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From Digital Self-Control Apps to iOS Shortcuts: Enabling Privacy-Centric Wellbeing Research Without Code

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Abstract. Academic research on Digital Self-Control Tools (DSCTs), i.e., mobile applications that enable users to exercise control over technology use, faces technical and privacy-related challenges. This paper lays the foundations for an alternative approach: empowering researchers to use automation tools, e.g., iOS Shortcuts, to create and evaluate interventions without writing code. First, we interrogate the capabilities of iOS Shortcuts in replicating current DSCT functionalities, grounding our exploration in a state-of-the-art taxonomy of intervention strategies. Findings show that iOS Shortcuts is a viable tool for digital-wellbeing research as it can replicate 75% of the features of contemporary DSCTs, potentially overcoming DSCTs' well-known limits, e.g., through multi-device and feature-level interventions. Then, we report on a between-subject study (N=193) investigating how researchers should distribute interventions to participants in digital wellbeing experiments. Results highlight that iOS Shortcuts can alleviate initial privacy concerns among participants by empowering them to manually re-create the intervention to be tested.

Keywords: Digital wellbeing · Privacy-sensitive design · End-user programming · Trigger-action programming · IOS Shortcuts · Digital Self-Control Interventions · no-code tools

1 Introduction

Recently, there has been a significant and contentious discussion - both across research communities and on mass media - surrounding the potential drawbacks of excessive technology use [21,58], particularly concerning smartphones [14,2,79]. In parallel, the HCI community has recently started to highlight the importance of supporting users' digital wellbeing [57,7], showing a growing interest in the field of Digital Self-Control Tools (DSCTs) [54,60]. On smartphones, mobile DSCTs are dedicated mobile applications that assists users in exercising self-control over their use of other apps, enabling users to monitor their usage

patterns and instantiate interventions such as timers and lock-out mechanisms, e.g., to use Instagram no more than 30 minutes per days [54]. Nevertheless, the same HCI community highlighted that innovating interventions for digital self-control and evaluating their effectiveness in human subject research is challenging for digital-wellbeing researchers [60]. Specifically, developing DSCTs demands advanced programming skills and faces challenges due to operating system limitations [54], thus forcing researchers to exploit "unconventional" methods to develop their interventions, e.g., using Android's Accessibility APIs [9,**?**]. Furthermore, users often have privacy concerns when installing third-party DSCTs that make access to sensitive information like time spent on other apps [35,40].

Building upon the evidence from initial research [69,72,71,77,74], this paper investigates the use of iOS Shortcuts [29] – the popular Apple's automation tool – as a viable alternative to enable academic researchers to a) *create* and b) *evaluate* digital self-control interventions at operating system level. Implementing such an approach would circumvent the complexities of traditional programming and address technical and privacy concerns associated with third-party applications, making DSCT research more accessible to researchers without extensive coding skills, such as those in the medical domain.

To assess the feasibility of *creating* digital self-control tools through iOS Shortcuts, we first interrogated the capabilities of the platform in replicating interventions implemented by existing mobile DSCTs, grounding our exploration in the taxonomy of intervention features set forth by Lyngs et al. [54] (Section 3). Specifically, a research group composed of 3 researchers and a Reddit user active in the iOS Shortcuts community tried to construct a digital self-control intervention for each of the 24 DSCT features in the taxonomy, operating on Apple's automation tool on an iPhone. Our findings reveal that iOS Shortcuts can accommodate 18 of the 24 interventions outlined in the Lyngs et al. taxonomy (75% coverage) for a smartphone, positioning it as a viable tool for digital-wellbeing research. Additionally, as discussed in the last section of this paper, iOS Shortcuts can overcome well-known limits of contemporary DSCTs, by easily allowing researchers to develop context-aware and feature-level interventions, as well as combining multiple interventions and targeting multi-device ecosystems.

To explore how to *evaluate* digital self-control interventions built with iOS Shortcuts, we then investigated how researchers could take advantage of this tool to start a digital-wellbeing experiment while minimizing privacy concerns among participants (Section 4). Addressing these initial issues is crucial for the sustained use and management of these interventions during and beyond their evaluation, as privacy is major barrier to the installation and adoption of digital wellbeing apps [70,23]. To this end, we conducted a between-subjects experiment involving *N=193* participants, wherein we critically compared two different modalities for distributing iOS Shortcuts mobile interventions in digital-wellbeing research studies: manual re-creation by end users *vs.* reuse of pre-built interventions (Study 2, Section 4). Our findings show that, despite pre-build interventions were available for review and could potentially be modified, participants had more privacy concerns and perceived more privacy risks when reusing

a ready-made intervention. This suggests that allowing users to manually inspect a DSCT before using it, seeing all the steps that characterize its intervention strategies, could potentially reduce initial attrition.

To summarize, this work offers two main contributions. First, we provide the digital-wellbeing researchers with a deeper dive into how iOS Shortcuts can play a role in digital wellbeing research experiments and enhance users' digital self-control (Section 3). On top of that, we underpin our assertions with empirical evidence, offering optimal strategies to craft and disseminate these interventions and start digital wellbeing experiments in a manner sensitive to participant privacy concerns (Section 4). We conclude the paper by discussing opportunities and challenges that may define the path toward the end-user development of digital self-control interventions (Section 5), thereby democratizing such an approach to end users beyond researchers.

2 Background and Related Work

2.1 Achieving Digital Wellbeing by Exercising Self-Control

Smartphone use is increasingly linked to terms like overuse [48], compulsive use [79], and addiction [45], prompting researchers to develop psychological scales to measure user dependence [43]. While some debates on technology addiction remain speculative [45], extensive evidence suggests that excessive smartphone use disrupts daily tasks [2,44], harms mental health [44], and reduces quality social interactions [80]. Features like infinite scrolling and autoplay further diminish user agency and self-control [52,61]. Many users express a desire to replace negative digital habits with more meaningful activities [48,79,59]. This growing concern has led to an emerging HCI research field on "digital wellbeing," defined by Burr et al.[7] as "the impact of digital technologies on what it means to live a life that is good for a human being in an information society" (p. 2313). In response, various Digital Self-Control Tools (DSCTs) have been developed to help users manage distracting apps and websites. As highlighted in recent reviews[54,60], most DSCTs are mobile apps offering intervention strategies such as self-monitoring [54] and digital nudges [70,56] to encourage healthier smartphone use.

2.2 Innovating DSCTs: Technical and Privacy Barriers

While DSCTs have shown short- to medium-term effectiveness in modifying technology use [60], developing and evaluating them in human-subject research remains challenging [57,40,54]. A key concern is their paradoxical nature—third-party tools that restrict technology use [52,60], raising privacy and manipulation concerns [84]. As DSCTs access sensitive data, privacy safeguards are crucial and widely demanded [35,40,60]. Rooksby et al.[75] highlight that "data about everyday device use can reveal much about someone's life, raising privacy concerns" (p. 293). Ensuring ethical and privacy-conscious study designs

remains an open challenge[60]. This paper examines privacy concerns at the installation stage, where researchers introduce DSCTs to participants. Developing DSCTs also presents technical challenges, requiring advanced programming skills and workarounds for OS restrictions[39]. Research on iOS-based DSCTs remains limited due to Apple's strict platform controls on usage data and app blocking[54,57,32]. On Android, DSCTs often rely on accessibility APIs to bypass restrictions[9]. Across platforms, DSCTs are also vulnerable to software aging[76] and OS updates [39], which can disrupt their functionality. To address these challenges, this paper explores iOS Shortcuts as an OS-level automation tool, offering researchers a low-code approach to designing and testing digital self-control interventions.

2.3 Task Automation Tools and Trigger-Action Programming

There has been sustained interest in HCI in enabling users to automate digital tasks, particularly on smartphones [63]. Recently, iOS Shortcuts (Apple)[29] and Android Rules (Google)[1] have expanded automation possibilities through the Trigger-Action Programming (TAP) paradigm, where predefined rules execute actions based on specific triggers. Building on early TAP systems like iCAP [18], prior research has demonstrated its effectiveness across various domains, including smart homes [81] and IoT [11]. iOS Shortcuts, pre-installed on most Apple devices, enables users to automate tasks across their ecosystem, creating custom workflows such as "If I'm home at 10 p.m., remind me to sleep." Shortcuts are composed of sequential actions, which interact with both Apple's apps (e.g., Notes, Calendar) and third-party applications. Automations extend this by allowing tasks to run automatically based on triggers, such as opening Instagram prompting a project reminder. As an OS-integrated tool, iOS Shortcuts bridges system-level data, settings, and sensors with third-party apps, broadening its applicability. Recently, researchers have leveraged iOS Shortcuts for digital self-control interventions. Purohit and Holzer [69] created a shortcut-based Instagram usage timer to reduce mindless scrolling, while Purohit et al. [72] developed strict and self-regulated newsfeed diets for Facebook, tracking users' app usage. This paper extends this exploration, assessing the feasibility of using iOS Shortcuts as a low-code platform for researchers to design and implement digital self-control interventions more effectively.

3 Assessing iOS Shortcuts for Digital Self-Control

This section examines the viability of leveraging iOS Shortcuts as a TAP tool empowering digital wellbeing researchers to create and develop digital self-control interventions. Specifically, we used Apple's automation tool to replicate interventions included in state-of-the-art mobile DSCTs, investigating what can be implemented and what cannot, as well as the degree of difficulty of the implementation. To facilitate reproducibility and reuse of our methods, we are sharing

videos and QR codes for the basic steps of all reproduced interventions in the following repository: *https://shorturl.at/X2qp2*. These steps include tracking Instagram's opening and closing times, recording Instagram usage data, storing this data, and displaying usage timers.

3.1 Methodology

Three researchers from different continents—including the two authors—and a Reddit user from the iOS Shortcuts community collaborated to design digital self-control interventions using iOS Shortcuts. To assess the tool's potential, we restricted development to the iOS Shortcuts ecosystem, avoiding third-party apps. For a structured approach, we followed a taxonomy of digital self-control interventions. After reviewing recent efforts to categorize DSCTs, we adopted Lyngs et al.'s taxonomy [54] due to its comprehensive scope and prior use in digital wellbeing research [60,53,15]. The taxonomy was developed by Lyngs et al. [54] through an in-depth analysis of 367 apps across major platforms and is grounded in a dual systems regulation model. It categorizes intervention strategies into 24 design features categorized as blocking/removing, tracking, goal advancement, and rewarding/punishing. The research team, in particular, tried to construct a digital self-control intervention for each of the features included in the taxonomy, taking inspiration from research-based DSCTs, e.g., those reviewed in [60], and selecting Instagram as the target application. Instagram was chosen for its tendency to create digital wellbeing problems [59] and because researchers have paid less attention to it than Facebook [71].

During solution development, step-by-step action flows were first sketched on paper, aligning with computational thinking principles such as decomposition, which involves breaking problems into smaller parts, and abstraction, which focuses on key attributes [16,31,20]. These conceptual solutions were then implemented as trigger-action protocols using iOS Shortcuts. As with most complex tasks, debugging and iterative refinement were necessary to ensure robustness. Each collaborator independently developed their version of the intervention, and the team met three times a week via video calls to discuss design choices and challenges. Solutions were evaluated based on their alignment with Lyngs et al.'s taxonomy [54] and categorized by implementation difficulty. Solutions with five or fewer actions were considered low difficulty, those requiring six to nine actions were labeled medium difficulty, and those with ten or more actions were classified as high difficulty. It is worth noting that collaborators' programming experience may have influenced their perception of difficulty.

3.2 Findings

Table 1 summarizes the results of our investigation, listing all the *DSCT features* of the Lyngs et al. taxonomy [54] and their *category*, the *interventions* that we tried to replicate through iOS Shortcuts, the *reference* work from which we selected the target interventions, and the level of *difficulty* characterizing the implementation in iOS Shortcuts, if feasible. In the following sections, we detail

the findings of our analysis, dividing them according to the category of the targeted DSCT features. Overall, we implemented digital self-control interventions in iOS Shortcuts for 18 of the 24 DSCT features included in the Lyngs et al. taxonomy, reaching 75% of coverage.

Table 1: Summary of Study 1 Results. For each *DSCT feature* from Lyngs et al. [54], we attempted to create a self-control intervention using iOS Shortcuts, inspired by research-based DSCTs (*main reference*). *Difficulty* indicates implementation complexity based on the number of required actions.

DSCT Feature	**Category**	**Intervention**	**Main Reference**	**Difficulty**
Feature minimization	Block/removal	Turn the smartphone into gray-scale when the user opens Instagram.	Holte et al. [27]	Low
Effortful task to override	Block/removal	Lock the smartphone screen when the user opens Instagram, forcing them to enter the smartphone's PIN.	Park et al. [68]	Low
Block	Block/removal	Redirect to the home screen whenever the user opens Instagram.	Kim et al. [33]	Low
Time limit for use	Block/removal	Allow Instagram access only between 9 AM and 6 PM.	Hiniker et al. [25]	Medium
Time lag before launch	Block/removal	Introduce a 10-second delay before launching Instagram.	Kovacs et al. [40]	Low
Uninstallation prevention	Block/removal	✗	N/A	✗
Pay to override	Block/removal	✗	N/A	✗
Record history	Self-tracking	Log how many times Instagram is opened.	Purohit et al. [72]	Medium
Visualize usage	Self-tracking	Display Instagram usage metrics: openings, time spent, and remaining time before limit.	Kovacs et al. [41]	High
Display a timer	Self-tracking	Notify users when they have been on Instagram for 5 minutes.	Monge Roffarello et al. [57]	Medium
Set time/activity goals	Goal advancement	Define a time objective for Instagram use when the app is opened.	Shen et al. [78]	Medium
Goal reminders	Goal advancement	Notify users when they reach their Instagram usage limit.	Okeke et al. [66]	Medium
Motivational quotes	Goal advancement	Show a random motivational quote whenever Instagram is accessed.	Foulonneau et al. [22]	Medium
Compare behavior w/ goal	Goal advancement	Allow users to track time spent on Instagram relative to their goal.	Kim et al. [32]	Medium
Redirect activity	Goal advancement	Redirect users to the reminders app when they attempt to access Instagram.	Inie et al. [30]	Low
Praise/blame/please/annoy	Reward/Punish	Send a notification blaming users who exceed their Instagram usage limit.	Collins et al. [10]	High
Gain points/streaks	Reward/Punish	Grant points when Instagram use stays within the goal limit.	Ko et al. [38]	High
Lose points/streaks	Reward/Punish	Deduct points if Instagram use exceeds the goal limit.	Liu et al. [49]	High
Unlock achievements	Reward/Punish	✗	Zhou et al. [87]	✗
Social sharing leaderboards	Reward/Punish	✗	Ko et al. [37]	✗
Points as life forms	Reward/Punish	✗	Liu et al. [49]	✗
Real-world reward/punishment	Reward/Punish	✗	Park et al. [67]	✗

Blocking/Removing Humans inherently possess a propensity for distraction. Our brains are naturally inclined to gravitate towards stimuli that are enjoyable, pose a threat, or present novelty [3]. The interventions in the cluster of blocking/removing are characterized by their ability to restrict users' access to

the application or remove functionality that tempts users to spend more time than they would have otherwise [54]. Concerning the blocking/removing category, we were able to implement 5 out 7 DSCT features included in the Lyngs et al. taxonomy with iOS Shortcuts:

- *Feature minimisation*: The goal of feature minimisation is to put obstacles in the way of distracting functionality [53]. For example, hiding the newsfeed, hiding notifications, or dimming the screen [23]. For feature minimization, we took inspiration from Holte et al. [27] and Zimmermann et al. [88] based on which we constructed an intervention which turns the smartphone into gray-scale when the user opens Instagram. The gray-scale intervention creates as an obstacle in the way of using Instagram. On iOS Shortcuts, we used the Color Filters action with two automations to detect Instagram's opening and closing (low difficulty, $<= 5$ actions).
- *Effortful task to override*: The aim of an effortful task to override is to implement a deliberately effortful task that needs to be fulfilled prior to gaining access to the desired application [53]. For example, introducing a lockout task that requires user to input 10-digit number when the target app is opened [34]. In our initiative to develop an intervention characterized by intentional effort, we found inspiration in the study conducted by Park et al. [68]. We devised an intervention that locks the smartphone screen upon opening Instagram, forcing the user to input their smartphone pin upon accessing the application. To achieve this on iOS Shortcuts we used the Lock Screen action, associating it with an automation intercepting the opening of the Instagram app (low difficulty, i.e., $<= 5$ actions).
- *Block*: The aim of this DSCT feature is to block all access to the target application [53]. For example, blocking certain apps during certain time of the day [35]. In our block intervention approach, we drew inspiration from the works by Ko et al. [35] and Kim et al. [33]. Based on these, we devised an intervention that redirects the user to the smartphone's home screen upon opening Instagram, preventing access to the app. To achieve this on iOS Shortcuts we used the Open action, using the home screen as the target destination whenever the associated automation intercepted the opening of the Instagram app (low difficulty, $<= 5$ actions).
- *Time limit for use*: The intention behind this DSCT feature is to restrict the frequency and timing of app activations [60]. For example, limiting app usage to 10 minutes per day [25] or restricting access to specific hours [54]. In our initiative to develop an intervention that limits the use, we took inspiration from the DSCT presented by Hiniker et al. [25]. We designed an intervention restricting Instagram access to 9 AM–6 PM. Attempts to open the app outside this window redirect users to the home screen. In iOS Shortcuts, this was implemented by checking the current time and triggering the previously described "block" shortcut if access was outside the allowed period (medium difficulty, $5 <$ actions < 10).
- *Time lag before launch*: The intention behind time lag before launch is not to fully restrict access to the application or service. Instead, it introduces a delay

in loading, aiming to deter persistent usage [60,54]. A few examples that exist induced delay on the websites [41,40,70,76]. We took inspiration from Kovacs et al. [40] and introduced a 10-second delay before the Instagram app is launched. As directly delaying Instagram when its opening was intercepted was not possible in iOS Shortcuts, we developed a shortcut – with a dedicated icon on the home screen – that launched Instagram after waiting 10 seconds through a Wait action (medium difficulty, i.e., 5 < actions < 10). The goal is to open Instagram via the shortcut instead of its app icon.

In the block/removal category, we could not implement *uninstallation prevention* or *pay to override*. The former aims to prevent users from removing interventions, such as blocking DSCT uninstallation, which requires root access. The latter involves charging users to bypass a blocking session, necessitating third-party service integration. Unsurprisingly, we found no similar interventions in the HCI literature (Monge Roffarello et al. [60], Figure 3).

Self-tracking The pursuit of electronically detecting a wide array of phenomena has remained a persistent goal in the domains of engineering and computer science [64]. Interventions grouped in the self-tracking category are characterized by their ability to log user activity history, present visualizations of the gathered data, and incorporate timers or countdown mechanisms [54]. Fundamentally, these interventions are designed to examine user behavior and furnish feedback. Concerning the self-tracking category, we were able to implement all the 3 DSCT features included in the Lyngs et al. taxonomy with iOS Shortcuts:

- *Record history*: The aim of recording history is to allow users with logging facilities. For example, monitoring the frequency of app launches [60], quantifying the duration of app utilization [66], and tracking the remaining allowance before hitting the predetermined daily usage limit [83]. For this intervention we took inspiration from Purohit et al. [71], developing an intervention that logged when how many times Instagram was opened locally on the Notes application of the iOS device. In iOS Shortcuts, we automated Instagram's launch to log the date and increment the opening count in Notes (medium difficulty, i.e., 5 < actions < 10).
- *Visualise usage*: This DSCT feature facilitates users in viewing their past data and potentially enables the reception of real-time feedback [60]. For example, Okeke et al. [66] utilized haptic (vibration) feedback to give users immediate updates on the duration they've spent, as the app simultaneously logged the history. Building on Kovacs et al. [41], we designed an intervention that provides real-time feedback on Instagram usage, displaying the number of accesses, time spent, and remaining time before reaching the usage limit. In iOS Shortcuts, this was implemented using two automations to detect Instagram's opening and closing, along with actions to track and visualize usage data (high difficulty, actions >= 10).
- *Display a timer*: Through this DSCT feature, a timer is leveraged to present the usage data in real-time for immediate insight [60,69]. For example, Monge

Roffarello et al. [57] implemented a timer-based intervention in their Socialise app to notify users when they are using an app for too long. Drawing insights from both Purohit et al.[69] and Monge Roffarello et al.[57], we designed a timer intervention within iOS Shortcuts. The timer notified users once they've been on Instagram for 5 minutes. If Instagram is closed before 5 minutes, the timer turns off (medium difficulty: 5–10 actions).

Goal advancement The interventions under the goal advancement are components of self-determination and self-management, serving as a meta-cognitive strategy enabling users to control and modulate their behaviour [42,54]. In the goal-advancement cluster, interventions help users to set explicit goals and remind them, as well as to measure, record, and visualize their actions and compare them to their goals. Concerning this category, we were able to implement all the 7 DSCT features included in the Lyngs et al. taxonomy with iOS Shortcuts:

- *Set concrete time goals* and *set activity goals*: These two DSCT feature allow user to choose/set a concrete goal, either in terms of time to be spent on an app or in terms of other activities to be performed online or offline. For example, Shen et al. [78] gave users the option to establish specific time targets to handle smartphone usage addiction. Drawing from Shen et al. [78], we harnessed iOS Shortcuts to craft an intervention prompting users to establish a specific time objective each time they accessed Instagram. To realize this within Shortcuts, we utilized the Menu action, associating it to an automation that intercepted the opening of Instagram. This granted users the option to select a specific time goal, ranging from 30 seconds to 120 seconds, to spend on the app (medium difficulty, i.e., $5 <$ actions < 10).
- *Concrete goal reminder* and *value/general goal reminder*: Reminders about concrete or general goals notify users once they surpass a predetermined time limit, by using haptic or notifications. For instance, Okeke et al. [66] utilized haptic (vibration) feedback to give users a reminder that they have reached the time limit. To build this intervention within iOS Shortcuts we took inspiration from Collins et al. [10] and Okeke et al. [66], devising a timer that notifies users when they have reached their usage limit. We used automations to detect Instagram's opening and closing, Timer actions to manage usage time, and a Show Notification action to display the timer. (medium difficulty, i.e., $5 <$ actions < 10).
- *Motivational quotes*: The objective of motivational quotes is to bolster confidence, motivation, and foster empowerment [4]. For example, Foulonneau et al. [22] utilized persuasive messages like *"Less time on your smartphone means more time with loved ones, better focus on your work, or simply peace of mind"* Following a similar approach, we developed an intervention within iOS Shortcuts that presented a random quote whenever Instagram was accessed. To implement this intervention, we utilized the Notes action in Shortcuts. When Instagram was accessed, a random quote from the Notes app was selected and presented to the user in the form of a notification (medium difficulty, i.e., $5 <$ actions < 10).

- *Compare behaviour w/ goal*: This DSCT feature enables users to contrast their actual behavior with their predetermined objectives [60]. For example, Chisler et al. [8] provided users with information about their set goals and their current status in relation to those goals. Similarly, Kim et al. [32] displayed time left in the notification drawer. Inspired by Kim et al. [32], we crafted a shortcut allowing users to track their progress relative to their set goals. This shortcut was engineered to either operate autonomously for status checks or activate upon opening Instagram. Within iOS Shortcuts, our implementation logic is as follows. If Instagram is opened, then log the opening time. Conversely, if Instagram is closed, note the closing time, calculate the session duration by subtracting and subsequently display the time left from the user's goal (medium difficulty, i.e., $5 <$ actions < 10).
- *Redirect activity*: This DSCT feature directs the user to a constructive activity or service before allowing access to a website or app that might be distracting. [60]. For example, Inie et al. [30] crafted a Chrome extension that steered users towards a learning platform when they attempted to visit a site deemed distracting. In a parallel approach, we fashioned a shortcut that redirected users to the reminder application whenever they tried accessing Instagram. To achieve this on iOS Shortcuts, we employed the Open action and linked it to the reminder app, activating it upon the launch of Instagram through a dedicated automation (low difficulty, i.e., $<= 5$ actions).

Reward/Punish Diving into reward/Punish, it is essential to acknowledge a principle within the discipline of psychology that posits behaviors are primarily shaped by their ensuing consequences. This foundational theory argues that individual actions can be steered and modified through the dual avenues of rewards and punishments [62,24]. In the Lyngs et al. [54] taxonomy, in particular, the interventions grouped in the cluster of reward/punish aims at influencing the expected value of control, a cost-benefit analysis that weighs the potential gains and losses of exerting self-control, ultimately influencing its strength. In regards to reward/punish category, we successfully implemented 3 of the 7 DSCT features from the taxonomy by Lyngs et al. using iOS Shortcuts:

- *Praise/blame/please/annoy*: The objective of this DSCT feature is to praise or blame users when they achieved a goal or failed to meet a goal [60]. For example, Collins et al. [10] blamed the user for being unproductive on the interface of RescueTime *"17% less productive than usual and you are 31% less focused."* Drawing from the work by Collins et al. [10] and RescueTime interface, we crafted an intervention that sends users a blame-toned alert if they fail to meet their goal. Using iOS Shortcuts, we set up two automations: one triggered when Instagram is opened and another when it is closed. Users set a daily Instagram time limit; if exceeded, they receive a blaming notification the next day (high difficulty, i.e., actions $>= 10$).
- *Gain points/streaks*: The goal of the gain points/streaks feature is to influence user behavior through gamification. Specifically, users earn points when they achieve their set goals [60]. For instance, Ko et al. [36] informed how

many points they would receive if they met their goals. Inspired by this approach, we developed a shortcut that allowed the user to choose how many points they would like to receive if they met a certain goal. Using iOS Shortcuts, we set up two automations: one activated upon opening Instagram and another upon its closing. The automation logged points in a JSON-formatted dictionary, storing them for future retrieval (high difficulty, actions >= 10).
- *Lose points/streaks*: Building on the principle of behavioral influence through gamification, the objective of the lose points/streaks feature is to deter users from deviating from their set goals by deducting points [60]. Drawing from Liu et al. [49], who instilled a sense of loss when users deviated from their goals, our implementation deducts points if users surpass their daily limits. Utilizing iOS Shortcuts, we crafted two automations: one triggered when Instagram is initiated and another upon its termination. These automations log and store points in a JSON-formatted dictionary on the device for future access(high difficulty, i.e., actions >= 10).

In the reward/punish category, we were not able to implement, *unlock achievements*, *social sharing leader-boards*, *points represented as life forms*, and *real-world reward/punishment*. The aim of the first three DSCT features is to steer and modify the user behaviour through complex gamification strategies. Examples include interventions that gradually become stronger depending on the user's behavior (Zhou et al. [87], *unlock achievements*), rankings comparing user's self-regulation achievements (Ko et al. [37], *social sharing leader-boards*), and virtual flowers that wither if the user does not respect their own limits (Liu et al. [49], *points represented as life forms*). Implementing these features mandates the integration of both graphic capabilities and external APIs. The aim of *real-world reward/punishment*, instead, is to steer user's behavior leveraging real-world incentives or deterrents, e.g., making the user lose money if they spend too much time on the smartphone (Park et al. [67]). These strategies, particularly those suggesting micro-financial incentives, necessitate integration with third-party service providers.

4 iOS Shortcuts in Digital Wellbeing Research

This section examines how digital wellbeing researchers could take advantage of iOS Shortcuts in their digital wellbeing experiments. Specifically, we conducted an online experiment to investigate the approaches that researchers and practitioners should take to distribute a digital self-control intervention and start a digital wellbeing experiment while minimizing users' privacy concerns.

4.1 Methodology

Intervention Design and Distribution Modalities To run our investigation, we first developed an intervention on iOS Shortcuts implementing a *Time Limit For Use* (Block/Removal) feature, i.e., Siri providing a voice-based feedback to users when they have spent 2 minutes on Instagram (Figure 1). The

implementation was informed by two main reasons. First, according Lyngs et al. [54], *Time Limit For Use* feature is among the most used features in their taxonomy. We chose 2 minutes as the time threshold as users often visit apps intending to check for just a few minutes and are immediately sucked into the addictive social media newsfeed, watching video after video [85]. Second, to minimize bias in the study, we opted for a voice-based delivery method for the timer. Such an approach avoided interventions delivered through traditional notifications, which users might have encountered in commercially available apps, potentially influencing their behavior in our research. Supported by previous works with smart speakers [46], in particular, we considered a voice-based intervention as more privacy intrusive – even just when it comes to its creation – than defining the same intervention in the form of a visual notification or popup. As shown in Figure 1, the intervention comprises a set of actions to be executed when Instagram is opened (Step 1) and closed (Step 2), respectively, which are then associated to two different automations (Step 3).

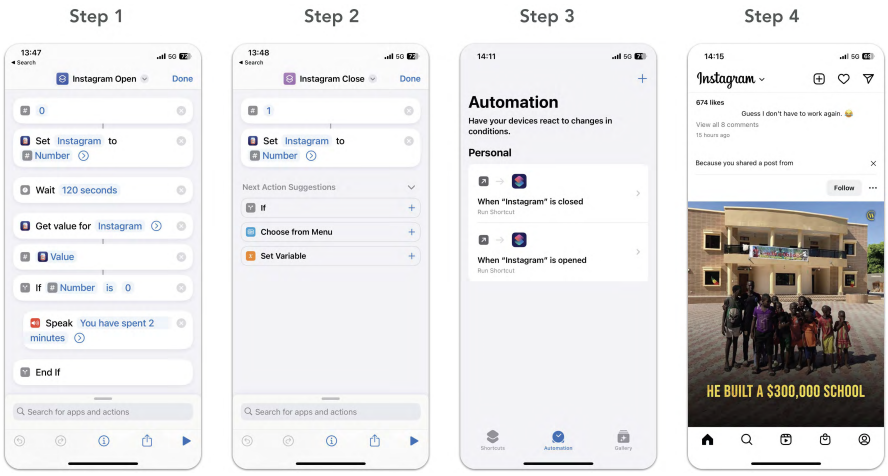


Fig. 1: Voice based Digital self-control intervention via Shortcuts

Inspired by two of the most popular programming modalities typically adopted in TAP, we considered two alternative strategies for distributing the developed intervention, i.e., *manual re-creation* and *reuse*. Manually operating on trigger-action rules in TAP platforms involves using wizard-based interfaces to link specific triggers with the desired actions [17]. Prior work in the domain of web and IoT personalization demonstrated that manual creation allows users to have fine-grained control over the programmed behavior, at the cost of sometimes being a complicated task for non-technical users [28,13]. Reusing pre-built trigger-action rules in TAP platforms, instead, involves directly activating trigger-action

rules suggested by the platform or by other users [13]. In the web and IoT personalization domain, in particular, recommender systems suggesting pre-built trigger-action rules have been used to speed up and simplify the composition process [13,12,55]. In our work, participants in the *manual re-creation* condition were provided with a detailed step-by-step tutorial on how to implement the voice-based Instagram intervention[3]. The tutorial included 15 steps, guiding participants on creating actions and linking them to automation. In the *reuse* condition, participants received a prebuilt intervention, only needing to scan a QR code to import it. However, they were encouraged to review the intervention with the same level of detail as those who manually recreated it.

Procedure, Participants, and Measures To examine how iOS Shortcuts-based digital self-control interventions influence privacy concerns, we conducted an online experiment with 193 participants using a between-subjects design. Participants were recruited via Prolific and met the following criteria: native English speakers, iPhone users, and Instagram users with at least 10 minutes of daily usage. The final sample included 164 female participants (85%), 25 male (13%), and 4 non-binary/other (2%). Participants' education ranged from 2 to 24 years (M = 14.5, SD = 3.97), and ages ranged from 18 to 59 years (M = 25.1, SD = 7.89). Participants were randomly assigned to either the manual re-creation or reuse condition. In the manual re-creation condition, participants followed a step-by-step tutorial to build and test the intervention on Instagram for 10 minutes. To ensure accurate implementation, we conducted a manipulation check, requiring participants to describe their Instagram session. In the reuse condition, participants received a prebuilt intervention and tested it under the same conditions.

Following the intervention, participants completed a survey measuring perceived privacy concerns (PCON) and perceived privacy risks (RISK), adapted from Xu et al. [86] using a seven-point Likert scale (1 – Strongly disagree to 7 – Strongly agree). Sample items include *"I am concerned that the information I submit to this intervention could be misused"* (PCON1) and *"In general, it would be risky to give personal information to this intervention"* (RISK1). Both scales demonstrated excellent reliability (PCON: $\alpha = .96$, RISK: $\alpha = .95$). To ensure consistency, negatively worded items were reverse coded, enhancing the reliability and validity of the data. [4].

4.2 Results

Before analyzing perceived privacy concerns and risks, we conducted a Levene's test for equality of variance, which indicated that homogeneity assumptions did not hold for both metrics (p = .014 for privacy concerns, p = .018 for privacy

[3] The tutorial is available at *https://osf.io/yu5m8/?view_only=c71e492d6632481287678426 79d3d074*.

[4] The complete survey scales are available at `https://osf.io/yu5m8/?view_only=c71e492d66324812876784267 9d3d074`

risks). Consequently, we performed Welch T-tests to compare differences between the two study conditions. Regarding perceived privacy concerns (PCON), participants in the manual re-creation condition reported lower concerns (M = 3.871, SD = 1.808) compared to those in the reuse condition (M = 4.664, SD = 1.604). The Welch T-test confirmed a statistically significant difference (t(169.27) = -3.181, $p < .001$), with a medium effect size (Cohen's d = 0.465). This suggests that manually recreating digital self-control interventions in iOS Shortcuts reduces perceived privacy concerns at installation time.

Similarly, perceived privacy risks (RISK) were lower in the manual re-creation condition (M = 4.338, SD = 1.671) compared to the reuse condition (M = 4.782, SD = 1.451). The Welch T-test revealed a significant difference (t(167.13) = -1.941, p = .027), though with a smaller effect size (Cohen's d = 0.284). This further indicates that manually recreating interventions mitigates perceived privacy risks at installation time. Overall, these findings align with prior research on digital nudges. While pre-built nudges are often perceived as intrusive or manipulative [47,5,82], self-constructed interventions—termed self-nudging[73]—can empower users to take control of their digital environments[50,73] and reinforce their sense of agency [82].

5 Discussion & Conclusion

5.1 Implications for Digital-Wellbeing Researchers

Developing Digital Self-Control Tools (DSCTs) is challenging, particularly in mobile ecosystems where programming expertise is often required. Researchers must navigate technical barriers, such as OS restrictions that limit third-party applications, forcing them to adopt complex and time-consuming strategies [9,51]. Our work demonstrates that iOS Shortcuts, an integrated OS automation tool, can provide an accessible, ethical, and effective alternative for creating (Section 3) and evaluating (Section 4) digital self-control interventions. By leveraging OS-level integration, iOS Shortcuts grants researchers access to data and settings typically unavailable to third-party apps while offering a user-friendly interface that eliminates the need for extensive coding.

One key advantage of this approach is the democratization of DSCT development. The accessibility of iOS Shortcuts allows researchers from non-technical backgrounds to participate in designing and studying digital wellbeing interventions, fostering interdisciplinary collaboration. Additionally, our findings suggest that involving participants in manually re-creating DSCTs can reduce initial privacy concerns by making intervention strategies more transparent. Unlike third-party applications, which obscure implementation details, iOS Shortcuts naturally supports intervention decomposition through its end-user programming interface. While privacy concerns may evolve over time, minimizing them at installation could help reduce the high attrition rates commonly observed in DSCT research trials [40,76,19]. Privacy concerns have historically been a major factor in user resistance to digital wellbeing apps [70,23], and our results align

with prior evidence suggesting that TAP-based tools like iOS Shortcuts offer greater privacy control than traditional third-party DSCTs [69,72,74].

Beyond replicating existing DSCTs, TAP-based interventions can address well-known DSCT limitations. Since iOS Shortcuts operates across Apple devices, it enables interventions that extend beyond smartphones, reaching iPads and MacBooks. This integration helps overcome the single-device focus of many DSCTs [54,58,60]. Additionally, iOS Shortcuts allows the combination of multiple intervention strategies, creating a bundle of interventions rather than a single, isolated measure. Research suggests that rotating intervention strategies can improve user retention [40]. Furthermore, TAP enables context-aware interventions, linking digital self-control strategies to triggers such as time of day or location [26,59,60]. Finally, our approach supports feature-level interventions, which target app mechanisms directly. For instance, detecting user interactions via smartphone gestures could be used to mitigate attention-capture design patterns like infinite scrolling [72,61]. Overall, leveraging iOS Shortcuts not only simplifies DSCT development but also enhances intervention flexibility, privacy control, and contextual adaptability, opening new opportunities for digital wellbeing research..

5.2 End-User Development of Digital Self-Control Interventions

This study examined the feasibility of iOS Shortcuts for designing and distributing digital self-control interventions in digital wellbeing experiments. Findings from our second study suggest a promising direction: empowering end users—beyond researchers—to create personalized interventions. By shifting from passive consumers to active creators, users can enhance intervention effectiveness through customization, integrating multiple actions and contextual triggers to tailor interventions to their specific needs.

However, broader adoption of end-user development (EUD) for DSCTs requires further research. While participants in our study followed a structured tutorial, Trigger-Action Programming (TAP) usability challenges remain, particularly in uncontrolled settings. Prior research shows that users frequently misinterpret TAP behavior[28] and encounter common programming errors[6]. These challenges are especially relevant when creating complex interventions requiring multiple automations, such as tracking app openings and closures. In the short term, community-driven platforms like RoutineHub could help mitigate the learning curve by enabling collaborative DSCT development. However, long-term TAP adoption for digital wellbeing requires further simplification of intervention creation. Two key design improvements could enhance future TAP platforms for DSCTs: First, native support for DSCT mechanisms would reduce the need for workarounds. iOS Shortcuts lacks direct support for common intervention strategies, requiring manual solutions such as storing usage thresholds in local JSON files. Future TAP platforms could model high-level triggers and actions, such as event-based usage statistics, automated timers, and lockout mechanisms, aligning with IoT-based high-level TAP models [17,11]. Second, better third-party app integration would expand intervention capabilities. The

effectiveness of iOS Shortcuts depends on its built-in features and the extent to which external apps expose custom actions. Future TAP platforms should facilitate deeper app integration to streamline intervention design. For example, Lukoff et al.[51] had to rebuild a video-streaming app from scratch to counteract YouTube's recommendation system. Instead of requiring full app reconstruction, community-driven modification frameworks like GreaseDroid[39], which allow non-expert users to disable dark patterns, could offer researchers feature-level intervention tools rather than app-level solutions. By improving TAP-based platforms to better support digital wellbeing interventions, both researchers and end users could develop, share, and refine self-control strategies more effectively, fostering a more inclusive and adaptable approach to digital wellbeing.

5.3 Limitations and Future Works

This study has several limitations that offer directions for future research. First, it focuses solely on iOS Shortcuts, limiting its applicability to other task automation tools and operating systems. While Android Rules [1] provides similar functionality, future research should explore whether our findings generalize across platforms. Second, our study assessed the feasibility of iOS Shortcuts for digital wellbeing experiments, focusing on intervention creation and distribution rather than their long-term impact. Future work could examine whether these interventions produce sustained behavioral change, for instance, through longitudinal studies tracking users' digital wellbeing over time. Third, intervention effectiveness is constrained by iOS Shortcuts' capabilities. Blocking strategies such as usage timers depend on friction to prevent bypassing [57,53], but users can easily disable shortcuts, as they would with third-party DSCTs. Future research should explore ways to enhance intervention persistence and user commitment. Further, integrating third-party apps could enable richer interventions, such as gamification and features targeting internal app mechanisms like recommendations and newsfeeds. Lastly, our study examined privacy concerns only at installation, but perceptions may evolve during continued use. Future research should investigate how privacy concerns change over time and whether transparency in intervention creation influences trust. Additionally, our sample was skewed toward female participants, potentially limiting generalizability. However, as previous DSCT research has been male-dominated [65], our findings help balance prior perspectives. Furthermore, this study highlight its versatility in replicating digital self-control interventions and suggest that empowering users to manually re-create interventions can help reduce privacy concerns in research studies. Overall, this work underscores the role of OS-level automation tools in digital wellbeing research, offering a scalable, accessible, and customizable approach to DSCT development for both researchers and end users

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