

## CONSTANT CHECKING IS NOT ADDICTION: A GROUNDED THEORY OF IT-MEDIATED STATE-TRACKING<sup>1</sup>

Jin P. Gerlach

School of Business, Economics & Law, Technische Universität Darmstadt, Hochschulstrasse 1,  
64289 Darmstadt, GERMANY {gerlach@is.tu-darmstadt.de}

Ronald T. Cenfetelli

Sauder School of Business, University of British Columbia, 2053 Main Mall,  
Vancouver, BC V6T 1Z2, CANADA {cenfetelli@sauder.ubc.ca}

*“Constant checking” of digital devices has been a widely observed phenomenon: people check email clients, social networking systems, news websites, and other information technologies (ITs) at the expense of distracted driving, neglected children, and lost productivity. The predominant perspective on such phenomena of excessive IT use is that users are addicted to technology. But actually, we know very little about what exactly constant checking is, what causes it, and under what conditions negative outcomes might ensue. Based on qualitative data collected from 90 individuals, we develop a grounded theory that views constant-checking behaviors as information-seeking habits instead of an addiction in need of medical treatment. We find that these habits satisfy deep-rooted and recurring needs for information, are facilitated by today’s high accessibility of information, and are fueled by an interesting reward pattern. To represent constant-checking behaviors in light of our findings, we posit a new construct: IT-mediated state-tracking, defined as an individual’s habitual use of IT to seek information that closes the gap between their knowledge about a real-world domain’s state and its actual state. We also learn that the intended and unintended consequences of IT-mediated state-tracking are contingent upon situational factors, which suggests that a more balanced perspective on these behaviors is warranted. Our research steers the discussion about excessive IT use in a new direction by offering a new construct and a grounded theory that helps us to better understand the phenomenon of constant checking.*

**Keywords:** IT-mediated state-tracking, information needs, constant checking, representation theory, grounded theory, unintended consequences, technology addiction

*If you pull out your phone to check Twitter while waiting for the light to change, or read e-mails while brushing your teeth, you might be what the American Psychological Association calls a “constant checker” (Shanker 2017)*

### Introduction

A new phenomenon has surfaced across societies: people constantly check digital devices for new information. In

2016, almost nine out of ten Americans reported “constantly or often” checking their digital devices (American Psychological Association 2017), while smartphone users from the United Kingdom admitted to checking their phones once every 12 minutes on average in 2017 (Wakefield 2018). As our study will show, these checking behaviors are not limited to smartphones, but also occur using laptops or tablets, and include not only communication channels such as email

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clients or instant messaging apps, but also any source of information about an area of life relevant to an individual, such as the workplace, news, sports, stock prices, and many more. The popular press paints a negative picture of individuals who constantly check digital devices for new information, relating the behavior to undesirable outcomes such as stress (Condliffe 2017), distracted driving (Chang 2015), neglected children (Shull 2017), or a failure to cope with our anxieties in a healthy manner when there is nothing else to do (Lieberman 2016).

Despite the phenomenon's prevalence and the apparent desire of many to discuss its implications, our current understanding about it is very limited. We lack an adequate construct representing these behaviors, which thwarts structured research on this phenomenon. Most problematic is the predominant practice to categorize phenomena of excessive information technology (IT) use too easily as "technology addiction" (Kardefelt-Winther et al. 2017; Shaffer et al. 2000; Widyanto and Griffiths 2006). Fundamental concerns about the validity of the technology-addiction construct have been raised (Morahan-Martin 2005; Shaffer et al. 2000; Starcevic 2013; Widyanto and Griffiths 2006), which has come into existence through confirmatory approaches, unsuitable for emerging and ill-understood phenomena (Billieux et al. 2015; Kardefelt-Winther et al. 2017). It is deeply concerning that the technology-addiction perspective is still being applied, because labeling someone an addict has far-reaching implications for the individuals involved (e.g., fear of stigmatization, decrease in self-efficacy), the countermeasures taken (treatments of addictions aim at the achievement of long-term abstinence), and future research (NIH 2012; Van Rooij and Prause 2014; Volkow and Li 2005). As we will show in detail below, the existing literature does not offer a construct that adequately represents "constant checking" and does not rely upon an addiction perspective. And this leads to our first research question (RQ):

*RQ1: How can we define individuals' observable behavior of constantly checking digital devices for new information?*

The lack of a construct that represents constant checking prevents qualified statements about why individuals "constantly" perform these behaviors. As we will argue below, related research is limited to the work context (Mazmanian et al. 2013; Sarker et al. 2012), is based on the broad construct of IT use (Boswell and Olson-Buchanan 2007; Derks and Bakker 2014; Maier et al. 2014), or suggests that individuals excessively use IT because they are addicted and crave the thrill and relief (Turel and Serenko 2010; Turel et al. 2011; Vaghefi et al. 2017). To explore what makes users constantly engage in these checking behaviors, we ask:

*RQ2: Why do individuals constantly check digital devices for new information?*

Finally, studies on technology addiction (e.g., Haug et al. 2015; Takao et al. 2009; Turel and Serenko 2010) or unintended consequences of IT use (e.g., Ferguson et al. 2016; Soror et al. 2015) make it difficult to draw any conclusions about the outcome quality of constant checking. In the popular press and everyday life, these behaviors are seen as being largely negative. However, solid evidence for this negativity is missing, since we lack a construct representing these behaviors and thus are unable to rigorously distinguish them from other behaviors. This negativity also ignores the possibility that these are underappreciated purposeful behaviors, whose costs and benefits depend on situational conditions. We therefore ask:

*RQ3: When does constant checking lead to positive or negative outcomes?*

We investigate these three questions in a grounded theory study that explores the poorly understood phenomenon of constant checking. We follow Grover and Lyytinen (2015) who call for phenomenon-driven research that invites new constructs reflecting important and emerging empirical phenomena and that challenges our current beliefs and dominant theories. Based on qualitative data from IT users, we argue that constant checking is not an addiction but rather a purposeful behavior that satisfies humans' recurring need for information, afforded by today's information technologies in an unprecedented manner. We develop a new construct—*IT-mediated state-tracking*—that represents the observable phenomenon of constant checking from a theoretical perspective, but allows us to abandon this ambiguous term, the inappropriate addiction perspective, as well as the overly broad construct of IT use. We define IT-mediated state-tracking as an individual's habitual use of IT to seek information that closes the gap between their knowledge about a real-world domain's state and its actual state. IT-mediated state-tracking captures that, by constantly checking, individuals are using IT to maintain awareness of changes in real-world domains that are relevant to them (e.g., their social network or the political landscape). Based on this new construct, we also conduct a first exploration of its causes and outcomes to develop a theory that broadens our understanding of constant checking.

## Related Research

Below, we present two major areas of research concerned with individuals' frequent technology use that relate to the

phenomenon of constant checking. Afterward, we summarize studies from different research areas, which explicitly mention constant checking.

### **The Technology Addiction Perspective**

The dominant perspective used in countless studies to explain why individuals excessively use IT is that of technology addiction (e.g., D'Arcy et al. 2014; Haug et al. 2015; Takao et al. 2009; Turel and Serenko 2010; Turel et al. 2011; Vaghefi et al. 2017; Weinstein and Lejoyeux 2010; Xu et al. 2012). This perspective suggests that users are mentally diseased and use technology to experience thrill and relief and avoid painful withdrawal effects (Griffiths 2000). Technology addiction is defined as

a psychological state of maladaptive dependency on the use of technology to such a degree that the following typical behavioral addiction symptoms arise: (1) salience—the technology dominates a user's thoughts and behaviors; (2) withdrawal—negative emotions arise if a person cannot use the technology; (3) conflict—the use of the technology conflicts with other tasks, which impairs normal functioning; (4) relapse and reinstatement—a user is unable to voluntarily reduce the use of the technology; (5) tolerance—a person has to use the technology to a greater extent to produce thrill; and (6) mood modification—using the technology offers thrill and relief, and results in mood changes (Turel et al. 2011, p. 1044).

In addition to “technology addiction,” other labels have been used synonymously, such as compulsive or pathological use (Turel et al. 2011; Widyanto and Griffiths 2006).

This perspective on excessive technology use has received strong criticism due to fundamental concerns about the construct validity of technology addiction (Kardefelt-Winther et al. 2017; Morahan-Martin 2005; Shaffer et al. 2000; Starcevic 2013; Widyanto and Griffiths 2006). The mere existence of the construct itself has been severely criticized because its genesis reflects what constitutes a larger trend of classifying too many excessive behaviors too easily as behavioral addictions. Billieux et al. (2015) explain that such new “behavioral addictions” come into existence through an *a priori* classification of a behavior as an addiction which is then somewhat *confirmed* using measures adapted from recognized addictions. This approach has led to the “discovery” of absurd addictive disorders such as addiction to “Argentine tango” (Billieux et al. 2015). Along the same lines, Kardefelt-Winther et al. (2017, p. 1710) (a group of

scholars from different countries and fields with an interest in behavioral addictions) criticize

atheoretical and confirmatory approaches are far more common than research that is exploratory and theory-driven, which is unsuitable and ineffective for an emerging research area ... we risk pathologizing common behaviours due to the lack of a clear theoretical framework.

Many others have argued that the term “addiction” is so commonly and unreflectedly used that it overpathologizes everyday life, while trivializing serious addictions (e.g., Billieux et al. 2015; Morahan-Martin 2005; Shaffer et al. 2000; Starcevic 2013; Turel et al. 2014). The resulting “inventions” of new addictions can be dangerous. For instance, addiction diagnoses teach patients that the behavior is not under their control, reducing their self-efficacy and inhibiting behavioral change (Van Rooij and Prause 2014). Further, treatments of addictions aim at achieving long-term abstinence of addictive stimuli (NIH 2012; Volkow and Li 2005). In the case of technology addictions, this has given rise to unlicensed military-style detox camps that have led to casualties and even deaths (Reuters 2009).

In sum, the idea of technology addiction is far from being uncontested. It should also be noted that both the World Health Organization and the American Psychiatric Association, who officially recognize all mental disorders, have decided against inclusion of technology-related addictions in their official catalogs due to a lack of evidence for such diseases (Grant and Chamberlain 2016).<sup>2</sup>

### **Unintended Consequences of Frequent IT Use**

A less extreme perspective that could offer insights on constant-checking comes from research on unintended consequences of IT use (e.g., Boswell and Olson-Buchanan 2007; Butts et al. 2015; Derks and Bakker 2014; Krasnova et al. 2015; Maier et al. 2014; Soror et al. 2015). This research shows that higher degrees of IT use are associated with an increase in various negative outcomes such as work-home conflicts (Boswell and Olson-Buchanan 2007; Derks and Bakker 2014), social overload (Maier et al. 2014), and other difficulties in life (Soror et al. 2015).

<sup>2</sup>An exception is the inclusion of “Internet Gaming Disorder” in the World Health Organization's 11<sup>th</sup> edition of their *International Classification of Diseases*. Likewise, the American Psychiatric Association has acknowledged this phenomenon as a tentative condition that requires further study. Internet gaming is outside the scope of our research.

While these studies raised awareness of the potential adverse effects of using IT too much, they most commonly conceptualized and measured individuals' behaviors in terms of frequency, extent, or duration of IT use (Barley et al. 2011; Boswell and Olson-Buchanan 2007; Derks and Bakker 2014; Ferguson et al. 2016; Maier et al. 2014; Soror et al. 2015). This leaves the assumption unquestioned that IT use is a useful construct to understand the nature, causes, and outcomes of users' behaviors. In fact, this construct has been criticized for being too broad to account for differences in its nature (Barki et al. 2007; Burton-Jones and Straub 2006; Petter et al. 2008). For example, the "use" of an email client can include various activities (e.g., checking, writing, archiving, searching). It is questionable whether IT use, in its entirety as a construct, is responsible for the various negative outcomes found in prior studies and we do not know whether their findings apply to the phenomenon of constant checking.

Furthermore, these studies have mostly neglected moderators of the relationship between IT use and its negative consequences, although some studies call for future research in this direction (Boswell and Olson-Buchanan 2007; Ferguson et al. 2016; Krasnova et al. 2015; Soror et al. 2015). Hence, this research paints a rather negative picture of individuals' IT use instead of a more balanced perspective that represents both positive and negative aspects. A few studies on individuals' work-life balance have investigated how individual differences (e.g., preferences for integrating or segmenting work and home) affect the link between IT use and work-life conflict (Butts et al. 2015; Derks et al. 2016). Despite their valuable results, these studies are specific to the work-life balance context, are based on the broad construct of IT use, and only focus on individual differences as conditions under which IT use results in work-life conflict.

### **Use of the Term "Constant Checking" in Academic Literature**

Hinting at the phenomenon's significance for research, a few studies have explicitly mentioned (but not focused on) constant checking or similar expressions, such as "repeated" or "continual" checking. These undefined terms have sometimes appeared in manuscripts, mentioned casually by scholars to refer to observed patterns of email-client use (e.g., Barley et al. 2011; Mazmanian et al. 2013; Middleton and Cukier 2006; Sarker et al. 2012). For instance, Sarker et al. (2012, p. 148) observed users who "have the urge to constantly check their emails." Similarly, Mazmanian et al. (2013) reported that their participants continually checked their work emails. Despite the casual use of constant checking and similar terms that are to be taken at face value, no construct has been defined that clearly represents these behaviors and distin-

guishes them from other forms of IT use. Furthermore, these studies are limited to the context of work emails, while anecdotal and media reports suggest that constant-checking behaviors also extend to other ITs such as social media systems, news websites, and other update feeds (American Psychological Association 2017).

Some explanations as to what causes individuals to constantly check work emails can be derived from two of the studies (Barley et al. 2011; Mazmanian et al. 2013). In both studies, the authors made a similar observation that their participants were motivated to constantly check their emails to "stay connected to" or to be "up to date on" what was happening at work (which was further amplified by social norms). With regard to aspects of IT that contributed to these behaviors, Barley et al. (2011) discovered that the asynchrony of email technology allowed the accumulation of emails, which motivated immediate processing in order to avoid falling behind or missing important information. Mazmanian et al. (2013) reported that the materialities of mobile email clients (i.e., portability, ubiquity, unobtrusiveness, convenience, constant connectivity) allowed the participants to work flexibly and feel in control of their work. Although these are valuable insights in the context of work emails, they are based on observations of users who were highly involved in their work and thus do not necessarily explain why individuals constantly check news websites, social networking systems, and other ITs outside of a work context.

Regarding the quality of outcomes of individuals' constant-checking behaviors, two of the studies argued that the benefits of mobile email clients are immediately perceived by the users, while negative outcomes (e.g., distractions, work-life conflict) are unintended consequences that, almost inevitably, develop over time (Mazmanian et al. 2013; Middleton and Cukier 2006). Sarker et al. (2012) provided a more explicit discussion of contextual variations in work-life conflicts that result from mobile email checking. They posited that whether mobile email checking leads to negative outcomes depends on individuals' preferences for integrating the work and home domains. Despite these findings, it remains unclear whether and how the outcome quality of constant checking might depend on other contextual or situational factors and whether this behavior's negative consequences are indeed inescapable.

### **Summary of Related Research**

In sum, we lack an appropriate construct to study the phenomenon of constant checking that has spurred many discussions and seems to be associated with significant outcomes. Thereby, constant checking is ambiguous as a label in itself. It suggests a lack of variation in frequency, which raises the



question whether all constant-checking behaviors occur with equal frequency. The term constant checking when used in media reports also carries with it an inherent negativity without solid evidence that these behaviors are in fact negative in nature. We need a neutral perspective that does not categorize this behavior *a priori* as “negative,” “an addiction,” or too broadly as “IT use” and explains what individuals do when they constantly check, why they do it constantly, and what role the IT-artifact plays. In our grounded theory study reported below, we attempt to address these challenges and answer the research questions raised above.

## Research Method

Given the lack of theoretical insights reported above, we chose a *grounded theory approach* that allowed us to explore the phenomenon of constant checking without force-fitting data to *a priori* hypotheses (Glaser 1978; Glaser and Strauss 1967).

### Data Collection

We collected data at the individual level of analysis from a total of 90 Internet users. In grounded theory studies, it is recommended to use different data collection methods (Glaser and Strauss 1967; Urquhart et al. 2010). Therefore, we relied on two data-collection techniques: (1) in-depth semi-structured interviews ( $n = 46$ ) that should encourage participants to speak freely and openly in a friendly and natural atmosphere; and (2) anonymous online surveys ( $n = 44$ ) that asked open-ended questions and should allow responses that may not be comfortably made in person. After starting out with 21 interviews, we conducted two surveys among 20 participants from Europe and 24 from the United States to see if anonymous respondents would offer different insights. Data obtained through the surveys were consistent with the interview data (i.e., no interview bias). We thus switched back to in-depth interviews, ending after an additional 25.

The majority of participants (46 interviewees, 20 European survey respondents) were acquired through our personal and professional networks (Butts et al. 2015; McGrath 2016). In addition, 24 survey respondents were invited through Amazon’s Mechanical Turk (Goode et al. 2017; Hibbeln et al. 2017). This was to see whether a non-convenience sample would generate different insights, but constant comparisons showed that this was not the case. We invited individuals with different characteristics to increase the scope of our findings and move toward a more general theory (Davison and Martinsons 2016; Urquhart 2016; Urquhart et al. 2010). In particular, we invited and compared individuals of different

ages (range: 19–47; average: 31.4) and gender (52.2% were male), both from Europe as well as the United States. We also invited participants of different occupations (e.g., consultants, bartenders, engineers, students, managers, physicians, homemakers) to compare whether and how the phenomenon differed between them.

Interviews and surveys consisted of an evolving set of open-ended questions. At the outset, we started with a broad interest in individuals’ highly frequent use of smartphones and thus we asked participants to describe such behaviors. Based on their responses, our increasing understanding, and our integration of emerging findings with existing research, new questions were added over time, while others were removed (i.e., theoretical sampling). As constant checking emerged as a major theme, we started to ask questions such as what are examples where you constantly check digital channels for new information, when and where do you do it and how often, and why do you check for this kind of information and why is that important to you. Despite our initial focus on smartphones, we began to inquire about similar behaviors associated with other devices to gain a more general understanding of the material aspects of IT relevant to the phenomenon. As we progressed, we tried to elicit new aspects other than those we already knew of to enrich, confirm, or disconfirm our ideas but eventually ended our data collection when no new insights resulted from additional data and our theory had reached saturation. All interviews were recorded and transcribed.<sup>3</sup> This resulted in over 35 hours of conversations and about 680 single-spaced pages of text (12pt). Data from our surveys amounted to approximately 85 pages of single-spaced text. Example questions from our interviews and surveys are listed in Appendix A.

### Theorizing Techniques and Analytical Process

We used the theorizing techniques offered by the grounded theory method to iteratively develop our emergent theory (Birks et al. 2013; Glaser 1978; Glaser and Strauss 1967). Our goal was to develop a theory for explaining (Gregor 2006) to better understand the phenomenon of constant checking. The grounded theory method requires researchers to manage preconceptions (Birks et al. 2013), which means that existing theories are not used as a lens to interpret the data but to relate the emergent theory to the prior literature. We thus began our study with an open mind, without seeking any preconceived relationships in the data (Urquhart et al.

<sup>3</sup>Most interviews were conducted face to face; 11 interviews were conducted by phone.

2010). We used theories that emerged as being relevant to our observations later in the process to develop our findings and integrate them with this existing body of knowledge (Birks et al. 2013; Urquhart and Fernández 2013).

Data collection and analysis were inextricably linked, which means that we continuously iterated between collection and analysis (Birks et al. 2013; Glaser 1978). Central to this process is *theoretical sampling*, which means that intermediate results of data analysis guided us in terms of what additional data were needed and where to sample from next (Glaser 1978; Urquhart et al. 2010). As a result, we collected new data to answer questions that arose throughout the theory building process until no new insights emerged (i.e., theoretical saturation). Note that theoretical sampling does not aim at identifying representative populations (Birks et al. 2013).

Our theorizing was based on many iterations of coding (Birks et al. 2013). We coded all data based on the techniques offered by Glaser (1978), using the software Atlas.ti. At the beginning, we used *open coding* by analyzing our material line-by-line, providing descriptive and often preliminary conceptual labels to meaningful units of text at the phrase or word level (Glaser 1978). This allowed us to gain a deep understanding of our data and to discover common themes. As our understanding grew and interesting themes started to emerge, we engaged in *selective coding* to focus our coding on those interesting aspects. IT-mediated state-tracking emerged as an interesting construct and earned its way to the center stage of our study. We focused our coding on this construct as well as those categories associated with it in significant ways (Glaser 1978). Selective coding was followed by *theoretical coding*. We theorized about relationships between the emergent categories and validated these relationships against our data (Glaser 1978).

We *constantly compared* different slices of data that we gathered (Birks et al. 2013; Glaser 1978). For instance, we compared data from different individuals using different ITs in different situations that led to different outcomes. We also compared our findings with prior literature that emerged as relevant to further develop these findings and integrate them with this literature (Urquhart and Fernández 2013). These comparisons helped us to identify similarities and differences in our data, and thus to categorize our data and achieve abstraction. We also engaged in *memo-writing*—a sense-making technique, which helps to reflect on ideas and understand the data (Birks et al. 2013; Glaser and Strauss 1967; Urquhart et al. 2010).

In sum, our analytical process eventually resulted in the final categories presented in Table 1. In the following section, we

present our theory based on the themes in the right column of this table.

## A Grounded Theory of IT-Mediated State-Tracking

In what follows, we first develop and define the construct of IT-mediated state-tracking. We then report what emerged as root causes of these behaviors. Afterward, we focus on situations in which these behaviors are performed, elaborating on factors (1) responsible for checking in a given situation and (2) determining positive and negative outcomes of a checking performance. Note that grounded theory research includes an *ongoing integrative phase*, in which the researcher consults prior literature to develop emerging ideas and integrate them with related existing theory (Urquhart and Fernández 2013). Thus, the literature cited below did not serve as *a priori* theory but was treated as data to enrich our study (Urquhart and Fernández 2013).

### IT-Mediated State-Tracking

We now report how we compared different observations of constant-checking behaviors to abstract similarities and how we integrated our findings with theory on information systems (IS) and information behavior. We then describe our observation of the habitual nature of constant checking and define the construct of IT-mediated state-tracking to represent these behaviors.

### Using IT as a Mediator to Track the State of the Real World

A pattern emerged while constantly comparing participants' reports of their constant-checking behaviors. We realized that, by constantly checking digital devices, users tried to learn about the latest changes in different, not directly observable parts of the world—mediated by ITs that provided information about these changes. As in previous studies (Barley et al. 2011; Mazmanian et al. 2013), this included checking emails to learn about news and decisions at work. But email clients were not the only ITs they checked; participants usually checked several different ITs to learn about changes in the different aspects of the world that each technology represented. The following quote illustrates the multitude of ITs checked by a user to learn about updates in different areas of his life, such as his work as an IT-administrator. Asked about the kind of information he was interested in when constantly checking, he responded:

Table 1. Data Structure Diagram		
First-Order Codes	Second-Order Categories	Themes
<ul style="list-style-type: none"> <li>• Checking for updates in different areas of life</li> <li>• Trying to learn about the latest changes in the world</li> <li>• Continually checking the same channels for news</li> </ul>	State-tracking	IT-mediated state-tracking
<ul style="list-style-type: none"> <li>• Using different devices for the same channel</li> <li>• IT informs about changes happening in the world</li> </ul>	IT as a mediator between world and individual	
<ul style="list-style-type: none"> <li>• Checking having become a habit</li> <li>• Automatic or unconscious execution of checking behavior</li> </ul>	Habitual nature of checking	
<ul style="list-style-type: none"> <li>• Feeling the necessity to stay current in a certain domain</li> <li>• Desire to know about things immediately</li> <li>• Fearing missing out on something</li> <li>• Being curious about what happened in certain areas of the world</li> </ul>	Need to stay up to date	Causes of IT-mediated state-tracking
<ul style="list-style-type: none"> <li>• Doing well at one's job</li> <li>• Maintaining one's identity</li> <li>• Living an educated and self-determined life</li> <li>• Maintaining social relationships</li> <li>• Being perceived as a competent person</li> <li>• Managing everyday life</li> </ul>	Enduring goals*	
<ul style="list-style-type: none"> <li>• Having a connected device within immediate reach</li> <li>• Having immediate access to information</li> <li>• Speed and effortlessness of access to information</li> </ul>	Accessibility of representations	
<ul style="list-style-type: none"> <li>• Inability to predict when relevant information will be available</li> <li>• Possibility of exciting or important news</li> </ul>	Unpredictability of reward timing	
<ul style="list-style-type: none"> <li>• Routine situations (e.g., after waking up, climbing stairs)</li> <li>• Feelings of boredom</li> <li>• Facing unpleasant tasks (e.g., at work, household)</li> <li>• Having to wait somewhere or time to kill</li> <li>• Notifications by a device (e.g., vibration, visual signals)</li> <li>• Device use/presence of a device</li> <li>• Taking a break from actual task</li> <li>• Seeing others use their devices</li> </ul>	Situational triggers/cues*	
<ul style="list-style-type: none"> <li>• (Not) being able to prevent checking behavior</li> <li>• Resisting the temptation to check</li> </ul>	Self-control	Situations of habit execution
<ul style="list-style-type: none"> <li>• Being up to date on things/people that matter</li> <li>• Being able to act on information obtained</li> </ul>	Service to enduring goals (intended)	
<ul style="list-style-type: none"> <li>• Receiving valuable information through checking</li> <li>• Checking leads to no/little relevant information</li> </ul>	Value of information	
<ul style="list-style-type: none"> <li>• Neglecting or being distracted from other people/tasks</li> <li>• Not being mindful and present</li> <li>• Others perceive the individual's checking as problematic</li> </ul>	Problem of attention (unintended)	
<ul style="list-style-type: none"> <li>• Other individuals demanding attention (e.g., spouse, children)</li> <li>• Tasks that require attention (e.g., work, household, driving)</li> <li>• Demands related to self (e.g., being mindful, taking time to reflect)</li> </ul>	Demands on attention	
		(Un)intended consequences of IT-mediated state-tracking

\*The first-order codes of this second-order category are selected examples; additional first-order codes not listed here for space reasons are similar in character to the ones displayed.

*For instant messages it's like: "what's new with friends, acquaintances, my wife, kids, etc."—all personal contacts. And for news websites, it's "what is happening in the world throughout the day?" Just to be up to date in that area, interested in these news. And with respect to the work-related things—let's take this one website, they have a really good news-feed that I'm interested in. They have [IT] security-related news that are relevant for my work, where I have to react really fast. But they also have IT-related topics that I find interesting for me, personally .... You check this channel several times a day, because they update it frequently throughout the day (#76, 39m).<sup>4</sup>*

Thus, what looked to an outside observer in a rather undifferentiated way as constant checking could actually involve the use of multiple ITs, which represented different parts of the world that were of interest to an individual.

Interestingly, participants reported using not solely mobile devices to learn about updates in different areas of life. While smartphones were highly prevalent in our data, many participants accessed the same kinds of information (e.g., social media, news, emails) through different devices. For instance, they reportedly used computers or laptops when sitting at their desk or tablet computers when sitting on the couch. It simply required a digital device that offered access to individuals' preferred information sources that was immediately at hand.

We stepped back to theorize on this observation and realized that it was highly consistent with *representation theory's* view on the purpose of IS (Burton-Jones and Grange 2013; Wand and Weber 1995; Weber 1997). According to this theory, the core purpose of an IS is to provide its users with views of the state (i.e., the current values for all properties of a thing) of a real-world domain (Wand and Weber 1995).<sup>5</sup> For instance, an inventory system offers its users a view of the current state of a company's real-world inventory. Likewise, a social networking system represents the current state of a user's contacts' thoughts and activities. These representations of the state of a real-world domain are valuable to users because learning about the current state of a real-world domain via an IS is usually more efficient than direct observation (Burton-Jones et al. 2017). Representation theory further states that good IS should faithfully *track changes* in the state of the do-

<sup>4</sup>Identification numbers (#1–#90) are used for each participant, in addition to each participant's age and gender ("m" for male, "f" for female).

<sup>5</sup>The state of a real-world domain should not be confused with the concept of "system state" (Matook and Brown 2017), which refers to the extent to which an IT artifact remembers its state.

main they represent (Burton-Jones et al. 2017). For example, an email client tracks changes in the work domain such as project updates, announcements, and decisions by other people. Overall, representation theory supported that constantly-checking individuals actually *tracked changes in the states of real-world domains* in which they were interested.

To further theorize these behaviors, we integrate the view of representation theory with research on information seeking from library and information science (LIS): users who track changes in the world can be seen as seeking information about these changes. As has been long established in the LIS discipline, *information seeking* is defined as a behavior aimed at closing gaps in an individual's knowledge (Case 2012; Kuhlthau 1991; Spink and Cole 2006). The knowledge gaps associated with constant checking concern the current state of real-world domains that are relevant to an individual and they arise constantly (due to an ever-changing world).

### The Habitual Nature of Constant Checking

We soon observed with striking consistency that most constant-checking behaviors had become *habits*. Habits are "learned dispositions to repeat past responses" (Wood and Neal 2007, p. 843). In order for a habit to form, an individual must frequently repeat the behavior in question and thereby consistently experience that the behavior serves as an effective means to reach a certain goal (Verplanken 2006; Wood et al. 2002). Through repeated performance in a similar context and the rewarding nature of goal achievement, cognitive associations between contextual cues (i.e., triggers) and the behavior are reinforced and the behavior becomes an automatic response to the trigger (Wood and Neal 2007; Wood and Runger 2016).<sup>6</sup> We realized that constant checking presents a behavior that, by its nature, is prone to becoming "hardwired" (i.e., habitual): given the ever-changing nature of the real world that individuals are trying to follow, they must check over and over to stay up to date. The next quote is just one example which illustrates this behavior's repetitive and habitual nature:

*I always have the same sequence. I check it [smart-phone] in the morning, then in between when I'm getting ready. On my way to work, I check if something came in in the meanwhile. Then during work and after work, when I'm driving home. In the evening, while eating or watching TV, it's always lying right beside me. I habitually check for any news (#4, 22m).*

<sup>6</sup>Note that these triggers can be both internal (e.g., hunger, fatigue) and external (e.g., time, place) to an individual (Verplanken and Wood 2006).



Another user who frequently checked her emails, news websites, and channels that were related to her hobbies and her social network, reflected on how most of her checking behaviors were rather automatic responses—indicating the habitual nature of her behavior:

*I think that 80% of it is unconscious and totally automatic. Well, if you're waiting for an email, of course, you might look deliberately for that. Or if you, I don't know, hear that something happened somewhere in the world and want to know more about it and then look deliberately. But otherwise, I think you rather do it unconsciously, automatically (#80, 26f).*

As the previous quote shows, not every single act of checking can be labeled habitual, as such a behavior can be deliberate as well. But the overwhelming majority of checking behaviors were reported as being habitual. As occasional purposeful checks did not seem to contribute significantly to the overall phenomenon of constant checking, we focused our theorizing efforts on those checking behaviors that had become habits.

### Defining the Construct of IT-Mediated State-Tracking

Based on the findings presented above, we can now define a construct to better represent constant-checking behaviors from a theoretical perspective. Given our observation that users are trying to *track the states* of real-world domains to update their knowledge about the state of these domains, we label this construct *IT-mediated state-tracking*. We define IT-mediated state-tracking as an individual's habitual use of IT to seek information that closes the gap between their knowledge about a real-world domain's state and its actual state. IT-mediated state-tracking varies based upon the frequency with which a user performs this behavior with respect to a given IT. From here on, we will often refer to IT-mediated state-tracking simply as *state-tracking*.

Our new construct enables us to refer to constant-checking behaviors but allows variation in frequency and does not imply that more frequent state-tracking behaviors are necessarily negative. Furthermore, the construct of IT-mediated state-tracking also describes an individual's behavior toward a single IT—in contrast to the undefined term constant checking (which might or might not involve the use of multiple ITs). This allows researchers to isolate a state-tracking behavior with respect to one IT from the same individual's state-tracking behavior towards another IT. For instance, a user's frequency of tracking the state of work emails might differ from the same user's frequency of tracking the state of

a social media system. What an outside observer might label constant checking can now be understood as an aggregation of state-tracking behaviors towards multiple different ITs.

State-tracking is related to but different from existing constructs. It represents a form of IT use but should not be equated with other forms of IT use that do not fall within the construct's boundaries (e.g., writing an email, watching movies). State-tracking is also a form of information seeking (Case 2012; Kuhlthau 1991; Spink and Cole 2006) but cannot be equated with it because other information-seeking behaviors exist which are associated with other knowledge gaps that individuals want to close (e.g., learning a language, searching a paper in a database). Furthermore, our definition aligns well with previous reports of constant checking (Mazmanian et al. 2013; Sarker et al. 2012) but transcends the context of work emails.

### Causes of IT-Mediated State-Tracking

Four factors emerged as causes of IT-mediated state-tracking: users' need to stay up to date, their enduring goals, the accessibility of representations, and the unpredictability of reward timing.

#### Recurring Information Needs: Users' Need to Stay Up to Date

According to our data, one of the core causes of state-tracking behaviors seemed to be a *need to stay up to date* on a given real-world domain. Not every user tracked the state of every possible real-world domain but each participant identified some real-world domains whose current state they needed to stay up to date on and thus engaged in state-tracking.

To illustrate this need to stay up to date, let us provide a comparison of two exemplary state-tracking behaviors from our data. They involve different ITs, representing different real-world domains, but share the users' need to stay up to date on the state of the respective domain. The first example involves a student who reported to frequently use a mobile app provided by her university to see whether the university had published her grades. She described this need to stay up to date as follows:

**Interviewer:** *Why do you constantly check [this app] and not just once a day?*

**Participant:** *Because there are changes during the day and if I, for instance, check at 9 a.m. and they publish [grades] at 9.03 and I would not check until the next day at 9, there's a whole day where I could*

*have known it [my grades]. I mean, rationally, it doesn't make a difference, but you want to know as fast as you can .... you just want to be up to date and know immediately (#82, 23f).*

The second case reports a participant's need to stay up to date on everything pertaining to his work and his state-tracking of work-related ITs (email clients, chat systems, enterprise social media systems):

*That [up-to-date information] is essential because otherwise you will miss things and then you'll do your job the wrong way or in an inefficient way .... Also project statuses: in my job as a controller, I have to do a lot with controlling, understanding interdependencies, one project's impact on another project, which project gets done twice, where do projects overlap, causing additional costs, inefficiencies, no coordination. Because of that, a lot depends on me doing my job well. If I don't get certain information or don't read about certain things, many things go wrong (#78, 36m).*

Our observations of this need to stay up to date and not miss anything important resemble what Mazmanian et al. (2013) and Barley et al. (2011) reported in the context of work emails. But, as our data suggest, individuals want to stay up to date not only in the work context but also with regard to other nonwork domains relevant to them.

Theorizing this need to stay up to date, we return to our above definition of IT-mediated state-tracking as a form of information seeking. The LIS literature has established that humans' information-seeking behaviors are the result of information needs (Case 2012; Kuhlthau 1991; Spink and Cole 2006). An *information need* is defined as "a recognition that your knowledge is inadequate to satisfy a goal that you have" (Case 2012, p. 5). Thus, participants' need to stay up to date can be seen as recurring information needs that occur due to a constant lack of knowledge about the ever-changing state of a real-world domain, which motivates users to seek information to fill their knowledge gaps. Based on the preceding discussion, we propose:

**Proposition 1:** *An individual's need to stay up to date motivates them to engage in state-tracking.*

### The Source of Information Needs: Enduring Goals

As defined above, information needs serve certain goals that individuals have. Our data showed that these goals could be manifold, but they had one thing in common: they were rather

stable and not accomplished through a single act of state-tracking at a certain point in time.<sup>7</sup> Examples of goals that participants mentioned in our study were being good at one's job, pursuing a career, maintaining social relationships, and maintaining one's identity through hobbies. These goals resembled what psychology research has referred to as *personal strivings*—individuals' *enduring goals* that they try to achieve through their everyday behavior and which are not terminated by single accomplishments (Emmons 1986, 1989, 1991). In general, each person possesses a unique configuration of strivings, pursuing a variety of enduring goals (Emmons 1991). For instance, some individuals may strive for "being physically attractive" and "living an eventful life," while it might be more important for others to "make a secure existence" or "live a harmonious family life" (Emmons 1986; Kökönyei et al. 2008).

The enduring goals mentioned by the participants led to a need to stay up to date with regard to the state of different real-world domains and a lack of information about the state of these domains would entail consequences for the individuals' goal-pursuit. For instance, an attorney who had a need to stay up to date with respect to work emails reflected on her enduring goal of trying to avoid being perceived as incompetent by others:

*So somehow, it has to do with competency. If there's someone at work who never checks emails and isn't up to date, these people sometimes start talking about things in meetings that are obvious. So in the work context, you have it quite often that people evidently don't do it [check emails] .... there are things that you could avoid if you're up to date (#72, 32f).*

Others expressed an enduring goal of living a well-educated life in today's society, which resulted in a need to stay up to date about politics or other societal topics. This drove frequent state-tracking with regard to certain news streams:

**Participant:** *News speaks for itself, to be up to date what's happening in the world.*

**Interviewer:** *Why is that important to you?*

**Participant:** *I think that's 100% essential for living an educated life, to know what's happening somewhere else in the world. To know about important things that happen, what's been decided, to think about it how that might affect me as well. Or maybe*

<sup>7</sup>Other goals can be accomplished at a certain point in time such as "running a marathon once in my life."

*I think it's bad what happens, maybe I like what happens. To think about that and reflect, talk about it with colleagues and be informed (#80, 26f).*

Another example was the enduring goal of trying to maintain social relationships with important others. This created a need to stay up to date regarding individuals' social networks, as the following user stated, who frequently used an instant messenger to track the state of her friends:

*I don't see many of these old friends anymore .... I think I wouldn't be in contact with many of them anymore, if it wasn't for WhatsApp .... It's neat to know what's going on (#83, 34f).*

In sum, we observed enduring goals as the underlying reason for participants' need to stay up to date because current information about the state of associated real-world domains helped individuals to satisfy their goals and avoid the consequences of not doing so (e.g., not doing well at work, not being seen as competent). This results in the following proposition:

**Proposition 2:** *Enduring goals lead to a need to stay up to date (which then motivates an individual to engage in state-tracking).*

### The Accessibility of Representations

An IT-related cause of users' state-tracking behaviors was the *accessibility of representations*. Our participants emphasized that today's ITs make information about real-world changes (i.e., representations) so accessible, that they can effortlessly engage in state-tracking anytime and anywhere. This accessibility is afforded by the ubiquity of physical devices that are connected to the Internet and thus offer an interface to the domains of interest. One participant commented on the possibilities that modern IT offered:

*It's possible from a technology perspective. Today, there's mobile Internet everywhere and it's sufficiently fast. So the technology is there, you can always be connected and access information (#13, 27m).*

Accessibility of representations was increased by a user-friendly interface (e.g., allowing bookmarks, shortcuts, and quick navigation in general) and high processing and/or network speeds. Several participants noted how the evolution of ITs has made access to information they desired faster and more effortless, further promoting their state-tracking behaviors. One of them reflected on how modern IT affects his state-tracking of emails, social media, and sports news:

*Well, it's relatively simple. If there wasn't mobile technology like smartphones and mobile data and Internet, I would certainly do it [state-tracking] a lot less .... the smartphone has certainly increased the frequency of checking or the retrieval of information. And the performance of computers—I mean, 10 or 15 years ago, if I had to boot up my 386-PC for four minutes to get such information, I would certainly not have done that (#77, 31m).*

Another user told us how the use of mobile apps saves him the trouble of typing in passwords, which increased his state-tracking frequency:

*I have installed these apps on my phone. You could access Facebook through your mobile phone's browser as well, but that's definitely too much [effort]. Then I would check Facebook maybe once a day. But now, I'm checking Facebook much more often, maybe 10 times a day, or even more .... With these apps, you don't have to type in your passwords for Facebook, Instagram, my emails .... That would prevent me from doing it [state-tracking] because that would increase the time until you can access considerably (#81, 29m).*

These observations are consistent with the perspective of representation theory (Burton-Jones and Grange 2013; Wand and Weber 1995; Weber 1997). According to this theory, an IS consists of three structures: its deep structure (i.e., the specification of the real-world domain the IS represents), its surface structure (i.e., facilities that allow users to interact with representations), and its physical structure (i.e., the machinery required for the other structures). Representations are *accessed* through a system's physical and surface structure (Burton-Jones and Grange 2013). As a consequence, these structures' features affect the *accessibility* of representations—a notion that is also consistent with Culnan's work on the accessibility of information sources (1983, 1985). As our data suggest, a higher accessibility is associated with more frequent state-tracking behaviors because it reduces the behavior's costs:

**Proposition 3:** *A higher accessibility of representations leads to more frequent state-tracking. This accessibility is a necessary but not sufficient cause as there might be highly accessible representations of domains that are irrelevant to an individual's goals.*

### The Unpredictability of Reward Timing

A reason for participants' "constant" performance of state-tracking behaviors was this behavior's remarkable *reward*

*structure.* Sometimes, a single act of state-tracking yielded a reward (e.g., important news, a message from a friend; even the absence of bad news could feel rewarding). However, on many occasions, state-tracking was perceived as offering little reward. One user was frequently state-tracking her emails at work and reflected on the ever-present possibility of an important incoming email that motivated her to engage in this behavior rather sooner than later to avoid missing out on important information:

*I'd say in 90% of all cases in which I open this program [Outlook], it's not important. Maybe 90% is not enough—95%! And in 5% of all cases, it's important but these 5% somehow get this weight, they somehow weigh more than the other 95%. So it's not often, but if so [an important email has come in], you think "now that [checking] was worth it!" (#26, 31f).*

The crux of the matter was that individuals were usually unable to predict whether state-tracking would offer a reward or not and thus had to check to find out. We asked one participant why she checked her instant messages so frequently although she had already admitted that only a small percentage of these messages were worth reading. She expressed her inability to predict whether a message was rewarding or not:

*You cannot say per se "I only check every tenth message" (#73, 29f).*

This pattern where state-tracking was only sometimes rewarded was consistent across different contexts. For instance, individuals could not predict whether interesting or relevant news were posted on a news website or in a social media system. Overall, there was always a chance of a reward when state-tracking.

This reward schedule (i.e., pattern which determines when a behavior will be rewarded) is known as a "variable-interval" pattern, which constitutes one of several identified forms of operant conditioning (Ferster and Skinner 1957). This pattern pertains to behaviors that are rewarded after a rather unpredictable amount of time has passed. Another example of this pattern is fishing—you never know if the next catch will be in 5 minutes or 2 hours. Operant conditioning research posits that a variable-interval pattern causes a steady and continuous repetition of the behavior in question because the timing of rewards is difficult to predict, which provokes persistent attempts to see whether a reward is available again (Domjan 1998; Ferster and Skinner 1957; Pierce and Cheney 2004). In other words: by constantly performing the behavior, individuals ensure that any reward is collected as soon as it becomes available (DeRusso et al. 2010). Many of these persistent attempts will be unrewarded, which reduces an

individual's experienced correlation between the rate of performing the behavior and the rate of rewards (Dickinson 1985). Individuals simply learn that constant repetition will occasionally lead to a reward, which makes behaviors associated with a variable-interval pattern especially prone to habit formation (DeRusso et al. 2010; Dickinson 1985; Wood and Neal 2009; Yin and Knowlton 2006). The preceding discussion leads us to the following proposition:

**Proposition 4:** *The unpredictability of reward timing leads to a "steady and continuous" performance of state-tracking.*

Up to this point, we have reported on the *general* characteristics of IT-mediated state-tracking as a behavior, as well as its causes. We now move to a different perspective by focusing on *situations* in which these behaviors are performed. This helps us understand why individuals might engage in state-tracking in sometimes inappropriate situations and how state-tracking could lead to intended or unintended consequences in a given situation.

### **Situations of Habit Execution**

Two factors were mainly responsible for whether IT-mediated state-tracking would be performed in a given situation. The first factor that led to habit execution in a given situation was the *presence of a situational trigger*. This is consistent with habit theory; remember that habitual behaviors become an automatic response to contextual cues (i.e., triggers) after they have been formed (Polites and Karahanna 2013; Wood and Neal 2007). Given the omnipresence of connected devices that afford state-tracking, our participants reported a wide variety of occasions in which they repeatedly engaged in state-tracking, leading to habit formation in these contexts. Thus, many different triggers representing "cues" of these contexts led to the execution of state-tracking habits. For example, routine situations (e.g., after waking up, before going to bed) or facing unpleasant tasks (e.g., cleaning the house, difficult tasks at work) were often-reported triggers of state-tracking. As one participant stated:

*When I wake up in the morning, the first thing I do before anything else ... I'm checking my emails (#22, 34m).*

But state-tracking would also be triggered by internal states such as boredom or by the technology itself. For instance, notifications by a device (e.g., vibration, visual signals) or simply becoming aware of the device's physical presence (e.g., seeing it lying around) could serve as a trigger. We propose:



**Proposition 5:** *The presence of a trigger leads to the habitual execution of a state-tracking behavior in a given situation.*

The second factor that affected whether state-tracking would be performed in a given situation was an individual's (in-)ability to actively inhibit habit execution through *self-control*. For instance, a user told us that he sometimes tried to resist the temptation to check when he realized that he was just engaging in this behavior. Sometimes he succeeded, sometimes he did not:

*I'm not always successful. I think I talked about that automatism. There are times ... I automatically take my phone. In that moment, if I really consciously think "not again, not much can have happened in the last 20 minutes, the last time you checked," then I put it away again. But if that train of thought doesn't happen, then it's that automatism again (#78, 36m).*

This observation is also consistent with habit research, stating that the automatic execution of habits makes them difficult to override and control (Graybiel 2008; Verplanken 2006; Verplanken and Orbell 2003). This means that individuals often act out of habit (e.g., unhealthy eating) even when the behavior conflicts with their intentions (e.g., lose weight, increase fitness) or does not help them meet their goals (Wood and Neal 2009; Wood and R nger 2016). Thus, "habits provide a default response unless people are sufficiently motivated and able to tailor their behavior to current circumstances" (Wood and R nger 2016, p. 291). As a consequence, individuals have to exert active self-control to interrupt a habit from being executed in a given situation (Quinn et al. 2010; Wood and Neal 2009). But humans' ability to control habit execution requires both awareness that self-control is required as well as mental resources to exert such self-control (Quinn et al. 2010; Soror et al. 2015; Wood and Neal 2007). This ability to exercise self-control varies across situations, as self-control resources fluctuate during the day, may be depleted, and regenerate with rest (Baumeister and Heatherton 1996; Wood and Neal 2009). Summarizing our observations and prior knowledge, we propose:

**Proposition 6:** *The exertion of self-control can interrupt the habitual execution of a state-tracking behavior when it is about to happen.*

### **(Un-)Intended Consequences of IT-Mediated State-Tracking**

Media paint a negative picture of what it has labeled constant checking but our findings suggest that a more balanced per-

spective is warranted. In particular, we found the quality of outcomes of state-tracking to vary between situations. Further, the "goodness or badness" of state-tracking is a subjective matter, as we will report. Thus, we refrain from labeling the outcomes of state-tracking as "positive" or "negative." Instead, we share our observation that this behavior could have both intended and unintended consequences, depending on situational factors.

### **Intended Consequences: Service to Enduring Goals**

Remember our observation that individuals' state-tracking behaviors were driven by underlying enduring goals. Thus, at an abstract level, the intended consequence of participants' state-tracking was that information obtained about the current state of a real-world domain would *serve these enduring goals*. Satisfying their information needs through state-tracking, participants felt that it was good to be up to date again on the things or people that mattered to them or they were now able to consider the information obtained within their future actions or decisions.

We mentioned the variety of enduring goals reported by our participants, which means that we also observed different manifestations of this abstract consequence. A work-related example was provided by one participant who reported an enduring goal to do well at his job. He felt that staying on top of his emails—even those that were more of a "for-your-information" nature—would serve this enduring goal because certain emails might become useful in a future situation:

*Sometimes they [emails] contain information, which help me to make more reasonable decisions later on or [help] in certain conversations with other people, even when they [emails] don't contain an immediate task (#77, 31m).*

In a nonwork context, another participant pursued an enduring goal of living an educated life and to make educated choices when political elections were due. He explained how following political news on different news websites served this goal:

*I want to be up to date because of my decisions ... at elections. I'm forming an opinion. And that opinion that doesn't form spontaneously, it's an ongoing process that stretches across the year. My [political] attitude develops across several years in between elections .... And of course it [attitude] is based on constant information I obtain (#76, 39m).*

Whether this intended consequence was achieved in a given situation was contingent upon the *situational value of information* that resulted from state-tracking. Given that state-tracking is rewarded on a variable-interval schedule, the information obtained in each checking situation varied in terms of how well it served users' enduring goals: not every social media content made them feel connected with their friends, not every news article helped them to live a well-educated life in today's society, some emails were just spam, and work mails did not always contain information that helped them to do their job well. When asked about the value of information obtained through state-tracking, one of our participants answered:

*Of course, sometimes more, sometimes less [value]. It certainly depends on the information that exist or are available at that moment and whether something important has happened (#80, 26f).*

Thus, the very same behavior could vary across situations in terms of whether it served the users' enduring goals or not, depending the situational, yet unpredictable value of information obtained in each situation:

**Proposition 7:** *The habitual execution of a state-tracking behavior leads to the satisfaction of an associated enduring goal when there is value in the information retrieved.*

### Unintended Consequences: Problems of Attention

Despite the generally purposeful nature of IT-mediated state-tracking, we also observed a variety of unintended consequences resulting from these behaviors such as distracted driving, ignored conversation partners, or neglected children. Constantly comparing different observations and abstracting from different contexts, we found that these unintended consequences were all instances of what Stanko and Beckman (2015) have labeled *problems of attention*, which occur when an individual does not focus or sustain focus on a stimulus that requires such focus. State-tracking involves the acquisition and processing of information, which consumes attention (Endsley 1995; Simon 1957; van Knippenberg et al. 2015). As attention is a limited resource, focusing attention on one stimulus (e.g., an electronic device) can lead to the exclusion of other stimuli (Ocasio 2011; Simon 1957; van Knippenberg et al. 2015).

The unintended consequences we observed were all just different forms of such attention problems where state-tracking led to a lack of focus on other stimuli in the indi-

viduals' environment that required their attention. A school teacher, who described herself as a very social person, often checked her text messages to avoid missing out on something. Asked whether she could think of a situation in which her state-tracking behaviors resulted in negative consequences, she responded

*Of course, when driving a car! .... I sometimes do it while driving when it's not only unnecessary but also totally dangerous (#75, 36f).*

Similarly, in the work context, a manager mentioned the lack of attention she paid in meetings due to her state-tracking:

*But let's take work emails ... I always have to check them. And I realize that I'm sitting in a meeting, constantly looking into my emails, although my focus should be on the meeting. And that annoys me and I think to myself: "What are you doing? Pay attention!" (#90, 30f).*

Sometimes, state-tracking would seem ironic from an outside perspective. As mentioned above, individuals frequently reported an enduring goal to maintain their social relationships and thus engaged in state-tracking. But, through this very same behavior, they were hurting their social relationships with friends and family members that were physically next to them:

*There's a few people who are constantly doing this ... sometimes they are just scrolling through Facebook .... another example is looking through Snapchat stories of other people—that's so unnecessary ... looking through Snapchat stories, especially when you're together with friends and you're checking "what did others post?" You can do that later when you're alone somewhere, that doesn't go away. And then you're like "ok is this really more important than actively participating at this table?" (#82, 23f).*

Like its intended consequence, the unintended consequence of state-tracking was contingent upon a situational factor as well: *demands on a user's attention*. We observed that the same behavior (e.g., checking a social networking system) could lead to some problem of attention in one situation but could also be completely unproblematic in another—depending on whether other individuals (e.g., participants' spouses, children) or tasks (e.g., work, household) required attention. But the demands on individuals' attention were not necessarily associated with stimuli external to them. Our participants also reported that their state-tracking prevented them from focusing on themselves, from being mindful. The

following user reflected on the common situation when two people eat a meal together, one of them gets up to go to the bathroom, and the other person immediately takes out the phone. The participant told us that he dislikes this immediate distraction:

*You could just think about things and just wait. Well, that sounds unspectacular. But this art of being engaged with yourself, just wait, reflect and be mindful, whatever. I think that gets lost (#76, 39m).*

Summing up these observations, we propose:

**Proposition 8:** *The habitual execution of a state-tracking behavior leads to problems of attention when this execution competes with other situational demands on an individual's attention.*

It is important to note that demands on an individual's attention (and the resulting problems of attention) are a matter of perspective. A problem of attention perceived by one individual might not be perceived by another individual. For example, the following user was not always aware of the attention problems created by his state-tracking—in contrast to his wife:

*It's a frequent discussion with my wife that I'm having the phone in my hand too often .... she always says that I don't realize that. And I must say: "Yes, I don't realize it." So I don't think it's too often (#71, 37m).*

Ironically, users who disliked others' state-tracking behaviors also admitted to us that they themselves engaged in state-tracking in inappropriate situations.

## Summary of Findings

Figure 1 summarizes our findings and offers an overview of our theory. Appendix B provides additional quotes to support our theory based on the categories shown in Table 1.

## Discussion

In this study, we have defined a new construct—*IT-mediated state-tracking*—and have developed a grounded theory of IT-mediated state-tracking that helps us understand the phenomenon of constant checking, as well as its causes and outcomes. Below, we will discuss the contributions that our study makes,

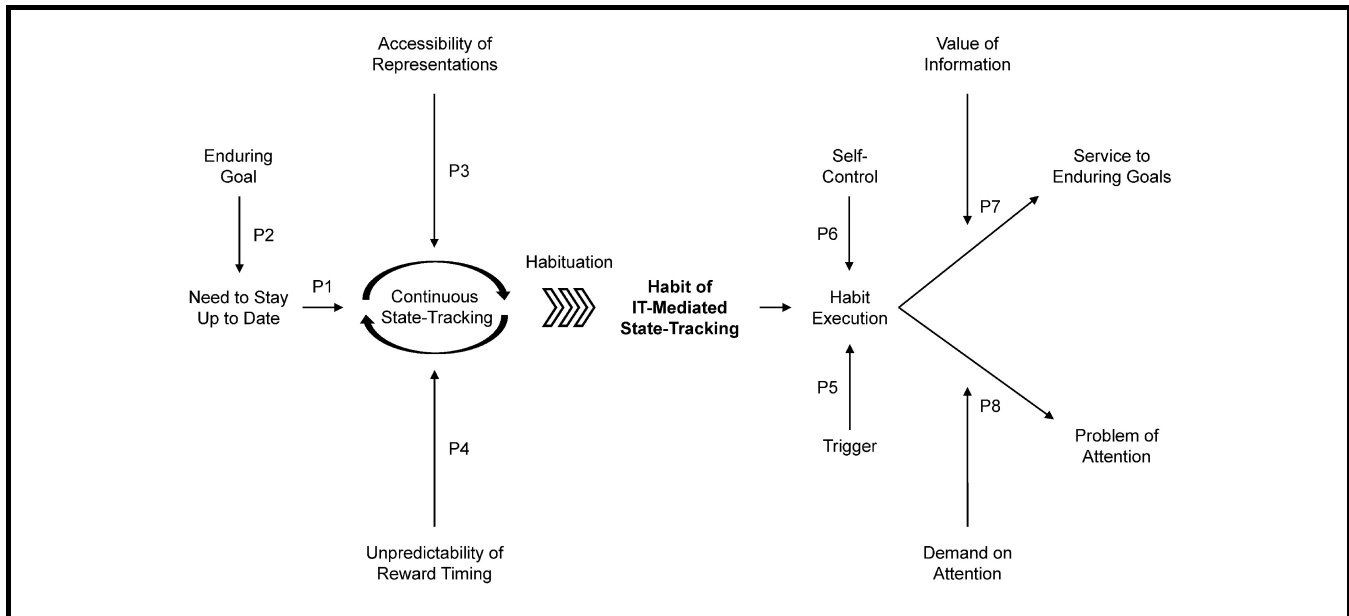
its limitations, and we highlight some fruitful avenues for future research.

## Contributions to Theory

The predominant approach to explain excessive IT use is that of technology addiction—despite fundamental criticism about this construct's validity (Kardefelt-Winther et al. 2017; Morahan-Martin 2005; Shaffer et al. 2000; Starcevic 2013; Widyanto and Griffiths 2006). For constant checking, which can be seen as a form of excessive IT use (Condliffe 2017; Newport 2015; Shull 2017), our theory serves as a more appropriate and less extreme explanation. Our grounded exploration shows that individuals do not keep on checking various ITs so constantly because they crave for emails, social media content, or text messages to experience thrill and relief and should therefore be treated to achieve long-term abstinence from these stimuli. Rather, these individuals have developed information-seeking habits to satisfy their own enduring goals, which are constantly executed due to today's high accessibility of information about real-world states and the users' recurring need for updates. State-tracking habits might look like addictions on the surface, as they are often performed with high frequency, are difficult to control, and can cause problems. Yet, they are very different behaviors.

These findings serve as an example that challenges an underlying assumption of technology-addiction research: just because individuals might show addiction-like symptoms, this does not necessarily reflect that individuals are truly addicted. Thus, our study supports existing critiques that technology-addiction scholars have been using terminology, measures, and definitions from addiction research as if technology addiction was an uncontested construct that is theoretically understood (Kardefelt-Winther 2017; Shaffer et al. 2000). Our findings in the context of constant checking should encourage scholars with an interest in other phenomena related to excessive IT use (Haug et al. 2015; Takao et al. 2009; Turel and Serenko 2010; Vaghefi et al. 2017) to carefully explore and understand these phenomena instead of applying the construct of addiction in a confirmatory manner (Billieux et al. 2015; Kardefelt-Winther et al. 2017).

We argue that constant checking constitutes a behavior that we have defined as IT-mediated state-tracking. Scholars who seek to study constant-checking behavior, its antecedents, and outcomes, but did not have a theoretical construct to refer to (Barley et al. 2011; Mazmanian et al. 2013; Middleton and Cukier 2006; Sarker et al. 2012) may now build on our construct and use it as a foundation in their theorizing. Our findings with regard to the causes of IT-mediated state-tracking add to those reported in studies on constant email



**Figure 1. A Theory of IT-Mediated State-Tracking (Overview)**

checking in the work context (Barley et al. 2011; Mazmanian et al. 2013) but also apply to contexts beyond work and beyond emails. In addition, our construct allows researchers who study unintended consequences of IT (Boswell and Olson-Buchanan 2007; Derks and Bakker 2014; Soror et al. 2015) to move beyond the black-box of IT use. Instead, we believe that IT-mediated state-tracking may offer a more nuanced explanation for a large share of work–family conflicts (Boswell and Olson-Buchanan 2007; Derks and Bakker 2014), social overload (Maier et al. 2014), phubbing (Roberts and David 2016), and other negative consequences (Patten et al. 2004; Soror et al. 2015).

Our study also contributes to a more situational and balanced perspective on the effects of IT use and IT characteristics. Research on unintended consequences of IT use paints a general and rather negative picture, emphasizing the detrimental outcomes of such use (Boswell and Olson-Buchanan 2007; Butts et al. 2015; Derks and Bakker 2014; Krasnova et al. 2015; Maier et al. 2014; Soror et al. 2015). Our research shows that a more balanced perspective is needed to acknowledge that both intended (e.g., doing well at work, maintaining identities and social relationships) and unintended consequences (e.g., neglecting other tasks or individuals) of IT use might depend on situational conditions. Likewise, our results suggest that a more balanced perspective is also needed in research areas with an overly positive view of IT and IT use. For instance, LIS research considers information seeking as a purely positive behavior, as it is directed at problem solving

and goal satisfaction (Case 2012). However, this neglects the potential unintended consequences of information seeking, as found in our study. Given the benefits of information seeking, LIS research further recommends that information should be made as accessible as possible (Connaway et al. 2011; Hargittai and Hinnant 2006; Zhou and Adkins 2016). Similarly, IS research considers the ease of use of an IT as purely positive, as it leads to technology adoption and use (Davis 1989; Venkatesh et al. 2003). Yet, our findings show that effortless access to information is not a purely positive attribute of IT but one that also affords behaviors to be performed to the point of negative consequences.

Finally, our study contributes to representation theory. While this theory and the majority of subsequent research have focused solely on an “internal view” of IS (i.e., the relationship between the real world and how it is modeled within an IS), Burton-Jones and Grange (2013) emphasize the need to also study its external view, which adds individuals and organizations to the theory’s scope (Wand and Weber 1995). Our state-tracking construct contributes to this external view as it may be used as a mediator between representation theory’s internal view and a variety of individual-level outcomes that state-tracking may cause, such as work–home conflicts (Sarker et al. 2012), reduced traffic safety (Patten et al. 2004), or a lack of mindfulness (Baer 2003). Specifically, our construct can be used to investigate the effects of how a real-world domain is modeled within an IS on state-tracking and its outcomes. For instance, future research can explore



whether changes to representational models (i.e., deep structure) within an IS might help to solve the puzzle of variable-interval rewards, which encourage individuals to check more often than is necessary. For example, designers could provide users with opportunities to define events in a real-world domain, which are most significant to them. Combined with filter techniques and notifications (i.e., the artifact's surface structure), this might help to prevent individuals from checking more often than necessary and make this behavior a more effective means to reach its associated goals by reducing its unintended side effects.

### **Practical Implications**

As a first implication, our study makes the case for much more careful usage of the addiction label when dealing with or talking and writing about users who use IT excessively. As we have argued above, calling someone an addict has significant and potentially dangerous consequences for the individual and the treatment of the associated behaviors.

Our study can help users who seek to reduce their state-tracking. We recommend to mindfully customize ITs they are using and perhaps refrain from creating shortcuts or bookmarks, or storing passwords for faster log-ins. Like one of our participants stated, not downloading an easy-to-use mobile app (e.g., email app) can inhibit frequent state-tracking. Furthermore, individuals can disrupt unwanted habits by following the advice offered by Polites and Karahanna (2013): purposely customizing their ITs. Like some participants of our study, users can delete bookmarks or shortcuts or move app icons from the starting screen of a mobile device to a different one to “break the chain” between an ingrained habit and its automatic execution.

Businesses that depend on individuals' usage of online services can also benefit from better understanding IT-mediated state-tracking. As public awareness of these behaviors increases (Kawa 2018), users might engage in alternative behaviors more often. For instance, Jeff Bezos has stated that he avoids constant checking to be present in each moment (Cain 2017), while providers of operating systems add features that help users to manage the time they spend using digital devices (e.g., Google's Digital Wellbeing, Apple's Screen Time). This increasing mindfulness means that businesses need to anticipate and cope with the risk of losing their customers. To counteract, service designers could implement functions to provide updates about real-world changes more efficiently. *The New York Times* website, for example, has introduced “daily briefings” that summarize the most important events readers might want to know.

### **Limitations and Future Research**

There are several limitations to our study. First, our methods relied on self-reports. While self-reports have been widely used in research on similar topics (Barley et al. 2011; Mazmanian et al. 2013), it is possible that our participants were not entirely open when talking about their constant checking—a subject which might be prone to social desirability bias. We tried to counter this risk by relying on both personal interviews, as well as anonymous online surveys with open-ended questions. Both ways of data collection led to consistent results and we felt that our participants were generally very self-critical. For instance, they usually had no problem admitting that they checked their devices in inappropriate situations, neglecting other individuals or tasks because of their checking.

Our theory includes statements about the formation of habits, which takes place over an extended period of time. As these statements are based on retrospective reports by our participants, we were not able to observe the “birth” of the phenomenon of interest. Instead, ITs were already immersed in participants' lives and, as a result, they had already formed habits of state-tracking. This reliance on retrospective reports is a limitation that is common to many interview-based studies (Gioia et al. 2010; Sergeeva et al. 2017). However, our observations were highly consistent with theory on habit formation (DeRusso et al. 2010; Verplanken 2006).

We have generated a theory based on observations that must be understood within their particular context (Davison and Martinsons 2016; Whetten 1989). Thus, more work needs to be done to clarify the boundaries of the theory as we do not know whether it holds in contexts that are different from those that we observed (e.g., different cultures, laws, policies). For instance, prior research has shown that cross-cultural differences exist with respect to Internet use (e.g., Kang and Jung 2014; Muralidharan et al. 2015), which might affect the theoretical mechanisms we have proposed. In a similar vein, laws that prohibit employees to check their work emails after hours might place boundaries on our theory (Morris 2017). Furthermore, certain individuals might not use ITs to satisfy their need to be up to date but rather prefer analogue offline channels instead, while other individuals in certain societal contexts might not be free to use ITs to stay informed about certain domains. For these individuals, information needs might not be a cause of IT-mediated state-tracking as proposed by our theory. Moreover, our theory is limited to state-tracking behaviors that are carried out frequently enough so that habits can be developed.

To improve the generalizability of our findings, we collected and compared data from individuals of different ages, gen-

ders, in different occupations, using different digital devices (smartphones, tablets, laptops), also including observations in different usage contexts (e.g., at home, in public, at work). Despite these differences, we could observe state-tracking behaviors across contexts. We believe that our theory's element of "enduring goals" allows generalizability across individuals, as different goals can motivate state-tracking in different domains. With respect to different devices, representation theory supports why state-tracking is not limited to specific devices. In particular, the theory states that a system's structures (e.g., machinery, interface) are only means to the end of representing a domain of interest (Burton-Jones and Grange 2013). Obviously, different devices can offer structures that help represent the state of a given domain.

There are several avenues for future research and additional research questions that can be derived from our work. For example, we have focused on a phenomenon of information seeking. Yet, excessive IT use might also include information provision. In fact, information related to the current state of the real world that is consumed through state-tracking is often provided by other individuals (e.g., updates provided about status, events, or work). Future research could address the nature, causes, and outcomes of excessive information-provision behaviors.<sup>8</sup>

Our theory also provides a foundation for studying additional moderators of its relationships. For instance, we have established individuals' need to stay up to date as a cause for state-tracking behaviors but this relationship could vary in strength, depending on the real-world domains being tracked and/or characteristics of the enduring goals motivating the behavior. In a similar vein, a variety of other factors could moderate relationships of our theory. Two individuals working in two different organizations could have the same enduring goals (e.g., pursuing a career), leading to state-tracking behaviors to stay up to date regarding work (e.g., by checking email clients). Yet, differences in organizational cultures (Leidner and Kayworth 2006; Mazmanian 2013) could affect the frequency of their state-tracking and its outcomes. Similarly, individuals could differ in their liability to state-tracking due to personality differences (e.g., conscientiousness, neuroticism).

Furthermore, our study shows that intended and unintended consequences of state-tracking depend on situation. This runs counter to the assumption that excessive IT use is negative per se. For instance, legislators and companies have started to prohibit employees to check their emails outside of work hours, which diminishes employees' opportunities to stay up

to date (Morris 2017). While these initiatives might reduce stress for employees (Barley et al. 2011), they might also limit the benefits of staying up to date. Thus, a clear area for future research lies in answering questions associated with the puzzle of how individuals can balance the costs and benefits associated with IT-mediated state-tracking. One example question is whether broad-brush countermeasures such as email bans are more effective in improving individuals' lives compared to approaches that take a higher number of contextual factors (e.g., current time, current location, source of information) into account such as rule-based email filtering or advanced screen-time controls.

## Conclusion

Based on our grounded exploration, we now understand that constant checking constitutes the evolution of a natural and purposeful human behavior: seeking up-to-date information about real-world domains of personal relevance. In the history of mankind, humans have always had the desire to be up to date regarding the state of important domains and have relied on "information systems" to do so. For instance, ancient civilizations used systems like smoke signals or couriers to represent and transmit news about victory or defeat from one end of the empire to the other. But IT has evolved since then and tracking the state of many domains has become feasible with a high accessibility of representations of the real world that are richer and more detailed. Furthermore, changes within attributes of the real world are tracked more immediately—often almost in real-time. The ongoing evolution of IT feeds humans' natural desire to track the state of relevant domains and makes IT-mediated state-tracking a highly salient behavior in today's societies. A central question is, therefore, where our societies will end up. It is foreseeable that future ITs will provide even better access to up-to-date information, from devices on our wrists, integrated in our glasses, or maybe even implanted in our brains (*Economist* 2017). More research is needed to better understand the antecedents and consequences of IT-mediated state-tracking, in order to cope with this evolving behavior.

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## About the Authors

**Jin P. Gerlach** is an assistant professor of MIS at the School of Business, Economics, and Law, Technische Universität Darmstadt. His research interests include the adoption and use of IS at the individual level, organizational management of IS security and privacy, and data-driven value creation within organizations. His work has appeared in the *Journal of the AIS*, *Information Systems Journal*, *Journal of Product Innovation Management*, and other outlets.

**Ronald T. Cenfetelli** is CANFOR Chair of MIS and Professor of Accounting and Management Information Systems at the University of British Columbia's Sauder School of Business. Ron conducts research into e-business, online customer service; the negative aspects of information technology; the behavioral and emotional aspects of technology usage; and human-computer interaction. His research has been published in *MIS Quarterly*, *Information Systems Research* and the *Journal of MIS*, among other outlets. He currently serves as a senior editor at *MIS Quarterly*. Before entering academics, Ron worked in the pharmaceutical industry in both production as well as technology management roles. He also has a prior career as a United States naval officer. Ron received his Ph.D. from the University of British Columbia in 2004. He also holds an M.B.A. from Indiana University's Kelley School of Business and a B.S. in aerospace engineering from Purdue University.

# Appendix A

## Interview and Survey Questions

Below are some selected questions from our interviews and open-ended surveys. As our study progressed, questions were added, modified, or removed to obtain data that answered theoretical questions that became salient throughout the research process (e.g., Glaser 1978). Interviews could take different directions and we spontaneously adjusted our questions to account for the particular interview context and freely pursued interesting themes as they unfolded.

- What are some examples where you constantly check digital channels for new information? When and where do you do it and how often?
- What particular information is it that you are looking for when checking X?
- Your constant checking of X: is that intentional or rather automatic?
- Why do you check for this kind of information and why is that important to you?
- Why do you check X frequently and not just once a day?
- What is it about the technology you use that facilitates or promotes your constant checking?
- Have you somehow modified the technology you used (e.g., installed, configured, created bookmarks, etc.) that affected your constant checking?
- Do you feel that your checking of X is good? Bad? Both? What determines good or bad?
- Do you feel that your checking of X is usually worth it?
- Have you experienced situations in which you should have been doing something else more important than checking?
- Do you remember situations in which you tried to prevent checking? When were you (not) successful?
- Have you experienced situations in which another person's constant checking has somehow disturbed or somehow negatively affected you?

# Appendix B

## Additional Quotes

Based on Table 1, each of the subsequent tables represents one of the themes of our data structure diagram. For each of the themes, we offer additional exemplary quotes to support the theme’s second-order categories. Please note that this table presents snippets of participants’ statements outside of the statements’ context. Thus, additional information provided by the participants that are not included in the following quotes may have been used to code these statements.

Category	Description	Raw Data Examples
State-tracking	State-tracking describes an individual’s behavior of seeking information about the current state of a real-world domain that is relevant to the individual.	<p>“We used to have these static websites that weren’t updated so often. And now there’s something new every second ... you wouldn’t always check if you’d know there’s nothing new .... But if there’s always something happening, you frequently take a look whether there’s something new.” (#84, 32m)</p> <p>“I have it [smartphone] in my hand so many times a day just to see what happens—totally mundane.” (#80, 26f)</p> <p>“In the personal context, it’s mostly about news about economy, politics, technology. When it comes to Facebook, it’s about updates from friends. In the business context, it’s mostly to be aware of changes, announcements, discussions, results of discussions. So [it’s about] work-related topics, just to be up to speed.” (#78, 36m)</p>
IT as a mediator between world and individual	IT serves as a mediating tool for users to obtain information about the current state of a real-world domain. Multiple different devices may fulfill this purpose for a given real-world domain.	<p>“It’s the dynamics of information and our world in general. It [technology] makes that visible. Think about it! Go back 15 years! Back then, you got that [soccer-related print magazine] on Mondays and Thursdays. You read the newspaper. But that was it. Maybe you’ve seen something in the news on TV. But it wasn’t possible to immediately provide users with information. And that’s certainly a big factor that’s being facilitated by technology or even enabled by it at all.” (#77, 31m)</p> <p>“I don’t check personal emails on my work computer. I use my phone for that when I’m somewhere away from home or my PC or tablet when I’m at home.” (#72, 32f)</p> <p>“I use both my phone and my laptop for LinkedIn. I think I do about the same on both [devices]. It’s not that I say ‘ok, I’m reading this article only on my computer or my laptop and with my phone, I only manage my network.’ Well, I tend to read articles rather on my laptop because it provides a better overview. But I also do it on my phone. It just depends on where I am at the moment. When I’m on the train, I’ll use LinkedIn on my phone.” (#90, 30f)</p>
Habitual nature of checking	IT-mediated state-tracking is characterized by its habitual nature. These behaviors are carried out automatically and unconsciously.	<p>“I do that unconsciously. I open a [browser] tab and have already clicked on Facebook. Just then, I realize that I’m surfing on Facebook .... It’s so natural to open Facebook that I’m sometimes totally unaware of it.” (#23, 23f)</p> <p>“Most of it is automatic and unconscious. Of course, I also use my phone to look for something specific but the majority is automatic and unconscious for sure.” (#86, 38f)</p> <p>“I always check my phone when I am hanging out with people, even if it is mindlessly scrolling through Facebook. It’s always boring, but I keep doing it .... I think I am just so used to checking various social media websites constantly, that I just do it automatically. Especially if my phone is near me, it makes it easier to keep doing this.” (#47, 25-34f)*</p>

\*Only age categories were available for Mechanical-Turk participants.



Table B2. Second-Order Categories of “Causes of IT-Mediated State-Tracking”		
Category	Description	Raw Data Examples
Need to stay up to date	An individual's need to stay up to date represents recurring information needs about the current state of an ever-changing real-world domain.	<p>“There are many topics that I'm interested in where I want to be up to date and want to know about new developments: economy, news, politics, technology. I have an interest in this 'renewable energy' topic, ranging from electric cars to photovoltaics, hydrogen, etc. I have a thirst for these topics, I want to know about the latest...finance, investments, I want to stay up to date.” (#78, 36m)</p> <p>“I think the most important thing to me is to know that I haven't missed something. I think that's the main factor.” (#83, 34f)</p> <p>“Well I think I just want to be up to date. You want to have information as soon as possible.” (#90, 30f)</p>
Enduring goals	Enduring goals represent what individuals typically try to achieve in everyday life. Enduring goals are not terminated by single accomplishments (e.g., Emmons 1986; Emmons 1989).	<p>Describing his enduring goal to do well at his job: “I have a certain aspiration when it comes to my job and I want to go home with a feeling 'you've done a good job.' But in the end, of course, I want to be appreciated for it and I want it to pay off. It's not just monetary but also standing, appreciation, and respect.” (#88, 32m)</p> <p>Describing her enduring goal to maintain her identity as a tennis fan/player: “I'm a tennis fanatic and I'm following every tennis website and everything that's on Instagram where I get news about tennis .... I love to play tennis myself, I think that's where my interest comes from. I grew up watching tennis—it's so exciting! I'm a fan of several players and I really want to see them win. It's a passion! .... I think I had a tennis racket in my hand before I was able to walk [laughs].” (#90, 30f)</p> <p>Describing her enduring goal to maintain her social relationships: “For Whatsapp, I would say that it's about being part of social life and not get left behind. You want to participate, you want to be a part of it.” (#73, 29f)</p>
Accessibility of representations	The accessibility of representations constitutes the effort needed to obtain information about the current state of a real-world domain from an IT.	<p>“It's just so quickly done, this checking .... Overall, technology and the Internet and everything is so extremely fast. Apps are extremely fast and you get information about breaking news automatically, half an hour after something has happened. It's really user-friendly. It's easy to use, it's no burden. If you would have to type in your password every time, I wouldn't do it [checking]. At least I think I wouldn't do it so frequently.” (#86, 38f)</p> <p>“One thing common to all devices is that it's so easy. It's one click, one app, one button that you have to press on your phone when you're opening an app and it's immediately there.” (#87, 34m)</p> <p>“It's all right there at my fingertips. It's so easy and has become second nature. Technology of my cell phone has a fast processor, so the app takes no time to load. I'm almost always on WIFI so the pictures and videos are available in seconds. I don't have any sort of trade off to stop me. If they took too long or were too complicated to use, I wouldn't do it so subconsciously I think.” (#38, 25-34f)*</p>
Unpredict-ability of reward timing	IT-mediated state-tracking is rewarded after a rather unpredictable amount of time has passed.	<p>“... consider how often you really get some new information. That's what's fascinating. You check ten times but if you're lucky, you get some new information in one out ten cases .... 95% of all information are meaningless. It's not important to have them, it could easily wait five or three hours to have them. But you never know and I think that's what causes it. There's always a chance that you get something what's so important that you want to know it immediately.” (#77, 31m)</p> <p>“...why do we check emails, everything we get is advertisements [laughs] .... But you still check often because you think 'maybe there's something important.’” (#80, 26f)</p> <p>“It's like a surprise box. I'll open it because there could be something exciting in it that helps me somehow. And when there's nothing in it, I'll close it and check it again 10 minutes later.” (#81, 29m)</p>

\*Only age categories were available for Mechanical-Turk participants.

Table B3. Second-Order Categories of “Situations of Habit Execution”		
Category	Description	Raw Data Examples
Situational triggers	Habits of IT-mediated state-tracking are triggered by a variety of cues that are associated with stable contexts in which this behavior is performed until habit formation.	<p>“That [checking the smartphone for new messages] happens automatically, I don’t think about it. It happens when I’m on the train or when I’m walking somewhere with nothing to do. Then there’s this standard move into the pocket, taking out the phone. And then there’s nothing exciting, back [into the pocket] it goes. So every time when you have nothing to do. Then it happens unconsciously: all of a sudden, you have your phone in your hand.” (#9, 23m)</p> <p>“That [automatic smartphone use] happens when I’m lying on the sofa and the commercials start or when I’m going to the bathroom [laughs] or sometimes, although I shouldn’t say that, when I’m standing at a red light. So every time when there’s time that can’t be used otherwise.” (#21, 29f)</p> <p>“Well I think in situations when I’m bored, it really happens without being aware that it happens. I sometimes realize that I’m on the train, then I’ll check for news. I don’t know, look at the new entries on Facebook.” (#81, 29m)</p>
Self-control	Individuals can exercise self-control to prevent the execution of IT-mediated state-tracking habits.	<p>“But I think that you have to really discipline yourself and say: ‘No, don’t look at it now. Leave the phone in your pocket for half a day.’ You just don’t do it [leaving the phone alone] in the end...it’s like a diet [laughs].” (#80, 26f)</p> <p>“Yes, I’m able to [not check the phone]. But I have to concentrate.” (#20, 27m)</p> <p>“It really happens that I take my phone and before I’ve actually checked something I’ll think ‘let it go, it’s not worth it, nothing has happened, let it go.’ But I’ll do it anyway [check].” (#89, 35f)</p>

**Table B4. Second-Order Categories of “(Un-)intended Consequences of State-Tracking”**

Category	Description	Raw Data Examples
Service to enduring goals (intended)	Being up to date regarding a real-world domain that matters to an individual serves an underlying enduring goal.	<p>Being up to date on IT-related news serves the participant's enduring goal to protect his digital assets: <i>“With respect to [IT] security, I'm very interested in IT-related news. What are the latest facts, like with Facebook and its data scandal. Where do I have to be careful with my own personal data? Where's a risk for me in terms of my personal information, freedom, how do they use my data? How can I get more information and protect myself against misuse of personal data? That's an example where these information concern and help me in my daily life, my personal use of IT. A lot is about security, being informed about security, how does IT work, what are the latest trends? How does it all work? How can I navigate and adjust to this world?”</i> (#76, 39m)</p> <p>Checking personal emails serves participant's enduring goal to manage everyday life: <i>“Something like 'survival' or something like that? .... I would say that there are many emails that have serious consequences for you if you don't respond .... I would say, it's about your existence.”</i> (#73, 29f)</p> <p>Following professional online social networks serves this student's enduring goal to pursue a career: <i>“I'm more interested in my LinkedIn newsfeed than what's going on Facebook ... because I'm interested in consulting, so I'm following this [consulting] company. And they post about current topics and, since I'm interested in these topics anyway, I think it's exciting what's going on there .... Right now, I want to find out 'ok when I'm done studying in one and a half years, what am I doing next?' That's important to me and getting such information has an influence.”</i> (#82, 23f)</p>
Value of information	The value of information obtained through state-tracking varies between situations in terms of how well it serves the enduring goal associated with the behavior.	<p><i>“But sometimes, they [instant messages] don't have a purpose for me. For example, there's this WhatsApp group of my birthing class. When they send pictures of all these exciting things that their babies are now able to do and whatever else, this doesn't serve a purpose for me.”</i> (#75, 36f)</p> <p><i>“Sometimes when I don't find anything of interest, then it's a disappointment.”</i> (#78, 36m)</p> <p><i>“Then I'll take phone and look into my emails and see 'there's no new email there!' and on this news website, there are no new articles. And the Facebook timeline: 'you already know all this!' And then I turn off the phone and put it back in my pocket and think it would have made more sense to make better use of this time, reflect on some things. Maybe it's because I'm checking too often so it's no use because there's no new information but I spent some time on it [checking].”</i> (#81, 29m)</p>
Problem of attention (unintended)	Due to IT-mediated state-tracking, users are unable to focus or sustain focus on certain stimuli that require their attention.	<p><i>“In situations with my partner, where we're somewhat in a conversation, don't really sit opposite to each other or look at each other ... I might take the phone and therefore prevent this situation from becoming more focused on each other. It's not taking away attention or focus from the other person but you prevent such a situation from happening.”</i> (#89, 35f)</p> <p><i>“There's certain situations where it [email checking] is bad. I was talking about it earlier: I should be focused on what's going on in a meeting or a phone call but I'm checking what's going on my phone. And it often happens, I think it happens to many, that you're being asked a question and you don't know the answer: 'sorry, what was that?’”</i> (#88, 32m)</p> <p><i>“So when you wake up next to your partner and the first thing you both do is look at your phone, you actually wonder 'how about saying good morning?' or 'what are you up to today?' instead of fumbling around with the phone.”</i> (#22, 34m)</p>
Demands on attention	Individuals need to pay attention to other individuals, tasks, or themselves. The presence of such demands depends on situational factors.	<p><i>“So when I'm alone, it [checking] doesn't bother me. It's not that I think I should reduce [this behavior] for some reason.”</i> (#71, 37m)</p> <p><i>“When I know that I really want to relax right now, on the weekends, I really want to relax, then I don't do it [check emails].”</i> (#79, 28f)</p> <p><i>“Well I'd say if I'm on my own and I don't annoy or neglect someone else, then it's totally ok. But as soon as it's like, you annoy someone else or neglect your conversation partner, I don't think it's okay.”</i> (#80, 26f)</p>

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