phone with your friends. I think it could be useful*" [P12].

A small number of participants (3 out of 19) perceived the social frictions as potentially problematic as they may increase tension in social contexts [P17, P6].

After seeing the provided examples of social frictions, most participants viewed them favourably:

> "*Seeing that two members are studying. I think it would work well. I would also be kind of motivated and encouraged to study*" [P10].

Social frictions were reportedly "*helpful for parents and teachers*" [P6] at the phone and app levels, and only potentially problematic with apps that store sensitive information such as health and banking apps [P6, P17].

5.5 Physical Frictions

Physical frictions prevent users from using the phone or specific apps by making the phone harder to access, for instance, by having it in another room. 10 out of 19 participants expressed strong concerns about situations where the phone is needed to do work [P3], complete time-sensitive tasks [P12], and manage emergencies [P3, P6, P10, P13, P4].

3 out of 19 participants viewed physical frictions as helpful to avoid unnecessary phone use at the gym [P6] or before going to sleep [P16].

After seeing the provided examples, most participants continued to perceive physical frictions as ineffective and unnecessary: "*I don't see this working for like at home*" [P3]. Another participant noted:

> "*I don't need to go for location-based services or any Wi-Fi fingerprint techniques to eliminate my access*" [P11].

Participants also suggested employing physical frictions at the app level to reduce mindless scrolling of social media apps such as Facebook, Reddit, and TikTok [P12, P6], but not for apps such as Calculator [P17] and Google Suite apps [P3].

6 DISCUSSION

This section is structured around the research questions presented in the Introduction, in order to highlight the novelty of our findings and their value when designing for digital wellbeing.

The first research question asks if there are different types of frictions, and if so, what such types may be. Drawing from research on digital wellbeing interventions (Almoallim & Sas, 2022), we identify five types of frictions which target predominantly cognition, emotion, motivation, as well as social and physical contexts in order to limit users' phone or app overuse.

These types of design frictions are grounded in HCI (Sas et al., 2016), psychology (Pekrun, 2023; Sas et al., 2016) and health research (Oyebode et al., 2021; Ryan, 2009; Van Cappellen et al., 2018).

The second research question focuses on how these design frictions can be defined and illustrated. For this, *w*e provided a rich set of design exemplars to illustrate each type of design friction, namely cognitive (J. Kim et al., 2019; Park et al., 2018), emotional (Mobifolio, 2022), motivational (Edwards et al. 2016, H. H. Lee 2021, Seekrtech 2022; You 2020), social (Lee et al., 2016; Parental Control App by Screen Time Labs, 2022), and physical frictions (I. Kim et al., 2017).

The working definitions for the different types of design frictions are intended to contribute towards the theoretical foundation in this space, by offering an initial vocabulary to talk about frictions.

Compared to digital wellbeing interventions which aim to support users' self-monitoring, increase awareness of phone overuse, and self-control for limiting such use (Lyngs et al., 2019, Roffarello and De Russis 2019), design frictions consist of uncomfortable interactions with the phone or app for limiting their use (Cox et al., 2016). Moreover, design frictions also differ from persuasive interfaces for behaviour change which target broader self-regulation of different types of behaviours from fitness to self-management of health (Zhu et al., 2025). Thus, instead of nudging users towards behaviour change, design frictions deliberately introduce discomfort in order to disrupt automatic or impulsive behaviours. Our work advances our understanding of design frictions through their classification, and users' perception of different types of frictions.

The third research question asks about users' perceptions of each type of friction for limiting phone use. The key outcome is that the five types of design frictions elicited strong, and sometimes contrasting reactions. However, rather than looking at these diverse users' responses in isolation, our outcomes indicate that preferences are informed by users' target tasks and apps they intend to use. This is significant, indicating the value of such contextual use previously argued for (Roffarello et al., 2023), which contrasts with the rather reductionist, one-size-fits-all approach of self-control tools supporting merely phone locking and setting time limits.

Cognitive frictions such as puzzles were particularly well received and perceived as one type of friction which can support both the frustration of delaying the desired tasks, and, more importantly, the curiosity and cognitive stimulation of solving a puzzle. But not all cognitive frictions are the same, as middle difficulty puzzles contrast sharply with the low cognitive demand of entering a long set of digits on the phone (Kim et al., 2019). Participants suggested a range of puzzles that they would like, such as puzzles or maths puzzles, which they may be offered the option to choose from.

Emotional frictions provoked the strongest negative reactions and remained the least preferred option for our participants. Participants' discomfort with emotional frictions highlights an interesting ethical tension. This reflects a sweet spot between the potential benefit of frictions whose discomfort can be both tolerated and beneficial for limiting phone overuse, and their limitation when the level of discomfort becomes problematic. Moreover, some participants described guilt-inducing designs as distressing or even manipulative, raising questions about user autonomy and emotional harm.

Participants also saw potential value of emotional frictions, particularly to mitigate against overuse of social media apps, and mindless scrolling on the TikTok app. Our outcomes open up new design opportunities to design for emotional frictions while answering the recent call for exploring discomfort as a resource for interaction design (Schraefel & Jones, 2023).

Findings also indicate participants' strong preference for positive motivational frictions. While generally the preferred option, motivational frictions were not universally welcomed as they could also discourage users from using the smartphone to engage in meaningful social interactions. This is again significant, indicating the value of users' situated tasks, and in particular, of distinguishing between these tasks being deemed as meaningful to users or not. For this, we can draw on emerging HCI research on goals (Lolla & Sas, 2023) and their importance for behaviour change (Zhu et al., 2025).

For social frictions, most suggestions focused on increasing the social component to provide users with a stronger support group. In addition, concerns of social frictions pertain to sensitive information targeting for instance health or financial domain, and the risk of some of such information being potentially shared through social frictions. Again, sensitive design is required to support users maintain control over what is shared and with whom.

While physical frictions were mostly disliked, similar to emotional frictions, participants saw their value in using them at the app level to reduce mindless scrolling of social media apps such as Facebook, Reddit, and TikTok.

7 DESIGN IMPLICATIONS

We now reflect on the value of our findings for informing design implications for frictions including the need to support design frictions at app level and in particular cognitive frictions such as puzzles, supporting adaptive design frictions that account for user's context of use and targeted task, supporting sensitive design of emotional frictions, and balancing user's need for privacy in social frictions.

7.1 Supporting Design Frictions at App Level

Participants indicated strong preference for app-level frictions to ensure effective support for their smartphone use in everyday life (Szyjewski & Fabisiak, 2018; Wang, Xiang, & Fesenmaier, 2016).

Among these, cognitive frictions involving small tasks which challenge users and allow for skill development were particularly appreciated. More challenging frictions, such as emotional and physical ones, were deemed as suitable for preventing overuse of social media apps such as TikTok or Facebook.

7.2 Supporting Adaptive Frictions

Designers could also incorporate contextual AI into design frictions, allowing apps to detect users' environment through calendar events, location data, or usage patterns. For instance, an app could automatically suppress notifications during meetings while allowing urgent calls to come through. Such adaptive frictions should also be easy to override to prevent frustration in unpredictable scenarios.

In addition to these desirable features, participants' responses highlighted two key user needs that must be met in order to ensure long-term use of design frictions. These needs relate to emotional wellbeing and privacy.

7.3 Supporting Sensitive Design of Emotional Frictions

Emotional frictions were criticized by participants for deliberately aiming to cause emotional discomfort; 10 out of 19 participants also rejected physical frictions because it may cause FOMO-induced anxiety (Rozgonjuk, Sindermann, Elhai, & Montag, 2020). Such responses indicate that design frictions with negative impact on users' emotional wellbeing are unlikely to be used in the long term or indeed even installed. Our findings indicate that emotional frictions should be carefully explored not only for their potential to limit phone overuse, but also for their potential harmful emotional impact, particularly on vulnerable users. We argue that future work should carefully consider if, and how, emotional frictions can be effectively leveraged through sensitive design. We can also image emotional frictions leveraging positive rather than negative affect, particularly when coupled with motivational frictions. For instance, design frictions could promote positive rather than punitive feedback, so that users are rewarded with motivational messages or small achievements for limiting meaningless phone use. This approach could enhance emotional wellbeing by turning the experience into a supportive one rather than a negative one.

7.4 Balancing User Need for Privacy in Social Frictions

Concerning privacy, many participants rejected social frictions involving data sharing, as this may cause embarrassment or uneasiness. This aligns with previous findings suggesting that most smartphone-related data is viewed as personal, and sensitive (Audrey et al., 2016).

Regarding this challenge of privacy raised by social frictions, careful consideration is required for data control and ownership. We can imagine transparent and customisable interfaces for user's consenting, or not to consenting to share data in the context of social frictions. Designers could also implement clear privacy policies and transparent data use practices. For example, frictions should allow users to opt out of social sharing entirely and keep their data anonymized. Providing detailed explanations of how data is processed can also increase user trust and acceptance. We argue that social frictions with clear, comprehensive privacy settings are more likely to be used. The aim here is to ensure the balance between frictions' positive impact, on the one hand, and ethical safeguards of privacy, on the other hand, which in turn could support users build trust in friction-based interfaces.

8 LIMITATIONS

We now reflect on two limitations of our work concerning study procedure, and study sample. Regarding study procedure, it is important to note that we used illustrative examples of design frictions rather than functioning prototypes. Thus, our findings reflect participants' perception of how frictions may impact them, rather than the actual experience with friction-based interfaces and observation of their impact on users. As a consequence, our findings should be considered carefully, and not generalized, and future work is needed to explore how they may extend to users'

actual engagement with fully working prototypes of friction-based interfaces.

Regarding study sample, we reflect on sample size, and participants' demographics. While total number of participants (n=19) is modest, we note that each participant interacted with all five types of frictions, which generated a total of 95 data points. Future work could focus on replicating our findings to larger sample, and extended participants' demographics. Indeed, our homogeneous age group of young adults, should not be generalized to broader populations, particularly older adults with different level of digital literacy, as well as different needs for design frictions.

9 CONCLUSIONS

We identified five types of design frictions: cognitive, emotional, motivational, social, and physical for informed by research in HCI, psychology and health, which we defined and illustrated with design exemplars. We report workshops with 19 participants to explore users' perception of these types of design frictions and their perceived value for digital wellbeing. Study outcome informed four design implications for digital wellbeing, namely supporting design frictions at app level, adaptive design frictions, sensitive design of emotional frictions, and balancing users' need for privacy in social frictions.

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