

Designing for Digital Wellbeing on a Smartphone: Co-creation of Digital Nudges to Mitigate Instagram Overuse

Aditya Kumar Purohit
iHub, Radboud University
aditya.purohit@ru.nl

Torben Jan Barev
University of Kassel
torben.barev@uni-kassel.de

Sofia Schöbel
Universität Osnabrück
sofia.schoebel@uni-osnabrueck.de

Andreas Janson
University of St.Gallen
andreas.janson@unisg.ch

Adrian Holzer
University of Neuchâtel
adrian.holzer@unine.ch

Abstract

The endless stream of social media newsfeeds and stories captivates users for hours on end, sometimes exceeding what users themselves consider unhealthy. However, reducing one's social media consumption has proven to be challenging. To address this issue, this study investigates how the co-creation of digital feedback nudge can improve digital well-being without increasing privacy threats. To achieve this goal, a mixed method study is used through a two-week single case experimental design. Results demonstrate that co-creation significantly increased users' sense of agency, sense of accomplishment and perceived sense of privacy while reducing users' privacy concern. Furthermore, the feedback nudge allowed participants to significantly decrease their social media use.

1. Introduction

Personal and health applications of social media are on the rise (Househ et al., 2014). Through social media, interactions can take place around various topics related to health, including patient education, health promotion, public relations, and crisis communication (Eckler et al., 2010). Almost 67% of all internet users in the United States use social media, utilizing it to search for health information online (Househ et al., 2014) making it one of the most popular online activities (Eckler et al., 2010). In healthcare, social media is used by patients for education, information, networking, research, support, setting goals, and tracking personal progress (Househ et al., 2014). On the flip side, social media usage in itself can be harmful to health (Chen, 2020). Indeed, social media apps are becoming the central activity on our mobile phones (Sha et al., 2019) with a daily consumption topping four hours in some countries (GlobalWebIndex, 2021). This

behaviour can be linked to psychiatric disorders, such as Obsessive-Compulsive Disorder (OCD), depression, and deteriorated social interaction (Boer et al., 2021). Additional effects in relation to social media usage can be loneliness (Ponnusamy et al., 2020), envy (Krasnova et al., 2015), and anxiety (Kuss & Griffiths, 2017).

To overcome these adverse effects and restore digital well-being, it is important to understand the principle on which social media platforms are designed. Social media platforms are designed to maximize connections and time spent online (Bhargava & Velasquez, 2022; Giraldo-Luque et al., 2020). To achieve this goal, social media companies employ design elements such as reminding users with notifications, providing feedback with likes, removing friction through infinite scrolling, thereby keeping users hooked and these design choices can be characterized as digital nudges (Thaler & Sunstein, 2009) i.e., indirect incentives that affect user behavior. While social media platforms are employing digital nudges as manipulative design elements, also known as dark patterns (Mildner & Savino, 2021), to increase the time spent online, digital nudges could potentially be used to reign over one's social media use i.e., to achieve digital well-being. Indeed, such mechanisms have been used for positive outcomes in a variety of domains from encouraging pro-environmental behaviour to privacy awareness (e.g., Bergram et al., 2020). This leads to our first research question:

RQ I : What are the characteristics of effective digital nudges to reduce one's social media usage?

However, when it comes to digital nudges, ethical concern can be an issue. Indeed, nudges can be perceived as being manipulative or paternalistic (Reijula & Hertwig, 2022). One way to mitigate these concerns about manipulation is to make the interventions more transparent by including users in the intervention design process (Purohit & Holzer, 2021; Reijula & Hertwig, 2022). Such a co-design approach could

have the added benefit of reducing the privacy concerns that usually hinder the adoption of digital well-being apps (Widdicks, 2020). This observation leads to our second research question:

RQ II: Does co-creation of digital nudges for digital well-being reduce privacy concern?

2. Theory Background and Hypotheses

Below, we provide an overview of the current state of knowledge in the field which leads to our hypotheses.

2.1. Digital Nudging

Digital nudges refer to the nudges that are provided via digital technology and employ user-interface design elements that guide people's choices or behaviors in digital environments (Weinmann et al., 2016). For instance, Barev et al. (2021) used a framing nudge to encourage users to disclose less personal information online, while Dennis et al. (2020) used a priming nudge to increase the consumers' willingness to pay in an online store. During the last decade, scholars and practitioners have demonstrated the effectiveness of digital nudges to change people's behavior (Caraban et al., 2019) such as making individuals mindful of the online privacy policy by changing the digital choice environment (Bergram et al., 2020). Meanwhile, in the context of social media addiction, the research is more targeted towards purposeful modification of the choice architecture by an unbiased observer via digital nudging. For instance, applying limits (Ko et al., 2016), repeating phone vibration (Okeke et al., 2018), and gamification (Lee et al., 2017) aim to provide means for digital detox via digital nudging. The term "digital detox" refers to periodic abstinence from social media, or strategies for cutting back on digital media consumption.

A fundamental feature of digital nudges for digital well-being is the provision of information, i.e., offering feedback on digital habits. There are other forms of digital nudges such as defaults, commitments, social, and deception. However, research suggests that the feedback nudges are often used to reinforce behavior change as they provide information about the past or current behavior of a user (Bergram et al., 2022). In other words, the feedback nudges place targets in a favorable context, encouraging them to make a right decision (Purohit & Helme-Guizon, 2020). For example, employing feedback intervention to increase password strength (Zimmermann & Renaud, 2021) and improve learning (Zamprogno et al., 2020). In the context of digital well-being, recently, Purohit

and Holzer (2021) employed the feedback nudges that nudged users after 1 minute of using the app, followed by feedback every minute thereafter. While the nudges successfully reduced the time users spent on Instagram, they were unable to reduce the number of times users opened Instagram on their smartphones. The reason could be that they informed users only about the time they spent and not how many times they opened the application. It is crucial that interventions reduce the number of times an app is opened because previous research has shown that individuals access social media in a frequent, repetitive and revisiting pattern (Monge Roffarello & De Russis, 2022). In short, users open the app unconsciously and scroll through their news-feed mindlessly (Rauch, 2018) out of habit. In our particular case, the goal of the digital feedback nudge is to raise awareness about this kind of social media usage and the number of times users open the app. We assume that providing individuals with digital feedback on how many times they open the app would not only reduce the time they spend on social media applications but also the number of times they open the app. This leads to the following hypothesis:

H1: Using a feedback nudge increases social media usage awareness and reduces the number of times the app is opened

The rationale behind the efficacy of feedback nudges is the idea that by raising awareness about a certain behavior, users will become more mindful and restrict their usage of social media when they do not find it important. To prove the case in point, consider Okeke et al. (2018) who employed feedback in the form of vibration to nudge users to reduce the time they spent on Facebook. In another instance, Y.-H. Kim et al. (2016) presented time spent on desktop devices as a positive or negative feedback and successfully made users aware of their digital habits. Hence, we formally state the following hypothesis:

H2: Social media usage awareness raised through feedback nudges decreases time spent on social media

As some previous research has pointed out, such a result is far from guaranteed. J. Kim et al. (2019) used notifications to mitigate social media use by delivering reminders after the users hit the daily goal limit. However, 92% of the participants ignored and continued using social media. While the intervention offered an opportunity for self-reflection, it was unfortunately frequently ignored (J. Kim et al., 2019). Thus, it is crucial to better understand the barriers in adoption of digital detox interventions.

2.2. Barriers to Digital Nudge Adoption

Digital nudging adoption is hindered by two factors: usability and ethical concerns (Purohit & Holzer, 2021). In addition to helping mitigate social media consumption, research on digital nudges has also identified potential problems, such as when the nudge is too forceful it leads to increased friction and lower usability. For instance, researchers at Cornell Tech leveraged nudging and negative reinforcement concepts with their vibration intervention (Okeke et al., 2018). The users' phones vibrated when their daily Facebook usage exceeded the limit. As a result of the intervention design, Facebook usage declined; however, participants had a negative reaction to the digital nudge and returned to their old habits once the intervention was removed. These findings suggest that though digital nudging interventions are potentially effective, they present a usability risk that might affect their effectiveness (Purohit & Holzer, 2021). It is important to note that a key aspect of feedback is timing (Purohit & Holzer, 2019). As a matter of fact, digital nudges offer distinct advantages over the physical ones because they can be precisely timed and personalized based on the context (Bergram et al., 2022). When delivered at a wrong time, digital nudges can make an individual annoyed and distracted (Mark et al., 2008). In the form of notifications that are non-interruptive, there is a favorable window of opportunity (optimal moment) for digital nudges to be delivered (Mehrotra et al., 2016; Purohit & Holzer, 2019). The above observations lead to the following hypothesis:

H3: Delivering feedback nudges when launching a social media app does not negatively impact usability of the intervention

In terms of ethics, Thaler (2018) proposed a set of design guidelines that should be used to design, what he called, nudges for good. Nudges should be (1) transparent, (2) easy to opt-out, and (3) designed with the well-being of the user in mind (Gold et al., 2020). Transparency can be understood both as the goal of the nudge, which should not be deceitful or obfuscated and the mechanism of the nudge through which it operates (Purohit & Holzer, 2021). This second aspect involves transparency about data usage and privacy. Looking at transparency in the context of digital detox app research, findings suggest that even though the goal of these apps is transparent and positive as these apps are designed to promote digital well-being, i.e., reducing digital overuse and addiction (Tseng et al., 2019), recent experiments have shed light on the key reason for users'

reluctance towards digital well-being / digital detox apps: privacy (Purohit & Holzer, 2021). Digital detox solutions compromise users' data privacy (Widdicks, 2020).

Opting out easily means that users should have the autonomy to follow the nudge or decide not to follow it (Purohit & Holzer, 2021). However, the person receiving a nudge is often unaware of the nudge or psychological mechanisms that choice architects use (Mills, 2020). In short, an individual's personal autonomy is threatened when the reflective or deliberative processes of decision-makers are ignored. Second, there is no easy way to reverse the effects of a nudge (Viale, 2018). For instance, inertia and status quo bias contribute to the tendency of users not to alter their default settings even though it is relatively inexpensive to do so (Viale, 2018). The well-being of users should be the central focus for nudging and not the well-being of the designer (Purohit & Holzer, 2021); however, even with noble intentions, who is to decide what is in the best interest of users (Thaler & Sunstein, 2009)? One approach to overcome the issue is to involve users in deciding to be nudged towards a particular goal. An approach that could overcome the risks of ethics and usability is co-creation.

Prior research has shown that when individuals construct a product themselves, even when the product is mediocre, they experience IKEA effect i.e., increased self-agency (Norton et al., 2012). As *self* comes into play, individuals will feel a richer sense of agency and hold more positive perception about what they do (Sun & Sundar, 2016). In the context of HCI, Lukoff et al. (2021) found that there is an enhanced sense of agency when users have specific intentions for how they want to use a system. Similarly, the concept of co-creation has also been explored extensively in the context of consumer-company co-creation in which customers design products based on pre-existing design tools provided by the company (Moreau et al., 2011). Co-creation may increase the individuals' awareness of being the creator of their product (Troye & Supphellen, 2012). On the negative side, participation in co-creation activities could also increase the perceived complexity of a product and thus impede its potential benefits (Randall et al., 2007). Nevertheless, we believe the positive aspects will surpass the negative ones and thus we posit the following hypotheses:

H4: Co-creation will lead to increased sense of agency

H5: Co-creation will lead to increased sense of accomplishment

In previous studies, users have reported concerns with privacy in the context of digital well-being

interventions. For instance, in a recent study by Purohit et al. (2020) a participant reported the following for a digital nudging intervention “I did feel skeptical about letting a relative alien add-on interfere with my Facebook.” The process of co-creation will most likely make the intervention transparent and the transparency of digital nudging intervention is crucial to design an ethical digital nudge (Purohit & Holzer, 2021). We assume that the transparency of the intervention and the sense of autonomy will lead to decreased sense of privacy risk and privacy concern as privacy is an essential aspect of digital well-being (Peters et al., 2018). This leads to the two following hypotheses:

H6: Co-creation will lead to decreased sense of privacy concern

H7: Co-creation will lead to increased sense of privacy

3. Co-designed Feedback Nudge

To co-design and build the digital feedback nudge, we employed Shortcuts automation app on iOS. Shortcuts app is an app that allows users to program a variety of tasks using simple visual commands without the need to master any programming language. Shortcuts allows interaction with apps and content on iOS devices by allowing a user to pack, combine and execute a set of instructions. For instance, a set of instructions can be triggered by various events, such as when any third party app on the phone is opened or closed. With this functionality it becomes possible to implement a timely feedback nudge. In addition, the visual commands used to build the automation make the instructions visible and accessible for inspection. Figure 1 illustrates a feedback nudge designed using Shortcuts app that displays a notification when a user opens Instagram indicating the number of times it was opened. Figure 1.A shows the set of four instructions needed to program that nudge: (1) the program gets the value of the variable holding the number of times the app was opened, (2) this variable is incremented, (3) stored, and (4) the notification is triggered. Figure 1.B shows the setting of the event that triggers the automation, i.e., when Instagram is opened. Figure 1.C shows the automation in action with a notification banner indicating the number of times Instagram was opened. In terms of availability, Shortcuts automation app comes pre-installed on recent Apple iOS devices.

4. Research Method

To assess the impact of the intervention, we utilized a parallel mixed-methods research design (Venkatesh et al., 2016). For this purpose, we recruited 10

students from our university’s graduate student pool. The participants co-created the intervention with a researcher and were then exposed to it through Instagram in a pre-post study design (N = 10). Pre-post study design has been shown to be helpful in evaluating digital health products and apps (Martens et al., 2019; Stallard et al., 2018). We conducted our experiment over a period of two weeks: a baseline week and an intervention week. The participants acted as controls by comparing their baseline (before the intervention) with their performance after the intervention. After their consent for the study, each invited participant spent an average of 1.5 hours with the researcher to co-develop the digital nudge intervention via Shortcuts automation app. In total, it took two days to complete the co-designing process with all the 10 participants. To begin with, the participants were informed of a cover-story that the purpose of this research is to build interventions that others would like to use and also themselves for digital well-being. The cover-story was crucial to minimize the social desirability bias.

The participants were shown how Shortcuts automation app on iOS works, and then the co-designing of the intervention began with a few sketches and logical flow diagrams. The design space for the co-design phase was limited to a feedback nudge that showed information (e.g., the number of times the app was opened) when a user accessed Instagram. The participants individually personalised the messaging of the intervention to their liking.

We selected Instagram as our target social media application based on the following two conditions: (1) The participants rated their time spent on Instagram as three times more than on Facebook, (2) more attention has been paid to Facebook and Twitter in comparison to Instagram. However, the intervention can be applied to any application. Although Instagram is extremely popular, there have been a few studies on Instagram addiction (Ponnusamy et al., 2020; Purohit & Holzer, 2021). The study required students to be active Instagram users (at least ten minutes per day) on iOS.

For tracking Instagram usage behavior, we followed similar methodology as Purohit and Holzer (2021). The shortcut app provided instructions for logging time stamps when the app was opened and closed onto a local CSV file. During the baseline period, the only timestamps in the CSV file were those of opening and closing Instagram. During that time, no intervention was provided. During the second week of the study, the participants were given feedback nudges. At the end of the second week, the participants received an exit survey with the instructions on how to modify, improve or delete shortcut automation. It is important

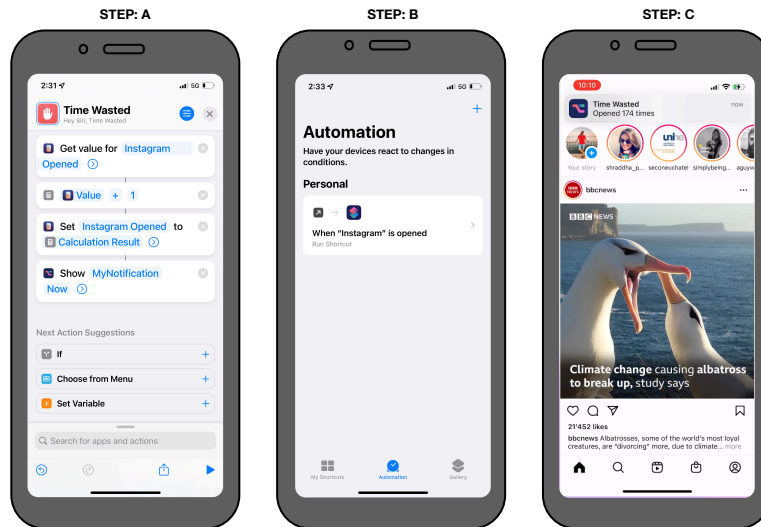


Figure 1. Intervention Design

to note that the participants were aware of how the data was being recorded as previous research has shown pre-familiarizing participants with experimental conditions, in particular data recording conditions, have shown to assist in decreasing the likelihood of the Hawthorne effect (Ayres et al., 2014). The researchers then double-checked the data collected by requesting the participants' CSV files and screenshots of the native screen time app.

5. Results

5.1. Quantitative Results

In order to assess the impact of intervention on social media use, we measured the number of times Instagram was accessed (H1) and the amount of time the users spent on Instagram (H2). The mean number of times Instagram was accessed after the unlocking of the phone before and during the treatment is shown in Fig 2.

To assess if the difference was statistically significant, we used a paired-sample t-test. Our sample size was $N < 25$, hence it required that we met the normality assumption, i.e., the difference in scores must be normally distributed in the population. So a Shapiro-wilk test was performed, which showed that difference in scores did not depart significantly from normality ($W = 0.945$, p -value = 0.612). The results show that the mean difference between the baseline and treatment is statistically significant $t(9) = 4.143$, $p < 0.001$ with a large effect size $d = 1.310$. The results indicate that the participants significantly reduced the number of times they opened Instagram after unlocking their smartphone. *H1 is supported.*

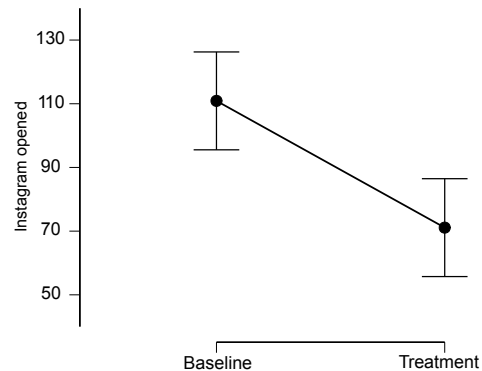


Figure 2. Baseline (Instagram opened) vs Treatment (Instagram opened)

We also analyzed the intervention's impact on the total amount of time that the participants spent on Instagram for a week. Fig 3 shows the mean time spent before and during the treatment. Shapiro-Wilk test was performed to test the normality required for t-test, difference in scores departed significantly from normality ($W = 0.705$, p -value = 0.001). In this case, we had to use a non-parametric test (Wilcoxon signed-rank). The results of the Wilcoxon signed-rank test showed that the mean difference between the baseline and the treatment is statistically significant ($Z = 2.497$, $p < 0.005$) with a very large effect size $d = 0.89$. *H2 is supported.*

In order to assess the usability of the intervention (H3), we used the IUS scale (Lyon et al., 2021). The IUS scale is based on the SUS scale by Brooke (1996). The feedback nudge intervention scored a mean of 74.68 points out of 100, indicating Good to Excellent usability.

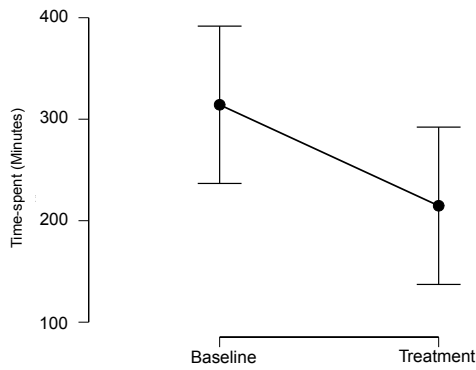


Figure 3. Baseline (Time-spent) vs Treatment (Time-spent)

H3 is supported.

To measure the different attitudes towards the intervention, we measured psychometric constructs such as sense of agency (Sun & Sundar, 2016) (H4), sense of accomplishment (Sun & Sundar, 2016) (H5), perceived privacy (Yousafzai et al., 2009) (H6), perceived privacy risks (Featherman & Pavlou, 2003) (H7) as well as an additional usability construct perceived usefulness (Warkentin et al., 2007) using a 7-point likert-scale. We applied one-sample t-test to measure the impact of the intervention. The normality assumption required by our t-test was met (see Fig 4).

Variables	W	p	Normality assumed
Sense of agency	0.853	0.063	Yes
Sense of accomplishment	0.971	0.902	Yes
Perceived privacy	0.945	0.607	Yes
Privacy concern	0.907	0.258	Yes
Perceived usefulness	0.928	0.428	Yes

Figure 4. Test of normality (Shapiro-Wilk)

The results indicate that the means for sense of agency and accomplishment were significantly greater than 4. Participants reported greater sense of agency $t(9) = 4.753, p < .001$ and sense of accomplishment $t(9) = 3.354, p < .004$ with large effect size. *H4 and H5 are supported.* Similarly, the means for perceived privacy, perceived privacy concern and perceived usefulness were also significantly higher than 4. The participants reported greater perceived privacy $t(9) = 4.367, p < .001$, less privacy concern $t(9) = -7.732, p < .001$ and with greater perceived usefulness $t(9) = 8.772, p < .001$

with large effect size. *H6 and H7 are supported.*

5.2. Qualitative Results

Next, we will discuss the qualitative part of the study; we were also interested in gathering diverse perspectives on the efficacy and experiences of co-creation and the resulting digital nudge for digital well-being. The participants were presented with several open questions in the exit survey directed towards investigating the best and worst design aspects about the digital nudge and understanding their experiences on Instagram. The following open questions were asked 1) How was your experience using the “Digital Feedback Intervention” ? 2) What is your opinion on co-creation of the “Digital Feedback Intervention” ? 3) How did the “Digital Feedback” Intervention make you feel, while using Instagram ? 4) If you were given a chance to redesign the Intervention, what kind of Intervention will you create to manage Instagram usage? The analysis was completed using grounded theory (Strauss & Corbin, 1994). By coding the data line-by-line, we articulated emergent themes that we discuss below.

Mindfulness. One theme in particular that emerged was the various ways in which the users experienced a sense of awareness while using Instagram. The users frequently referred to awareness, realization, and the time spent indicating that the co-created digital nudge intervention made users mindful of their actions. As an example, the following comment was coded as awareness: “it makes you realize that you spend a lot of time on Instagram without realizing it.” Another comment that was coded as attention to own behavior was: “it allows me to be able to control my reflexes, to keep track of how often you have opened an application”. Some users realized their increased use of Instagram was caused by boredom.

Behavior change. We also looked at whether the digital feedback intervention affected behavior. One user appreciated the ease of use, thus leading to reduced Instagram addiction. For example, “It was easy to use and install, and it helped reduce my addiction to Instagram.” The code that kept recurring was deliberate behavior; a user reported: “I now leave Instagram directly when I open it unnecessarily.” Another user commented “even before opening Instagram, I would think of it, so I wouldn’t even open it.” Likewise, a user reported: “I’ll reduce the number of times I open Instagram.” *These results align with H1.*

Guilt. A negative theme emerged from the analysis i.e., guilt in the form of emotion. The feeling of guilt is used as a negative indicator based on statements from the interviews. For instance, the code that kept recurring was guilt, a user reported “It uses guilt in order to make us close the app. So it’s very strong” and “Maybe the worst thing about digital feedback intervention is that it can make you feel guilty about using your phone and create a negative feeling”. Overall, guilt can be seen as ambivalent factor. As one interviewee puts it “I think it’s the most powerful emotion in this case”.

Transparency of use. A theme emerged indicating the participants’ expectations on transparency of Instagram use. For instance, the following comment was coded as transparency of use, “This will allow me to better analyze my addictions, while trying to reduce the time I spend on this application and the number of times it has been opened”. This also led the participants to expect a change in their use of social media. “So being able to see how many times I opened Instagram in a day will decrease the time I spend in this application”. Likewise another user reported “It induces you to use social media less because it shows you concretely how much you use it and it scares you.” In general, the newly gained knowledge of the number of times the users opened Instagram led them to the intention of changing their use of social media. *These results align with H2.*

Addictive design. Largely, the users spent time on Instagram in a more passive fashion instead of spending time with activities such as text messaging, posting etc. For instance, the following comment was coded passive use; a user reported “I waste my time by scrolling through photos and videos even though I know that doesn’t make me laugh or satisfy me, I keep scrolling because I search something to make me laugh that I can after send it to my friends to make them laugh with me”. This confirms the notion that infinite scrolling is an addictive dark pattern on Instagram that motivates users to keep scrolling. Other features such as the content itself, the algorithm’s suggestion of content, and the steady provided stream of content were claimed to keep users on the platform. This highlights the addictive design patterns on Instagram while also suggesting a more passive use in contrast to actively messaging or creating content.

6. Discussion & Conclusion

Our research makes the following contributions to the existing literature for reducing social media overuse.

Co-creation, sense of agency. Our research not only focuses on nudge effectiveness but also on privacy and ethical considerations by introducing co-creation. Interestingly, co-creating the feedback nudge for digital well-being adds to the intervention effectiveness, similar to the IKEA effect (Norton et al., 2012). The results revealed several insights on how co-creation can be supported by digital nudges to positively encourage digital well-being. The process of co-creation and setting up the intervention themselves had significant effects on the individuals’ sense of agency, accomplishment and perceived usefulness. Building a digital well-being intervention appears to also have had the “I designed it myself” effect, like that of self-assembling furniture. When individuals create digital well-being interventions and become familiar with their inner workings as opposed to simply interacting with pre-assembled digital interventions, they indeed come to believe that the intervention is “mine”, thus activating the “ownness heuristic”.

Timely feedback and behaviour. Our results showed that the design of a feedback nudge timed during opening of the social media app can significantly reduce the time on a social media platform. The intervention also displayed good usability, which implies that increasing mindfulness was achieved without adding too much friction to the user experience, which may result in the user abandoning the nudge. This complements existing research, which focused more on using commitment nudges, e.g., setting limits with potentially strong nudges, i.e., firm limits (J. Kim et al., 2019). Whereas timing has been identified as an essential factor in the design of digital nudges, few studies have explicitly investigated it. Our results show that the feedback on how many times an individual has opened the app received right at the time of the behavior, i.e., opening the app can provide a soft cue that can help users get mindful of their social media use. These findings point to the direction that unconscious and habitual opening of the app can be decreased by making an individual aware of the number of times an app has been opened. It should be noted that our results show how a nudge is used in full transparency and yet is still effective in instilling a change in behavior.

Feedback, from mindfulness to guilt. The participants indicated that the nudge made them more mindful of their social media consumption and also significantly reduced the number of times they opened Instagram while also significantly reducing the digital consumption. However, the qualitative analysis revealed that the intervention resulted in

the manifestation of guilt which is a strong negative emotion. This could be due to the fact that the participants experienced the intervention to be very strong. Furthermore, the analysis also revealed that that the users are not oblivious to the addictive dark patterns on social media platforms, instead they are knowledgeable on what keeps them hooked on Instagram like personalization of the content and infinite scrolling among many more. The future work could investigate the interplay between mindfulness and guilt and devise approaches to leverage their potentially powerful behavioural component without potentially backfiring through negative emotions.

Automation apps as research tools. In a recent research, Purohit et al. (2020) found that the users desired automation in digital well-being tools. Our research leads to designing and implementing a novel artifact, namely the feedback nudge built on Apple's Shortcuts automation app. The use of this tool proved to be a powerful tool to conduct field research. First, it opens the possibilities to capture users' simple behaviour on third party apps to which researchers do not have access. Second, it allows for rapid prototyping using simple visual script languages. Third, it allows to meet the privacy and ethical requirements by potentially involving the users in a full intervention creation to ensure transparency, preventing any third-party intervention.

Lessons for the industry. While phone manufacturers provide pre-builtin mechanisms for reducing digital consumption such as screen time on iOS, they mainly focus on providing real-time reports and limiting the time spent on apps by introducing limits. Our study's results could pave the way for them to develop more subtle but visible feedback features such as notifying users on how many times an application has been opened, thereby accompanying users in their digital detox journey. The findings in the study could lead social media designers to integrate various communication strategies that users could choose (and also edit to their liking) to decrease the feeling of guilt. For instance, *You have saved 2 minutes today* (Gain frame) / *You have lost 3 minutes today* (Loss frame). The ability to choose and edit messages to their liking could further improve the users' user experience who want to reduce their consumption without entirely leaving the platform. The use of Shortcuts, or other automation apps is still in its infancy. Presently, the automation applications like Shortcuts lack the ability to allow users to co-create an intervention remotely. However, the study we conducted may encourage developers

to build features that allow co-creation in automation applications to encourage digital well-being. With the assistance of such automation applications, the creation of nudges might come in the form of haptics or visual dashboards, while being triggered by other contextual information, such as time or location.

Limitations. This research is not without limitations. Due to the limitations inherent in all design decisions, we restricted our investigation to a particular location within the infinite design space. The nudge was targeted to a specific time frame, i.e., when the target application was opened. Further exploration of the design space can be carried out with different nudges and timings to increase efficiency and reduce friction. As a result of COVID-19 restrictions, recruitment was more difficult, and using an iOS smartphone as an experimental device (iOS only) severely limited the sample size for this study. A larger sample could be used in future research with a longer study period to replicate these results. In spite of these limitations, our study found that the intervention had a significant and robust impact on social media users, which encourages co-creation and allows users to design interventions for their personal digital well-being.

References

- Ayres, K., Ledford, J., & Gast, D. (2014). Single case research methodology: Applications in special education and behavioral sciences.
- Barev, T., Schwede, M., & Janson, A. (2021). The dark side of privacy nudging—an experimental study in the context of a digital work environment. *HICSS'21*.
- Bergram, K., Bezençon, V., Maingot, P., Gjerlufsen, T., & Holzer, A. (2020). Digital nudges for privacy awareness: From consent to informed consent? *ECIS'20*.
- Bergram, K., Djokovic, M., Bezençon, V., & Holzer, A. (2022). The digital landscape of nudging: A systematic literature review of empirical research on digital nudges. *CHI'20*, 1–16.
- Bhargava, V. R., & Velasquez, M. (2022). Excerpt from ethics of the attention economy: The problem of social media addiction. *Ethics of data and analytics* (pp. 391–402).
- Boer, M., Stevens, G. W., Finkenauer, C., de Looze, M. E., & van den Eijnden, R. J. (2021). Social media use intensity, social media use problems, and mental health among adolescents: Investigating directionality and mediating processes. *Comp. in H. Beh.*, 116.

- Brooke, J. (1996). Sus: A “quick and dirty” usability. *Usability evaluation in industry*, 189.
- Caraban, A., Karapanos, E., Gonçalves, D., & Campos, P. (2019). 23 ways to nudge: A review of technology-mediated nudging in human-computer interaction. *CHI*, 1–15.
- Chen, C.-Y. (2020). Smartphone addiction: Psychological and social factors predict the use and abuse of a social mobile application. *Information, Communication & Society*, 23(3).
- Dennis, A. R., Yuan, L., Feng, X., Webb, E., & Hsieh, C. J. (2020). Digital nudging: Numeric and semantic priming in e-commerce. *JMIS*, 37(1), 39–65.
- Eckler, P., Worsowicz, G., & Rayburn, J. (2010). Social media and healthcare: An overview. *PM&R*, 2(11), 1046–1050.
- Featherman, M. S., & Pavlou, P. A. (2003). Predicting e-services adoption: A perceived risk facets perspective. *International j. of human-computer studies*, 59(4), 451–474.
- Giraldo-Luque, S., Aldana Afanador, P. N., & Fernández-Rovira, C. (2020). The struggle for human attention: Between the abuse of social media and digital wellbeing. *Healthcare*, 8(4).
- GlobalWebIndex. (2021). *Social - gwi's flagship report on the latest trends in social media* (Report). Global Web Index.
- Gold, N., Lin, Y., Ashcroft, R., & Osman, M. (2020). ‘better off, as judged by themselves’: Do people support nudges as a method to change their own behavior? *Beh. Pub. Policy*, 1–30.
- Househ, M., Borycki, E., & Kushniruk, A. (2014). Empowering patients through social media: The benefits and challenges. *Health informatics journal*, 20(1), 50–58.
- Kim, J., Jung, H., Ko, M., & Lee, U. (2019). Goalkeeper: Exploring interaction lockout mechanisms for regulating smartphone use. *Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies*, 3(1), 1–29.
- Kim, Y.-H., Jeon, J. H., Choe, E. K., Lee, B., Kim, K., & Seo, J. (2016). Timeaware: Leveraging framing effects to enhance personal productivity. *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems*, 272–283.
- Ko, M., Choi, S., Yatani, K., & Lee, U. (2016). Lock n’lol: Group-based limiting assistance app to mitigate smartphone distractions in group activities. *CHI’16*, 998–1010.
- Krasnova, H., Widjaja, T., Buxmann, P., Wenninger, H., & Benbasat, I. (2015). Research note—why following friends can hurt you: An exploratory investigation of the effects of envy on social networking sites among college-age users. *ISR*, 26(3), 585–605.
- Kuss, D. J., & Griffiths, M. D. (2017). Social networking sites and addiction: Ten lessons learned. *International j. of environmental research and public health*, 14(3), 311.
- Lee, J., Lee, J. Y., Kim, S. W., & Cho, J. D. (2017). D-tox: Inducing digital detox for nighttime via smart lamp applied gamification. *Proceedings of the 2017 Conference on Interaction Design and Children*, 497–502.
- Lukoff, K., Lyngs, U., Zade, H., Liao, J. V., Choi, J., Fan, K., Munson, S. A., & Hiniker, A. (2021). How the design of youtube influences user sense of agency. *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems*, 1–17.
- Lyon, A. R., Pullmann, M. D., Jacobson, J., Osterhage, K., Al Achkar, M., Renn, B. N., Munson, S. A., & Areán, P. A. (2021). Assessing the usability of complex psychosocial interventions: The intervention usability scale. *Implementation Research and Practice*, 2.
- Mark, G., Gudith, D., & Klocke, U. (2008). The cost of interrupted work: More speed and stress. *CHI’08*, 107–110.
- Martens, K., Takano, K., Barry, T. J., Goedleven, J., Van den Meutter, L., Raes, F., et al. (2019). Remediating reduced autobiographical memory in healthy older adults with computerized memory specificity training (c-mest): An observational before-after study. *Journal of medical Internet research*, 21(5).
- Mehrotra, A., Pejovic, V., Vermeulen, J., Hendley, R., & Musolesi, M. (2016). My phone and me: Understanding people’s receptivity to mobile notifications. *CHI’16*, 1021–1032.
- Mildner, T., & Savino, G.-L. (2021). Ethical user interfaces: Exploring the effects of dark patterns on facebook. *CHI EA’21*, 1–7.
- Mills, S. (2020). Nudge/sludge symmetry: On the relationship between nudge and sludge and the resulting ontological, normative and transparency implications. *Beh. Pub. Policy*.
- Monge Roffarello, A., & De Russis, L. (2022). Understanding and streamlining app switching experiences in mobile interaction. *Int. J. Hum.-Comput. Stud.*, 158(100).
- Moreau, C. P., Bonney, L., & Herd, K. B. (2011). It’s the thought (and the effort) that counts:

- How customizing for others differs from customizing for oneself. *J. of Marketing*, 75(5).
- Norton, M. I., Mochon, D., & Ariely, D. (2012). The ikea effect: When labor leads to love. *J. of consumer psychology*, 22(3), 453–460.
- Okeke, F., Sobolev, M., Dell, N., & Estrin, D. (2018). Good vibrations: Can a digital nudge reduce digital overload? *MobileHCI'18*, 1–12.
- Peters, D., Calvo, R. A., & Ryan, R. M. (2018). Designing for motivation, engagement and wellbeing in digital experience. *Frontiers in psychology*, 9, 797.
- Ponnusamy, S., Iranmanesh, M., Foroughi, B., & Hyun, S. S. (2020). Drivers and outcomes of instagram addiction: Psychological well-being as moderator. *Comp. in H. Beh.*, 107, 106294.
- Purohit, A. K., Barclay, L., & Holzer, A. (2020). Designing for digital detox: Making social media less addictive with digital nudges. *ACM CH EA'20*, 1–9.
- Purohit, A. K., & Helme-Guizon, A. (2020). The power of digital nudge: Moving towards public transportation and debunking false beliefs: A conceptual framework: An abstract. In F. Pantoja, S. Wu, & N. Krey (Eds.), *Enlightened marketing in challenging times* (pp. 613–614).
- Purohit, A. K., & Holzer, A. (2019). Functional digital nudges: Identifying optimal timing for effective behavior change. *CHI EA'19*, 1–6.
- Purohit, A. K., & Holzer, A. (2021). Unhooked by design: Scrolling mindfully on social media by automating digital nudges. *AMCIS'21*, 1–10.
- Randall, T., Terwiesch, C., & Ulrich, K. T. (2007). Research note—user design of customized products. *Marketing Science*, 26(2), 268–280.
- Rauch, J. (2018). *Slow media: Why slow is satisfying, sustainable, and smart*. Oxford Press.
- Reijula, S., & Hertwig, R. (2022). Self-nudging and the citizen choice architect. *Beh. Pub. Policy*, 6(1).
- Sha, P., Sariyska, R., Riedl, R., Lachmann, B., & Montag, C. (2019). Linking internet communication and smartphone use disorder by taking a closer look at the facebook and whatsapp applications. *Addictive behaviors reports*, 9, 100148.
- Stallard, P., Porter, J., Grist, R., et al. (2018). A smartphone app (blueice) for young people who self-harm: Open phase 1 pre-post trial. *JMIR mHealth and uHealth*, 6(1), e8917.
- Strauss, A., & Corbin, J. (1994). Grounded theory methodology. *handbook of qualitative research*, 17, 273-85.
- Sun, Y., & Sundar, S. S. (2016). Psychological importance of human agency how self-assembly affects user experience of robots. *HRI'16*, 189–196.
- Thaler, R. H. (2018). Nudge, not sludge.
- Thaler, R. H., & Sunstein, C. R. (2009). *Nudge: Improving decisions about health, wealth, and happiness*. Penguin.
- Troye, S. V., & Supphellen, M. (2012). Consumer participation in coproduction: “i made it myself” effects on consumers’ sensory perceptions and evaluations of outcome and input product. *J. of marketing*, 76(2), 33–46.
- Tseng, V. W.-S., Lee, M. L., Denoue, L., & Avrahami, D. (2019). Overcoming distractions during transitions from break to work using a conversational website-blocking system. *CHI'19*, 1–13.
- Venkatesh, V., Brown, S. A., & Sullivan, Y. (2016). Guidelines for conducting mixed-methods research: An extension and illustration. *Venkatesh, V., Brown, SA, and Sullivan, YW “Guidelines for Conducting Mixed-methods Research: An Extension and Illustration,” Journal of the AIS (17: 7)*, 435–495.
- Viale, R. (2018). The normative and descriptive weaknesses of behavioral economics-informed nudge: Depowered paternalism and unjustified libertarianism. *Mind & Society*, 17(1), 53–69.
- Warkentin, M., Shropshire, J., & Johnston, A. (2007). The it security adoption conundrum: An initial step toward validation of applicable measures. *AMCIS'07*, 276.
- Weinmann, M., Schneider, C., & Brocke, J. v. (2016). Digital nudging. *BISE*, 58(6), 433–436.
- Widdicks, K. (2020). When the good turns ugly: Speculating next steps for digital wellbeing tools. *NORDICHI'20*, 1–6.
- Yousafzai, S., Pallister, J., & Foxall, G. (2009). Multi-dimensional role of trust in internet banking adoption. *The Service Industries Journal*, 29(5), 591–605.
- Zamprogn, L., Holmes, R., & Baniassad, E. (2020). Nudging student learning strategies using formative feedback in automatically graded assessments. *ACM SPLASH-E'20*, 1–11.
- Zimmermann, V., & Renaud, K. (2021). The nudge puzzle: Matching nudge interventions to cybersecurity decisions. *TOCHI*, 28(1), 1–45.