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# Digitally Distracted: Development and Examination of Conflicted Technology Use

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# Digitally Distracted: Development and Examination of Conflicted Technology Use

**Full research paper**

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## Abstract

With smartphones and other devices allowing billions of users to engage in a plethora of activities anytime and anywhere, many people are increasingly concerned with digital distraction, where technology is used in conflict with behavioral goals or intentions. To address it, we require a conceptualization and an understanding of its prevalence, its factors, and its mechanisms. Based on a review of research on cyberloafing, multitasking, procrastination, and addiction, we use the theories of self-control and dual process to develop the construct Conflicted Technology Use. We then develop and deploy an instrument to examine where and when it takes place, who is susceptible, how it is triggered, and which activities are involved. We further aim to examine the structure of the phenomenon through cluster analysis. We report on four studies from two countries, with a total of 690 participants. By discussing these findings in relation to behavioral theories we set out how it can inform specific studies into the combatting Conflicted Technology Use.

# 1 Introduction

With the growing reach of smartphones and the ever-expanding variety of applications, users of information technology spend an increasing amount of time using their devices. In 2020, over 60% of the world's population are mobile phone users (Statista 2020), with the average daily time spent using mobile devices being 3 hours and 40 minutes (DataReportal, 2020). This has brought the total time people spend using information technology to over 10 hours a day (Nielsen 2021). A majority of adults sleep next to their mobile phone for use before sleeping and after waking (Deloitte 2017). During the day, users tend to keep their phone with them constantly, or for all but 1 or 2 hours (IDC 2013). On average, users check their phone 52 times per day (Deloitte, 2018).

The growing dominance of the devices in people's attention is a source of increased concern. Users admit 'phone faux pas' such as texting during meal time (by 37% of users), checking the phone mid-conversation (32%), taking a phone call on public transportation (27%), and multitasking on phone during meetings (24%; Bank of America 2015). In developed countries, 48% state they overuse their phones (Deloitte 2019) with a majority of users trying to limit their phone usage (Deloitte 2018). Various institutions recommend limits on children's screen time, out of concern of unwanted impact on sleep, academic performance, social face-to-face time, physical activity, body weight, mood issues, self-image, and fear of missing out (Domingues-Montanari, 2017). Similarly, in adults, there are fears that the ability to concentrate deteriorates with frequent switching. Heavy technology use can lead to stress (Ayyagari et al. 2011), less psychological flow, work-family conflict, and technology-related addictions, making it difficult to overcome or reduce this negative impact (Turel et al. 2011).

Another complicating factor is that technology use has become deeply integrated into occupational and social functioning. Applications and devices can be used in a goal-oriented, purposeful manner but also in a habitual, impulsive manner that conflicts with current goals or purpose. This is even more pronounced after COVID-19 has led to more remote learning and working through screens as opposed to face-to-face. Hence, reducing screentime is not only difficult to achieve, as a recommendation, it is too generic to be effective.

These concerns call for a better understanding of digital distraction, or more precisely, the use of technology when this use is in conflict with a current goal held by an individual. We call this **Conflicted Technology Use** as it pertains not just to the process of diverting attention (i.e. distraction), but the outcome of it. This paper aims to explore when this occurs, where, how much, by whom, what activities are involved, and what triggers it, thus exploring the mechanics of this behaviour but also its cultural, personality, and behavioural context. We believe that this exploration should lay the groundwork for developing more specific and effective recommendations for individuals, organisations, and institutions alike to allow us take advantage of technology while reducing a negative impact.

In this paper we will first reflect on studies in the broader area of digital distraction, and develop the conceptual foundation of Conflicted Technology Use based on psychological theories. We then define Conflicted Technology Use, both conceptually and operationally. We then present four studies in two countries, which will help illuminate its basic phenomenological dimensions. The conceptual development combined with our preliminary findings from our studies, should aid in future studies of Conflicted Technology Use using various behavioral theories, and help develop more specific and effective recommendations to combat the deleterious impact of Conflicted Technology Use.

# 2 Background

While many studies have been conducted on constructs *related* to digital distraction, like multitasking, interruptions, ADHD, cyberloafing, and addiction, digital distraction itself has received scant attention. It has been studied mostly in educational contexts, using various conceptual models. Chen et al. (2020) linked it to internet addiction, automatic and habitual technology use, and attentional impulsiveness. Chen et al. (2014) linked it to cultural differences, and classroom management issues, and the characteristics of instructors and subjects. Nath et al. (2017) included learning style preferences as an underlying factor. McCoy (2016) examined the motivations to engage in distractive activities, such as wanting to stay connected, fight boredom, or be entertained.

While digital distraction is often measured in terms of overall frequency, sometimes duration of distractions are incorporated (McCoy 2016), or frequency per distractive activity (Chen et al. 2020). Instruments are typically tailored to the educational context, by e.g. referring to behavior exhibited in a classroom.

While these few studies have begun to uncover the plausible mechanisms and prevalence of digital distraction, it remains difficult to synthesize these findings, given the diversity in measurement and conceptualizations, and generalize them, given their focus on educational contexts. None of the studies

have developed a conceptualization of the phenomenon of digital distraction through a review of relevant theory.

In the broader area of digital distraction including attentional switches, and unintentional or even pathological use of technology many more studies have been conducted that all can help build a more common understanding of digital distraction. These studies have focused on particular constructs, namely cyberloafing, multitasking, procrastination, and addiction, each with their particular perspective and emphases, yet they share important theoretical linkages that can be leveraged to develop a construct to examine the phenomenon. Table 1 describes the related constructs, their associated theories, and how they are different in scope to distractions.

Table 1. Constructs related to digital distraction

| Related construct | Related theories | Scope difference with distraction |
|---|---|---|
| **Cyberloafing** (sometimes cyberslacking) refers to "the act of employees using their companies' internet access for personal purposes during work hours." (Lim 2002, p675). Many studies, however, do not focus on the internet per se, or how it was provided, but on computer activities (Akbulut et al. 2016). Some have extended the concept to the student context (Baturay and Toker 2015; Gökçearslan et al. 2018), where it has been defined as "the use of internet-enabled technologies by students in class for non-class related activities" (Rana et al. 2019). | Self-regulation and ego-depletion (Prasad et al. 2010; Wagner et al. 2012)<br><br>Theory of planned behavior (Askew et al. 2014)<br><br>Theories of Interpersonal Behavior and Organizational Justice (Betts et al. 2014)<br><br>Equity Theory (Cheng et al. 2020)<br><br>Dual Process/System theory (Chen et al. 2022; Zhang et al. 2019). | Unlike being distracted, cyberloafing can be planned and deliberate. For example, someone may do online groceries at work, saving time in the evening to do some work at home. By most definitions this does not constitute a distraction, as behavior does not divert from a goal at the time. In fact, many employers have come to accept occasional, and minor technology use for personal purposes during work hours, and some see it as fair in response to the reverse, i.e. tech use for work outside of work hours (Blanchard and Henle 2008). Employees may leverage arising opportunities throughout the day as an effective and efficient use of their time, blurring the boundary between work and family without a sense of injustice (Lim and Chen 2012; Lim and Teo 2005; Lim 2002; Schalow et al. 2013). |
| **Multitasking** refers to the simultaneous or quasi-simultaneous execution of two or more tasks by one individual. While most lab-based multitasking studies focus on simultaneous cognitive processing, everyday multitasking tend to also contain elements of task switching and automaticity (Carrier et al. 2015). | Threaded cognition (Salvucci and Taatgen 2008), Psychological Flow and Self-regulation (Adler and Benbunan-Fich 2013), Habit (Lisman and Sternberg 2013), Dual process theory (Khan et al. 2020). | The concept of multitasking does not discriminate between the priority or relevance of the various tasks, whereas with distraction, there is a focus on a lower priority task without spending cognitive resources on the task of priority. |
| **Addiction**, in the context of technology, refers to a pathological disorder that is involves the symptoms of improved moods when engaging in the addictive behavior (mood modification), the increased need for engaging in this behavior (tolerance), the dominance of the behavior in one's life (salience), jeopardized responsibilities (conflict), withdrawal symptoms when cutting it back (withdrawal), and failed attempts at cutting it back (relapse). | Reward pathway (Han et al. 2007)<br><br>Self-control or self-regulation (Kim et al. 2008; LaRose et al. 2003)<br><br>Dual process theory (Zhou et al. 2022). | Addiction studies tap into a more complex set of phenomena (symptoms) than simply the degree an individual exhibits a certain behavior. While these symptoms may correlate with distraction, everyday distractions can arise from alternative processes without a person exhibiting these symptoms. |
| **Procrastination** refers to the voluntary delay of an intended course of action despite expecting to be worse off for the delay (Steel 2007). | Self-regulation and Temporal Motivation Theory (Steel 2007), Habit (Schnauber-Stockmann et al. 2018) | With distractions, there need not be a delay. For example, one may be distracted during a meal, discussion, lecture, or movie, which may continue in spite of this distraction. |

While all of these related constructs are different from digital distractions in various ways, they all share a strong link to (1) self-control or self-regulation theory, and (2) dual process or dual systems

theory. We thus posit that these theories can form a solid theoretical foundation to conceptualize the phenomenon of digital distraction. Such a conceptualisation should enable a better and more integrated understanding of digital distraction across its dimensions and contexts.

### 2.1 Theoretical Foundation

We define and describe our construct after reviewing self-control and dual process theory. Self-control, often used interchangeably with self-regulation, can be seen as a broad ability to regulate action, thought, and emotion (De Ridder et al. 2012). That is, individuals who behave according to goals have a higher level of self-control than individuals who give in to impulse, in spite of a conflicting goal or preference not to do so (Tangney et al. 2018). Self-control has been studied as a broad, multi-dimensional construct that can be analyzed in various ways (De Ridder et al. 2012). It has been studied in situ, typically in a lab, where states of self-control are examined or manipulated. It has also been studied as a trait, typically through questionnaires that tend to focus on the frequency with which people succumb to various types of temptation. These studies have shown that while some variance in self-control failure can be attributed to domain-specific variables, there are important aspects of the underlying mechanisms that is shared across domains.

Whether an impulse is controlled or overridden can be seen as the outcome of an interplay between impulsive and reflective processes (Hofmann et al. 2009).This view is based on a broader dual-system model named the reflective-impulsive model (RIM; Strack and Deutsch 2004). One may have automatic activation of the impulsive system through stimuli that have been associated with certain responses; to override these impulses, the reflective system requires intervening in this process, but this tends to happen only under certain conditions (Vohs 2006).
Both self-control theory and dual process theory have been examined by thousands of studies (e.g. Hagger et al. 2010, De Ridder 2012); the insights they have uncovered should thus constitute a valuable resource for understanding domain-specific types of self-control failure, such as digital distraction.

## 3 Construct Development

We posit that digital distractions can be understood based on self-control and dual process theories. First, a distraction can be seen as a failure of self-control: a person intends to engage in one activity, but fails to resist impulses to engage in another activity, thus sacrificing attention to the intended activity. Individual differences in the trait self-control should explain variance in the degree to which individuals are digitally distracted, and similarly, in conditions of low state self-control we expect more digital distraction than in conditions of high state self-control.
Second, we posit that the process by which a distraction develops, like other forms of self-control failure, can be understood from a dual process perspective. Here, a distraction occurs when behavioral schemata are activated through the impulsive system, and insufficient resources prohibits the reflective system from pursuing the active goal or intention by preventing the enactment of this impulse (Strack and Deutsch 2004).
Accordingly, we define a digital distraction as an engagement with technology when such engagement is conflicted with a behavioral goal or intention held at that time. For example, a user may have an intention to read a book, listen to a friend, or mind the traffic but they use some technology for something else instead. This might be because the technology activity has attracted the user away from their goals, or because these goals fail to attract the user away from an ongoing, conflicted engagement. For clarity, given that digital distraction has been defined in other ways, we call this particular scope of behaviour Conflicted Technology Use (CTU).
More specifically, within this definition, technology use is conflicted when, according to the user, their use is in conflict with what they should be doing at the time. What others think of this situation, or how badly technology use objectively interferes with a behavioural goal may be factors of such perceived conflict but they are themselves irrelevant in the definition of CTU. This self-perceived CTU is consistent with studies on state self-control and theories of dual process theory. As such, it can be more readily linked to psychological and behavioral phenomena, including temptation, cognitive dissonance, trait self-control, feelings of guilt, and efforts to prevent or reduce conflicted behavior. This will allow for better opportunity to explain the phenomenon and test means to reduce it.
When the use of a technology is subjectively conflicted, it implies there must be *awareness of this conflict*. This can arise before, during, or after the episode of conflicted use. Enacting an impulse to use a technology can become so automatic and habitual that conscious awareness of the impulse, let alone its conflicted nature, is not necessary to trigger them (Limayem et al. 2007). When it arises during an impulse to use the device – i.e. it is a temptation (Hofmann et al. 2010) – it can trigger efforts to

override this impulse that need not be successful in preventing its enactment. Similarly, awareness during an episode of conflicted use can trigger efforts to stop it or redirect attention and behavior to other activities, with regulatory dynamics studied in the state self-control literature (Hofmann et al. 2012a; Hofmann et al. 2007). When no awareness of conflict arises until after the activity, one may still develop self-evaluative emotions such as guilt and remorse, and strengthen the goals that were conflicted, though arguably with limited effect (Hofmann et al. 2012b).
Hence, this conceptualization of digital distraction should allow researchers to study the phenomenon from both a trait and a state perspective. In our empirical studies of CTU, we focus on CTU as a trait, by analyzing the frequency with which technology is used in a conflicted way, consistent with how general self-control failures are measured. We can analyze this frequency along various dimensions of CTU: the conflicted goals, the distracting activities, the trigger of CTU, its location, and the time of day. This analysis should prove useful in describing the phenomenon, without being tied to particular aspects or contexts, such as the education context.

# 4 Method

We conducted four studies across two countries. We developed an instrument to study the basic dimensions of the CTU: which goals are conflicted, what activities are conflicted, how CTU is triggered, where it takes place and when it takes place.
While all sorts of technology may be used in conflicted ways, in our studies, we particularly focused on how smartphones were used in conflicted ways. Since these mobile and portable devices can be used nearly everywhere, anytime, and for a host of different activities, they carry the greatest potential for conflicted use. In fact, the smartphone use has surged on a global scale since its introduction in the late 2000s. By 2019, the total number of smartphone users reaches 3.2 billion globally (Statista, 2020), and 91% of Internet users access Internet via smartphones (Data Reportal, 2020). By focusing on this dominant device, we can drastically ease assessment without posing severe limitations on its scope, and reduce respondents' cognitive efforts in answering the CTU-related questions.

## 4.1 Samples

This study employed a convenience sampling method to recruit 699 participants from a university in Hong Kong and a university in New Zealand. After excluding cases which reported no smartphone use (n = 8), and cases with suspicious responding style (i.e., no variation in responses to several questions, n = 1), responses from 690 participants were valid for subsequent analyses. The sample size was distributed relatively evenly among the four studies. Across the studies, participants were mostly young (82.9% aged from 18 to 25), students (97.5%), and female (65.9%). On average, the student participants were in their third year of study at the university. The proportions of Asian and Oceanian/Australasian participants were nearly identical (47.7 and 47.1%, respectively) in the pooled sample.

## 4.2 Procedures

We employed the survey method in a lab experiment setting to collect the data on CTU. Participants were invited to participate in a lab study by a means of posters hanged around the campuses. Their participation involved answering a variety of questions and executing tasks related to executive functioning and self-control on computer screens. The questions were designed to measure various constructs (as discussed in the Measure and Validation subsection). On average, the lab sessions took around 40 minutes. Upon completion, all participants received a small monetary reward as an incentive to participate in the study.

## 4.3 Measures

Since there has been no scale established to date to measure the CTU, we developed a scale for that purpose. The final instrument encompasses 19 items about the frequency with which individuals exhibit CTU from six angles, so-called the dimensions of the CTU. The first dimension (GOAL) captures the common goals (e.g., reading, writing, listening, and sleeping) with which the smartphone use is conflicted. The second dimension (ACTIVITY) captures the common activities on smartphone (e.g., checking messages/email, having calls, reading news, watching videos, and playing games) that conflict the goals. The third dimension (TRIGGER) describes how the CTU is activated externally (via notifications) and internally (via mind). The fourth (PLACE) and fifth (TIME) dimension depict the common places (e.g., home, work, transit) and time durations (e.g., morning, afternoon, evening, and night) in which the CTU takes place, respectively. The sixth dimension (GENERALITY) encapsulates a

general view of the CTU (for more details, see Table 2). Methodologically, such incorporation of multiple perspectives on measuring the CTU could help to avoid a high sensitivity to sources of error associated with a particular means of measurement (Zwanenburg and Qureshi 2019). Moreover, it could provide an insight into the manifestations of the phenomenon of interest, rather than a constellation of items differed mainly syntactically. All items were measured by using a 7-point scale, from Never to Very often. The scores for each dimension were calculated by averaging the corresponding items.

Table 2: The CTU items.

| **GOAL** | |
|---|---|
| reading | I am using my smartphone when I should be reading instead. |
| writing | I am using my smartphone when I should be writing instead. |
| listening | I am using my smartphone when I should be listening instead. |
| sleeping | I am using my smartphone when I should be sleeping instead. |
| ACTIVITY | |
| message | I am checking or writing messages or email on my smartphone even though I should be doing something else. |
| call | I am having a call on my smartphone even though I should be doing something else. |
| news | I am reading the news (incl. social networks) on my smartphone even though I should be doing something else. |
| videos | I am watching videos on my smartphone even though I should be doing something else. |
| games | I am playing games on my smartphone even though I should be doing something else. |
| TRIGGER | |
| notification | A notification triggers me to use my smartphone even though I should be doing something else. |
| mind | My own mind triggers me to use my smartphone even though I should be doing something else. |
| PLACE | |
| home | At home, I use my smartphone even though I should be doing something else. |
| work | At work/school, I use my smartphone even though I should be doing something else. |
| transit | In transit, I use my smartphone even though I should be doing something else. |
| TIME | |
| morning | In the morning (6-12am) I use my smartphone even though I should be doing something else. |
| afternoon | In the afternoon (12-6pm) I use my smartphone even though I should be doing something else. |
| evening | In the evening (6-12pm) I use my smartphone even though I should be doing something else. |
| night | At night (12-6am) I use my smartphone even though I should be doing something else. |
| GENERALITY | |
| general | In general, I use my smartphone even though I should be doing something else. |

To further elaborate on who experiences the phenomenon, we also collected information on respondents' demographics (e.g., gender, age, and living place/cultural background) and psychographics. Particularly, a brief version of the big five personality inventory (BFI10; Rammstedt et al. 2013) was used to measure the traits of extraversion, agreeableness, conscientiousness, emotion stability, and openness to change of respondents.

## 4.4 Validation

First, many attempts were made to ensure the content validity of the CTU measurement. Particularly, the process of item generation and refinement went through a series of literature review (e.g., impaired self-control literature), a pretest (with 7 participants using reflective interviews), a pilot test (with 151 participants using an online questionnaire), and a field test (with 148 participant using an experiment design), with revisions made after each stage. To minimize the social desirability bias, we also made efforts to assure respondents' anonymity and limit interactions between participants, as well as our interactions with respondents during the lab sessions.

Next, the internal validity was assessed by the tests of reliability and confirmatory factor analysis (CFA). As a result, the CTU measure had a very high internal consistency (Cronbach $\alpha = .925 > .7$), indicating a good reliability. The CFA showed that the measurement model of the CTU achieved an excellent fit ($\chi^2 = 19.9$, $df = 9$, $\chi^2/df = 2.211 < 3$, $RMSEA = .042 < .06$, $CFI = .996 > .95$, $TLI = .994 > .95$, $GFI = .991 > .95$, and $SRMR = .011 < .08$), thus establishing the structural validity (Hu and Bentler 1999). The convergent validity of the CTU measurement was also established, with $AVE = .678 > .5$, and standardized factor loadings of all items > .5 (Hair et al., 2014). Multigroup analysis suggested that the measurement model was not significantly different between the four studies ($\Delta\chi^2$ of constrained and unconstrained model = 13.0, $\Delta df = 15$, $p = .600$), indicating the stability of the measurement model.

Moreover, we assessed the measurement of the CTU dimensions, and the threat of common method bias by using the PLS-SEM. PLS-SEM is a component-based approach for estimation which can easily handle formative and hierarchical measurement models(Hair Jr et al. 2021). Using SmartPLS 3 software, we modelled the CTU as a reflective second-order construct which consisted of the six dimensions as formative first-order constructs. Findings showed that all factors loadings and indicator weights in the measurement model were significant ($p < .001$). To check for common method bias, we followed the common method factor approach suggested by Liang et al. (2007). Results indicated that each item was mainly explained by, and had significant loadings on its corresponding theoretical construct (average variance = 62%), while the common method factor accounted for a very low variance explained of the items (average variance = 3%), and several items had insignificant loadings on the method factor. Therefore, we conclude that the common method bias was not a serious issue in this study.

Lastly, we assessed the external validity of the CTU measurement by examining its correlations with measures of substantive variables that were theoretically expected to associate with the CTU. Table 3 presents these criterion variables and how they were measured. Findings showed that all of the correlations were significant ($p < .001$) and in the expected directions (r FI = -.189; r SC = -.428; r IMP = .453; r ADHD = .420; r Guilt = .561; r No Concentration = .557; r Forgetful Use = .569; r Mindless Use = .645). Thus, the external validity of the CTU measure was satisfactory.

Table 3: The criterion variables.

| **Criterion variable** | **# items** | **Measure** | **Mean** | **SD** | **α** | **n** |
|---|---|---|---|---|---|---|
| Focused immersion (FI) | 5 | … (1 strongly disagree, to 7 strongly agree) | 5.11 | 1.25 | 0.84 | 508 |
| Self-control trait (SC) | 13 | … (1 not at all, to 5 very much) | 3.10 | 0.66 | 0.83 | 346 |
| Impulsivity trait (IMP) | 8 | … (1 rarely/never, to 4 almost always) | 2.10 | 0.47 | 0.79 | 310 |
| Attention deficit/hyperactive disorder (ADHD) | 9 | … (1 never, to 4 very frequently) | 2.07 | 0.50 | 0.81 | 148 |
| Guilt | 1 | How often do feel guilty about the way you use your smartphone? (1 never, to 7 very often) | 4.39 | 1.80 | - | 690 |
| No concentration | 1 | Overall, do you think your smartphone keeps you from concentrating? (1 not at all, to 7 very much) | 4.81 | 1.80 | - | 690 |
| Forgetful use | 1 | How often do you grab your smartphone and you forget what you were going to do? (1 never, to 7 very often) | 4.29 | 1.82 | - | 690 |
| Mindless use | 1 | How often do you grab your smartphone in a mindless way? (1 never, to 7 very often) | 5.11 | 1.70 | - | 682 |

# 5 Results

An examination of the CTU items (based on descriptive analyses, paired samples t tests, and PLS-SEM) revealed some patterns in the manifestations of the CTU phenomenon (see Table 4).

Table 4: Descriptive analysis and relative importance of the CTU items.

| **Item/Dimension** | **Mean[1]** | | **Standard Deviation** | **Beta weight[2]/ loading[3]** | | **Relative importance[4]** |
|---|---|---|---|---|---|---|
| Goal | 4.49 | *** | 1.38 | 0.85 | *** | |
| reading | 4.69 | *** | 1.71 | 0.31 | *** | 24.4% |
| writing | 4.55 | *** | 1.70 | 0.33 | *** | 26.0% |
| listening | 4.13 | ^ | 1.81 | 0.25 | *** | 19.7% |
| sleeping | 4.57 | *** | 1.91 | 0.38 | *** | 29.9% |
| Activity | 3.66 | *** | 1.13 | 0.78 | *** | |
| message | 4.37 | *** | 1.65 | 0.51 | *** | 35.2% |

| | | | | | | |
|---|---|---|---|---|---|---|
| call | 2.81 | *** | 1.48 | 0.11 | *** | 7.6% |
| news | 4.31 | *** | 1.89 | 0.28 | *** | 19.3% |
| videos | 4.21 | ** | 1.88 | 0.38 | *** | 26.2% |
| games | 2.62 | *** | 1.82 | 0.17 | *** | 11.7% |
| Trigger | 5.20 | *** | 1.43 | 0.82 | *** | |
| notification | 5.26 | *** | 1.69 | 0.42 | *** | 36.8% |
| mind | 5.13 | *** | 1.63 | 0.72 | *** | 63.2% |
| Place | 4.81 | *** | 1.42 | 0.88 | *** | |
| home | 5.04 | *** | 1.59 | 0.50 | *** | 42.0% |
| work | 4.77 | *** | 1.71 | 0.48 | *** | 40.3% |
| transit | 4.61 | *** | 1.91 | 0.21 | *** | 17.6% |
| Time | 4.48 | *** | 1.29 | 0.88 | *** | |
| morning | 4.24 | *** | 1.70 | 0.32 | *** | 24.6% |
| afternoon | 4.96 | *** | 1.48 | 0.41 | *** | 31.5% |
| evening | 5.30 | *** | 1.52 | 0.32 | *** | 24.6% |
| night | 3.44 | *** | 2.18 | 0.25 | *** | 19.2% |
| Generality | 4.97 | *** | 1.48 | 0.91 | *** | |
| general | 4.97 | *** | 1.48 | 1.00 | *** | 100% |
| CTU | 4.60 | *** | 1.16 | | | |

Note: *** p < .001, ** p < .01, * p < .05, ^ p = .055; [1] The significance of the means was obtained from one-sample t tests with test value = 4 (the mid-point between Never and Very often); [2] Weights of the items from the PLS-SEM; [3] Loadings of the dimensions from the PLS-SEM; [4] Relative importance = weight/Σ weights within the corresponding dimension

*Which goals were conflicted?* Smartphone use was frequently conflicted with all selected goals (reading, writing, sleeping, and listening), with means above the mid-point between Never and Very often. Listening was the least conflicted goal (since its mean was significantly lower than other Goal items, p < .001), and least important to CTU (i.e., the lowest relative importance percentage).
*Which activities were distracting?* CTU frequently involved checking for messages and email, checking news and social networks, and watching videos, with messages/email being the most important source of CTU. Having a call and playing games were the least conflicting activities (since their means were below the mid-point between Never and Very often, and significantly lower than other Activity items, p < .001), and least important to CTU.
*What triggered CTU?* CTU was triggered by external triggers (i.e., notifications) more frequently than by internal triggers (i.e., mind) (t = 2.110, df = 689, p = 0.035). However, compared to external triggers, the frequency of internal triggers was more important to CTU.
*Where did CTU occur?* CTU was most likely to occur at home (since its mean was significantly higher than other Place items, p < .001), followed by school/work, and then in transit (p < .05). The use of smartphone in transit was less strongly linked to CTU.
*When did CTU occur?* The CTU was most likely to occur in the evening (since its mean was significantly higher than other Time items, p < .001), followed by the afternoon, and then the morning (all p values < .001). After midnight was the day part that involved the least frequent CTU (since its mean was significantly lower than other Time items, p < .001), scoring lower than the midpoint between Never and Very often. It was also slightly less important to the CTU in comparison to other time durations during the day.
*Who experienced CTU?* Bivariate analyses between the CTU score and participants' demographics and psychographics revealed the salient characteristics of conflicted smartphone users (see Table 5). Findings showed that females and younger people were more likely to experience CTU. Compared to New Zealanders (with a Western cultural background), Asians (with an Eastern cultural background) were also more likely to experience CTU. Concerning personality, high conscientiousness, emotion stability, and openness to change trait were negatively associated with CTU. In contrast, extraversion was positively associated with CTU.

Table 5: The CTU and participants' characteristics.

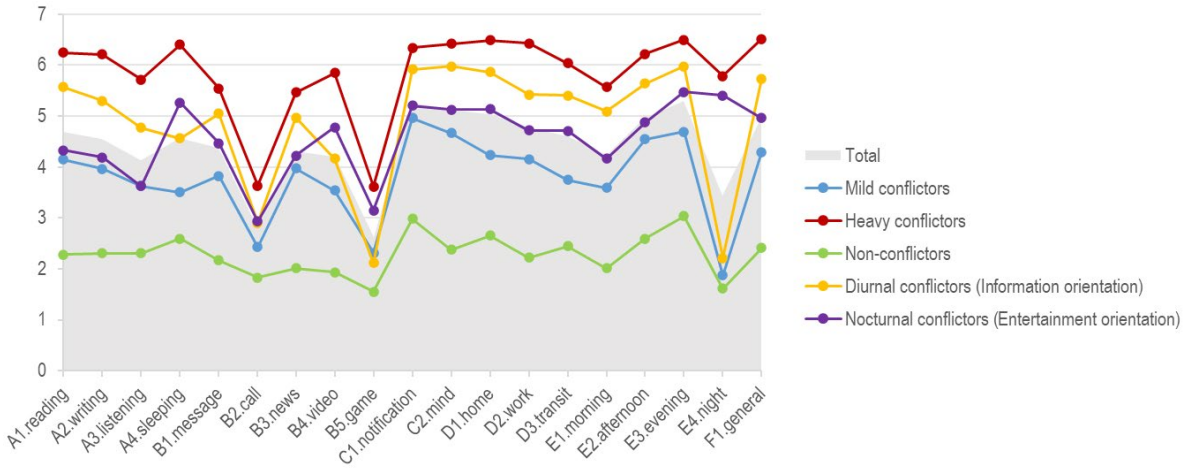
| | | **n** | **Mean** | **SD** | **Statistics** |
|---|---|---|---|---|---|
| Gender[1] | Female | 455 | 4.79 | 1.10 | t (df = 688) = 6.002, p < .001 |
| | Male | 235 | 4.24 | 1.18 | |
| Age[2] | 18-25 | 572 | 4.76 | 1.01 | F (2, 687) = 42.631, p < .001 |
| | 26-34 | 95 | 3.97 | 1.42 | |
| | 35-54 | 23 | 3.13 | 1.51 | |
| Cultural | Asian | 329 | 4.76 | 1.15 | t (df = 652) = 2.646, p = .008 |

| | | | | | |
|---|---|---|---|---|---|
| background[1] | Oceanian | 325 | 4.53 | 1.09 | |
| Personality[3] | Extraversion | 308 | 4.27 | 1.52 | r = .123, p = .030 |
| | Agreeableness | 308 | 4.63 | 1.25 | r = .031, p = .590 |
| | Conscientiousness | 308 | 5.08 | 1.23 | r = -.240, p < .001 |
| | Emotion stability | 308 | 4.56 | 1.42 | r = -.207, p < .001 |
| | Openness to change | 308 | 5.11 | 1.11 | r = -.282, p < .001 |

Notes: [1] means of the CTU score by the gender/culture categories were compared by the independent sample t-test. [2] means of the CTU score by the age categories were compared by the ANOVA. [3] means of the personality traits were related to the CTU score by the correlation coefficient.

To further examine the structure of CTU, cluster analysis was employed to identify different groups of smartphone users in terms of their CTU characteristics. Clustering variables were 19 CTU items. As recommended by Hair et al., (2014), a two-stage clustering procedure was carried out. First, a hierarchical clustering with the Ward's method and squared Euclidean distance measure was used to determine the number of clusters. Examination of dendrogram and change in agglomeration coefficient suggested a solution of five clusters. Findings from this stage also helped to specify initial cluster centroids that served as inputs for the next stage.
Second, a nonhierarchical K-means clustering method was used to refine the cluster solution. Convergence in cluster centroids was achieved after 11 iterations. ANOVAs showed significant differences in clustering variables between the clusters ($F > 26$, $p < 0.001$), indicating a good cluster solution.
Patterns of clustering variables (i.e., the CTU items) in each cluster revealed the nature of the clusters. Based on these patterns, we labeled the five clusters as: 'Heavy conflicting users', 'Diurnal conflicting users', 'Nocturnal conflicting users', 'Mild conflicting users', and 'Non-conflicting users' (see Figure 1). Across all studies, they accounted for 19.9%, 21.0%, 21.3%, 26.5%, and 11.3% of the sample, respectively.

Figure 1: Clusters of conflicted smartphone users




**Profiling the identified clusters**
Apart from the level of the CTU items, the identified clusters were also characterized based on demographics, personality, and functional smartphone usage (see Table X6). The main characteristics of the clusters were described as follows.
**1. Heavy conflicting users:** Have highest score on all CTU items; Use smartphone frequently for various activities; Are more likely to be female; Are more likely to be Asian (Eastern culture); Are more likely to be younger; Have lowest conscientiousness, lowest openness to change, and low emotion stability
**2: Diurnal conflicting users:** Have high scores on all CTU items, except for average score on CTU with sleeping, and CTU for videos and games, and low score on CTU at night; Are more likely to use smartphone for email, text, news and social networks (thus, they seem to be more information oriented); Are more likely to be female; Are more likely to be Oceania/NZ (Western culture); Are more likely to be younger; Have lowest emotion stability, low openness to change, and high extraversion.
**3. Nocturnal conflicting users**: Have average scores on CTU items, except for high scores on CTU with sleeping, CTU for videos and games, and CTU at night. The overall CTU score is higher than Cluster 4; Are more likely to use smartphone for videos and games (thus, they seem to be more

entertainment oriented); Are more likely to be Asian (Eastern culture); Are more likely to be younger; Have high openness to change
**4. Mild conflicting users**: Have average scores on all CTU items, and low score on CTU at night; Are more likely to live in Oceania/NZ (Western culture); Are more likely to be younger; Have high conscientiousness
**5. Non-conflicting users:** Have lowest scores on all CTU items; Use smartphone least frequently for all activities; Are more likely to be male; Are more likely to live in Oceania/NZ (Western culture); Are more likely to be older; Have highest conscientiousness, highest emotion stability, and highest openness to change.

We also checked for relations between the CTU clusters and our criterion variables (i.e., variables not included in the cluster analysis but expected to associate with CTU) (see Validation subsection). Findings from ANOVAs showed that the criterion variables significantly varied across the clusters as expected ($p < 0.001$). Specifically, users with lower CTU (e.g., mild- and non-conflicting users) tended to have higher focused immersion on assigned tasks and higher self-control trait. Meanwhile, they tended to have lower impulsiveness and attention deficit. On the other hand, users with higher CTU (e.g., heavy, diurnal, and nocturnal conflicting users) tended to exhibit higher guilty, distracting, forgetful and mindless smartphone use. Reports on these findings are omitted due to space limits.

# 6 Discussion

Many statistics point to an ever-pervasive reliance on digital technology, and increased frequencies of digital distraction. People fear this will have a variety of deleterious effects, such as on their flow, their concentration, and their well-being. Yet in spite of this concern about digital distraction, we know little about this phenomenon. Few studies have focused on digital distraction itself, and those that do tend to focus on narrow contexts and specific factors. Bigger streams of literature relate to cyberloafing, procrastination, multitasking, and addiction. While they are all somewhat different from the literature on distractions, they suggest that to understand digital distraction, the theories of self-control and dual process should provide a solid theoretical foundation to conceptualize the phenomenon.
In this study, we have applied these theories to being describe the phenomenon of digital distraction through the construct of Conflicted Technology Use. While this construct can be examined in situ, using lab studies, in our studies, we examined it as a trait, i.e. as the frequency with which technology is used in spite of a concurrent behavioral goal or intention. We have developed an instrument to measure and describe this CTU. By using a multi-dimensional design, this instrument is able to pick up variability across basic phenomenological dimensions of the conflicted goals, the distracting activity, the location, the time, and the trigger of Conflicted Technology Use. While our instrument passed the validity tests, one limitation of it is that it exclusively focuses on smartphone use being in conflict with goals of non-smartphone use. While this may be a good proxy of CTU more broadly for most, it may not necessarily be a good proxy for everyone.
From our studies we conclude that Conflicted Technology Use is pervasive, at least in the younger demographic of our study. Our findings further indicate that videos, news (incl. social networks) and messaging are more often conflicted than calls or video games, and that goals to write, read, or to sleep were more often conflicted with technology use than goals to listen. Consistent with the depletion theory of self-control (Baumeister and Vohs 2007), CTU happened more in the evening than in the morning. We further found that age was negatively associated with CTU, and that Asians were more likely to experience CTU compared to New Zealanders, possibly due to cultural effects. In terms of personality, our exploration suggests that being open to change, conscientious, and emotionally stable were all negatively related to CTU. All these findings have arisen out of our exploration; further research can hypothesize and confirm these findings.
Our cluster analysis suggested that the level of CTU and the time of day were primary ways to distinguish groups, rather than particular goals or activities. This suggests that studies on addiction of specific technologies, such as Facebook, video games, etc, may capture only an aspect of broader patterns of problematic use of technology within individuals.
Our studies involved a total of 690 research participants, being mostly young and from two countries. While this provides a rich and robust picture of behavior within these demographics, given the high adoption and use of smartphones in the younger population, the results do not necessarily generalize to the broader population. To do so, future studies' samples will have to diversify the demographics.
We hope that our grounding of digital distraction in psychological theories and our development of a broad instrument to capture the various dimensions of Conflicted Technology Use will allow for more constructive development of our body of our knowledge on this ever-important phenomenon.

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