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Digital Wellbeing as a Dynamic Construct

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Mobile media support our autonomy by connecting us to persons, content and services independently of time and place constraints. At the same time, they challenge our autonomy: We face new struggles, decisions, and pressure in relation to whether, when and where we connect and disconnect. Digital wellbeing is a new concept that refers to the (lack) of balance that we may experience in relation to mobile connectivity. This article develops a theoretical model of digital wellbeing that accounts for the dynamic and complex nature of our relationship to mobile connectivity, thereby overcoming conceptual and methodological limitations associated with existing approaches. This model considers digital wellbeing an experiential state of optimal balance between connectivity and disconnectivity that is contingent upon a constellation of person-, device- and context-specific factors. I argue that these constellations represent pathways to digital wellbeing that—when repeated—affect wellbeing outcomes, and that the effectiveness of digital wellbeing interventions depends on their disruptive impact on these pathways.

Keywords: Digital Wellbeing, Mobile Connectivity, Mobile Media, Wellbeing, Addiction, Problematic Phone Use, Addictive Design, Digital Wellbeing Interventions, Digital Detox, Screen Time

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Over the past 20 years, our work, social and leisure environments have become suffused with mobile technologies operating on wireless network infrastructures, such as laptops, tablets and smartphones (ITU, 2017). These mobile technologies afford ubiquitous connectivity: They connect us to content, contacts and services without time or place constraints (Vanden Abeele, De Wolf, & Ling, 2018). Operating on a mostly unseen and unknown infrastructure, ever-present in the background, they form a "technological unconsciousness" (Thrift, 2004). As a result, we often take ubiquitous connectivity for granted, only noticing it when it is absent—for example when our phone battery dies, or the wireless network goes down (Ling, 2012). But now that technologies permit us to be "permanently online and permanently connected" (POPC; cf. Vorderer, Krömer, & Schneider, 2016) we face a new challenge:

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How do we obtain a healthy balance between connectivity and disconnectivity? In other words: How do we attain digital wellbeing?

Studies show that we hardly disconnect. Smartphones are tapped, swiped and clicked over 2,600 times per day (Dscout, 2016), and people spend close to three hours per day on their little screens (Deng et al., 2019)—a figure that easily goes up to five hours and more for heavy users (Deng et al., 2019; Sewall, Bear, Merranko, & Rosen, 2020). While people reap ample benefits from mobile connectivity, they also struggle with it. Phone use is found, for example, to interfere with social activities (McDaniel & Drouin, 2019), to distract from work and study (Duke & Montag, 2017), to lead to procrastination (Schnauber-Stockmann, Meier, & Reinecke, 2018), to cause sleep and health problems (Lanaj, Johnson, & Barnes, 2014), and to induce negative emotions such as emotional exhaustion and anxiety (Büchi, Festic, & Latzer, 2019). It should therefore not be a surprise that three in four young adults (Paul & Talbott, 2017), half of teens, and one in three parents find that they spend too much time on their screens (Jiang, 2018). Many also express a desire to reduce screen time, but such attempts often fail (Jiang, 2018). This suggests that digital wellbeing is difficult to attain.

The "quest for digital wellbeing" (cf. Mason, 2018) thus appears an urgent issue. *Wired Magazine* even described it as the "rallying call of our time" (Ardes, 2018). A new industry of digital wellbeing interventions is developing to respond to this call. These interventions include digital detox programs, self-help literature, and various digital tools (e.g., the Forest and Moment apps), all with a shared goal to assist users in "re-gaining control" over their screen time. Tech behemoths Google and Apple, for example, integrated dedicated digital wellbeing tools into their operating systems for people to "set limits to" their digital media use (Apple.com), with the goal to "keep life, and not the technology in it, front and center" (wellbeing.google). To date, however, research on the effectiveness of digital wellbeing interventions is inconclusive. Digital detox interventions, for example, appear both positive (e.g., Anrijs et al., 2018) and negative (e.g., Wilcockson, Osborne, & Ellis, 2019), and while some work suggests that screen time apps are successful in safeguarding digital wellbeing (e.g., Hiniker, Hong, Kohno, & Kientz, 2016), other work shows no effect (e.g., Loid, Täht, & Rozgonjuk, 2020). These contradictory findings suggest that what digital wellbeing is, and how it can be attained, remains ill-understood.

Digital wellbeing has the potential to become a key concept in research on digital media use and wellbeing, with ample practical relevance. The concept can inform users, health practitioners, designers, and developers in the industry as well as policymakers about people's struggles with ubiquitous connectivity, and what can be done to help people foster healthier mobile media habits, with or without the use of digital wellbeing interventions. To date, however, we have only a limited theoretical vocabulary to describe what digital wellbeing is to guide empirical inquiry. Conceptual boundaries are needed to avoid that digital wellbeing becomes a bandwagon concept for related constructs such as smartphone addiction, or is used as a proxy to refer to every negative relationship between screen time and wellbeing

outcomes. In this manuscript, I propose a working definition of digital wellbeing, present a conceptual model for its study, and explore issues and challenges associated with the proposed approach in an attempt to advance our understanding of the paradoxical relationship we have with ubiquitous connectivity in our everyday life.

The mobile connectivity paradox

Mobile technology substantially increases autonomy in everyday life (Castells, Fernandez-Ardevol, Qiu, & Sey, 2009; Vanden Abeele et al., 2018): People can perform their social roles, manage their social networks and access personalized information and services anywhere, anytime. Moreover, they can easily and instantaneously respond to information by flexibly adjusting the situation or their actions. When their train is delayed, for example, people can use their laptop to catch up on work, use a mobile messaging app to inform their partner and stream music to their phone to relax.

But there is a mobile connectivity paradox: while ubiquitous connectivity can support autonomy, it can also challenge that very experience. Autonomy is challenged when mobile technologies exert *direct* control over thoughts and behaviors by directing attention away from people's primary activities. Developed against the background of an attention economy, mobile technology is designed to lure attention (Eyal, 2014; Williams, 2018). As a result, people may unintentionally abandon their work, social and leisure activities to engage in unintended screen time. While this screen time may be pleasurable in itself, one can experience it as excessive, inappropriate and sometimes even problematic, for example, when it hampers responsiveness to children (Vanden Abeele, Abels, & Hendrickson, 2020), reduces productivity (Duke & Montag, 2017), invokes negative feelings (Aalbers, McNally, Heeren, de Wit, & Fried, 2019), leads to dangerous behaviors such as texting-while-driving (Bayer & Campbell, 2012), or is simply experienced as meaningless or a waste of time (Hiniker et al., 2016; Lukoff, Yu, Kientz, & Hiniker, 2018).

Mobile technologies also challenge autonomy by controlling thoughts and behaviors in a more *indirect* way. The SIM card functions as a "mobile address" that makes individuals track-and-traceable (Thrift, 2004). While this infrastructure of individual addressability gives the freedom to instantly communicate, act and respond, it has also contributed to a global culture of ubiquitous connectivity, fraught with expectations about immediate availability and accountability (Licoppe & Smoreda, 2005; Ling, 2017; Vanden Abeele et al., 2018; Vorderer et al., 2016). These expectations constrain the freedom to refrain *from* connectivity: People may experience control in the form of real or perceived pressure to check, act and respond, and they face new responsibilities for negotiating their availability and accountability (Vanden Abeele et al., 2018).

The mobile Connectivity Paradox refers to this experience of being caught between autonomy and a loss of control, which becomes visible in people's ambivalence towards mobile connectivity in their everyday lives. While a majority recognizes the importance of mobile connectivity for self-governed living, many

report that they are simultaneously concerned about the time they spend on screens and the pressure they experience to connect. People struggle with decisions on whether, when and where to connect and—perhaps more importantly—disconnect (e.g., Aagaard, 2020; Lyngs et al., 2020). This paradoxical experience, that is oftentimes mentioned to in both public (e.g., Ardes, 2018) and scholarly discussions (e.g., Hiniker et al., 2016), lies at the core of the quest for digital wellbeing: How can we optimally embed mobile connectivity in our life so that it supports individual autonomy without experiencing a loss of control? To properly answer this question, we require a definition of digital wellbeing.

Towards a definition of digital wellbeing

Digital wellbeing is often implicitly defined by juxtaposing it against undesirable phone habits (i.e., drawing a parallel between phone use and unhealthy eating habits; see also Sutton, 2017) or against afflictions that represent digital ill-being, such as technology addictions (Lee, Lee, & Park, 2019; Roffarello & De Russis, 2019). This is surprising, as the concept of general wellbeing is generally not understood as the absence of an undesirable state, but rather as a state of "optimal psychological experience and functioning" (Deci, & Ryan, 2008, p. 1). Drawing arguments from ongoing debates between scholars in the field of behavioral addictions research and the definitional work on the conceptualization of general wellbeing, I argue that a more valid conceptualization of digital wellbeing is attained if we differentiate digital wellbeing and addiction and acknowledge that ubiquitous connectivity brings both value and discomfort to our lives. To that end, four considerations are important.

Consideration 1: avoiding medicalization

A simple way to conceptualize digital wellbeing is to consider it the opposite of digital media addiction. A lack of "addiction symptoms," then, should equate with digital wellbeing. This conceptualization of digital wellbeing falls short, however. It assumes that problems with digital media use are symptomatic of an underlying pathology or mental health disorder: a digital media addiction (Andreassen, 2015; Griffiths, 2019). Such a dependence is diagnosed by gauging the individual's behavior against widely recognized symptoms, such as suffering from withdrawal symptoms when technology is removed, requiring more usage to attain the same effect ("tolerance") and being mentally preoccupied with the technology or its use (cf. Pontes, Kuss, & Griffiths, 2015).

But this technology-addiction-as-a-disease approach (cf. Van der Linden, 2015) is under debate: It medicalizes people's problematic relationship with digital media as a clinical condition, while some scholars even question whether smartphone addiction is a "real" concept (Harris, Regan, Schueler, & Fields, 2020). Of late, steadily more scholars argue against the medicalization implied by the label of "media addiction," because it easily misclassifies users who *occasionally* experience *some* problems with digital media as individuals suffering from a disorder (Billieux, Schimmenti, Khazaal, Maurage, & Heeren, 2015; Kardefelt-Winther et al., 2017; Starcevic, Billieux, &

Schimmenti, 2018). Such misclassification leads to an overpathologization of everyday behaviors and experiences[1] (Billieux et al., 2015). Rather than medicalizing the condition of these false positives as a clinical disorder, it might therefore be more valid to consider the experience of "*sometimes*, having *some* struggles" as one of a lack of digital wellbeing (Cecchinato et al., 2019), rather than as a pathological condition that is so severe that it needs clinical help (Van Rooij & Kardefelt-Winther, 2017).

Consideration 2: acknowledging hedonic and eudemonic experiences

Which criteria need to be met, then, to identify (a lack of) digital wellbeing? Although there is debate among behavioral addictions researchers, the broad consensus is that technology use becomes excessive and problematic when individuals: (a) *lose control* over it, and (b) subsequently experience a significant *functional impairment* in their everyday lives (Kardefelt-Winther et al., 2017; Pies, 2009). While some scholars operationalize these criteria into symptoms that are either present or absent (e.g., Griffiths, 2005), others advocate conceiving of them as continua, ranging from an absence of loss of control and functional impairment to a severe experience of these criteria (Van Rooij & Kardefelt-Winther, 2017).

While this brings nuance to the debate, it still assumes our relation to technology as a unipolar phenomenon that, at best, is "not problematic." Such an approach ignores that people might also develop a positive relationship with digital technologies through hedonic and eudemonic experiences, which are known to contribute to wellbeing (Henderson & Knight, 2012; Huta, 2016; Ryan & Deci, 2001). *Hedonic experiences* occur when we derive pleasure from using digital media, such as when we enjoy entertaining content on our phones (Reinecke & Hofmann, 2016). In fact, it is the hedonic responses that people experience when using digital media that make it so difficult to resist using them (Van Koningsbruggen, Hartmann, Eden, & VeLing, 2017). When these pleasurable experiences are under control, however, these "controlled pleasures" may lead to positive experiences (e.g., Bauer, Loy, Masur, & Schneider, 2017). *Eudemonic experiences* occur when digital media use adds meaning to life, for example because it supports us to achieve personal goals (Lukoff et al., 2018). Such functional support may occur, for example, when digital connectivity aids to master complex logistical arrangements, such as the microcoordination of a group event (Ling & Lai, 2016).

Hedonic and eudemonic experiences form synergetic pathways to wellbeing (cf. Henderson & Knight, 2012). It is conceivable that when people reap hedonic and eudemonic benefits from digital connectivity, their digital wellbeing increases. A definition of digital wellbeing thus needs to consider such benefits by focusing on experiences of controlled pleasure and functional support in addition to experiences of loss of control and functional impairment.

Consideration 3: acknowledging temporal variability and person-specificity

A third consideration is whether our relationship to digital connectivity remains stable over time – and whether this relationship manifests itself similarly across

individuals. Technology addiction is generally assumed to be a temporally stable and structurally invariant condition that can thus be diagnosed with a "one-size-fits-all" screening instrument (e.g., Huang, 2010; Yu & Shek, 2013). Recent literature questions the validity of this assumption. Temporal stability appears an unwarranted assumption, as research shows that excessive media use is sometimes only a temporary—and potentially functional—coping response to a stressful life event (Kardefelt-Winther, 2014, 2017; Li, Zhang, Li, Zhen, & Wang, 2010). Structural invariance also appears an unwarranted assumption, as studies show that problematic use can take on different forms, in relation to the pathways leading to it (Billieux, 2012). Moreover, general screening instruments have difficulty differentiating passionate and enthusiastic media users from pathological users (e.g., Charlton & Danforth, 2007).

The wellbeing literature can help out here. General definitions of wellbeing emphasize that wellbeing is a subjective experience that can fluctuate over time (Diener, Suh, Lucas, & Smith, 1999; Headey & Wearing, 1989), By not defining a priori criteria for what counts as "being well" but by rather approaching wellbeing as an *experiential state*, these definitions accommodate temporal variability in, and person-specific manifestations of, wellbeing. In a similar vein, digital wellbeing can be understood as an experiential state. As with conceptualizations of general wellbeing, this subjective experience of digital wellbeing is assumed to comprise affective states and cognitive appraisals (cf. Diener, 1994; Shmotkin, 2005) that are dynamic: They fluctuate over time as they interact with various internal and external-contextual influences (cf. Cummins, Eckersley, Pallant, Van Vugt, & Misajon, 2003; Headey & Wearing, 1989). In the case of digital wellbeing, however, these emotional and cognitive appraisals reflect one's evaluation of digital connectivity rather than the evaluation of one's life.

Consideration 4: acknowledging ambivalence

Finally, a definition of digital wellbeing needs to consider the joint occurrence of positive and negative experiences. All too often, restricting screen time is proposed as a simple solution to attain digital wellbeing (e.g.,Twenge, 2017). Interventions such as digital detox programs and screen time apps (e.g., Apple Screen Time) build on this assumption. But by attempting to eliminate the negative outcomes of connectivity, we risk sacrificing its positive outcomes (Hiniker et al., 2016, p. 4746). In other words, straightforward constraints on connectivity can deprive users of positively valued aspects of technology use. This could explain why interventions such as smartphone abstinence are often ineffective (e.g., Wilcockson, Osborne and Ellis, 2019). This brings us to the Mobile Connectivity Paradox: The problems we experience with ubiquitous connectivity are an inherent, and therefore inescapable downside of the benefits it provides us with. Because we cannot have one without the other, digital wellbeing is a matter of "optimizing the ambivalence," of carefully adjusting our connectivity so that it provides us with controlled pleasure and

maximally supports us to achieve our goals, while causing a *minimal* degree of functional impairment and loss of control.

This understanding of digital wellbeing echoes scholars' conception of general wellbeing as a "dynamic equilibrium" between personality factors, life events and subjective experiences (Headey & Wearing, 1989). Similarly, digital wellbeing is the outcome of a dynamic equilibrium between the individual benefits and drawbacks that accrue from mobile connectivity.

A definition of digital wellbeing

Taking into consideration the above, I propose a definition of digital wellbeing that does not medicalize people's relationship with technology, assumes that connectivity brings both problems and benefits, acknowledges the subjective and dynamic nature of our experiences with technology, and recognizes the ambivalence of our relationship to technology:

> Digital wellbeing is a subjective individual experience of optimal balance between the benefits and drawbacks obtained from mobile connectivity. This experiential state is comprised of affective and cognitive appraisals of the integration of digital connectivity into ordinary life. People achieve digital wellbeing when experiencing maximal controlled pleasure and functional support, together with minimal loss of control and functional impairment.

Based on this definition, we can now work towards a model of digital wellbeing that allows intra- and interpersonal variability in the balance of benefits and drawbacks. To that end, we must avoid straightforward cause-and-effect thinking, and rather model digital wellbeing as a dynamic system that is influenced by not only person-, but also by device- and context-specific factors.

Towards a dynamic system model of digital wellbeing

Cause-and-effect thinking dominates current research, with several studies straightforwardly linking screen time measures to wellbeing. Twenge, for example, identifies screen time as a direct predictor of mental health problems such as depression (e.g., Twenge, Joiner, Rogers, & Martin, 2018) and even suicidal ideation (e.g., Twenge et al., 2018). Several scholars warn for the "conceptual and methodological mayhem" (cf. Kaye, Orben, Ellis, Hunter, & Houghton, 2020) associated with this approach. For example, re-analyzing Twenge et al.'s (2018) data, Orben and Przybylski (2019) and Ophir, Lipshits-Braziler, and Rosenberg (2019), found negligible associations between digital media use and wellbeing, that were highly contingent on methodological choices, such as item selection procedures, resulting in misleading interpretations. These observations have fueled a call for greater methodological and analytical rigor in this field (e.g., Davidson & Ellis, 2019; Kaye et al., 2020).

While the debate on "digital harm"—and how to best estimate it—rages on (see, e.g. Twenge, Haidt, Joiner, & Campbell's [2020] commentary and Orben and Przybylski's [2020] response), recent evidence shows that screen time in itself appears not as straightforwardly harmful as commonly assumed: If a relationship between screen time and wellbeing exists, it is likely a nuanced, moderate and reciprocal association (Orben and Przybylski, 2019). To examine this association, we have to build conceptual models and use empirical methodologies that disentangle the "many nuanced factors, contexts, situational circumstances, temporal effects, and interactions" (Whitlock & Masur, 2019, p. E2).

A conceptual model of digital wellbeing as a dynamic system can move the debate forward by reducing the risk of making faulty or over-simplified cause-effect judgments. By assuming that experiences of digital wellbeing are not only temporary and idiosyncratic, but also contingent upon a complex constellation of potentially interrelated factors, digital wellbeing is not reduced to a problem of psychologically predisposed individuals who use digital media excessively, but rather recognizes that we live in a deeply mediatized world in which digital devices such as the smartphone have a double-sided nature, "as object, or an instance of material culture" (Miller, 2014, p. 214). As such, our experiences with these interactive, dialogical media (cf. Gergen, 2002) are not only of our own making, but also shaped by devices in their material form, and by normative expectations, behaviors and rituals that pertain to specific social and situational contexts. To answer the question how individuals can attain digital wellbeing, we thus need to understand how *persons*, *devices* and *contexts* interact, and be open to the idea that screen time might not necessarily be the culprit.[2] To that end, we can approach associations between person- device- and context-specific factors as a constellation of pathways in a system that help or hamper specific individual in their quest for digital wellbeing (see Figure 1).

Person-specific factors: a unique user

Research identified several stable personality traits, such as impulsivity (Billieux, Van der Linden, & Rochat, 2008) or a fear-of-missing-out (Franchina, Vanden Abeele, Van Rooij, Lo Coco, & De Marez, 2018; see Table 1 for more examples) that increase one's susceptibility to develop problems with digital media use. A dynamic system model of wellbeing, however, should also include intra-individually variable factors, such as affective and cognitive states that interact with experiences of digital wellbeing, both in direct and indirect ways (see Table 1). Mood, for example, has been found to associate with momentary experiences of media enjoyment (Reinecke & Hofmann, 2016). Another example is state boredom. At work, state boredom is contingent on the momentary context (e.g., time of day, work activity), which may drive people to seek distraction online (Mark, Iqbal, Czerwinski, & Johns, 2014), which can lead to feelings of reduced productivity (Mark, Iqbal, Czerwinski, & Johns, 2015).

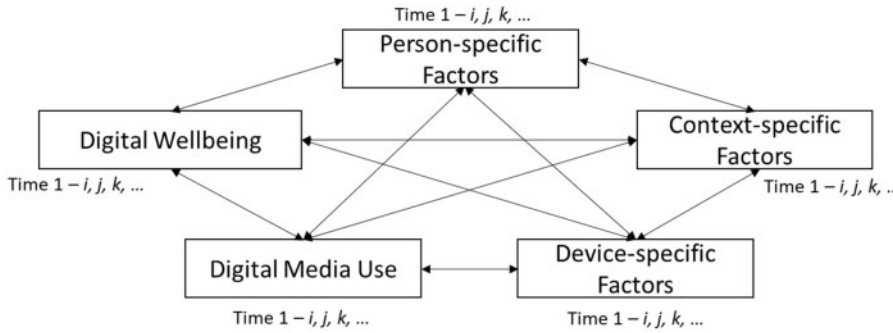

Figure 1 A dynamic system of digital wellbeing.

Recent studies identified some states directly related to digital wellbeing experiences, in the form of affective and cognitive appraisals resulting from digital connectivity (see Table 1). These may be associated with experiences of controlled pleasure, loss of control and of functional support/impairment. For instance, Reinecke et al. (2018) mention a cognitive state "state online vigilance," a state of mental preoccupation with, readiness to respond to and constant monitoring of online content and communication.

For a dynamic system approach to digital wellbeing, it is important not to consider these states in isolation, but to understand that devices and contexts can play a crucial role in producing them. With respect to the device, for example, recent research found that the mere visibility of one's smartphone suffices to trigger online vigilance (Johannes, Veling, Verwijmeren, & Buijzen, 2018). This warrants further investigation of device-specific factors.

Device-specific factors: the danger of the device

Our experience of digital wellbeing cannot be dissociated from our digital media devices. In constant competition over consumer attention, technology developers design devices with operating systems, applications and interfaces that keep users "hooked" (Eyal, 2014; Williams, 2018). Such "addictive design" (cf. Yousafzai, Hussain, & Griffiths, 2014) capitalizes on the fact that humans are evolutionarily hardwired to constantly scan the environment for new information, including of a social nature (Eyal, 2014). Smartphones in particular embed such a reward infrastructure,[3] turning people into "lab rats constantly pressing levers to get tiny pellets of social or intellectual nourishment" (Carr, 2010, p. 117). It is precisely because digital media are so hard to resist to, that people seek ways to manage their "distractive potential" (Hiniker et al., 2016) and reduce the "toll of overconnection" (Baym, Wagman, & Persaud, 2020).

Digital media such as smartphones operate on an underlying technological infrastructure that is built on the premise of portability, availability, locatability, and

Table 1 Examples of Stable and Dynamic Person-, Device- and Context-Specific Factors Associated Experiences of Digital Wellbeing

Person-specific factors	
Affective and cognitive appraisals of digital connectivity	
Online vigilance	Reinecke et al. (2018)
Cognitive overload	Steele, Hall, and Christofferson (2020)
Digital stress	Steele, Hall, and Christofferson (2020)
Social approval anxiety	Steele, Hall, and Christofferson (2020)
Digital stress	Steele, Hall, and Christofferson (2020)
Media enjoyment	Reinecke and Hofmann (2016)
Screen time guilt/shame	Du, van Koningsbruggen, and Kerkhof (2018); Reinecke and Hofmann, (2016)
Stable traits	
Impulsivity	Billieux, Van der Linden, and Rochat (2008)
Trait anxiety	Elhai, Levine, Dvorak, and Hall (2016)
Self-control	Reinecke and Hofmann (2016)
Trait fear-of-missing-out	Franchina et al. (2018)
Momentary affective and cognitive states	
Mood	Reinecke and Hofmann (2016)
Stress	Aalbers, McNally, Heeren, de Wit, and Fried (2019)
Exhaustion	Reinecke and Hofmann (2016)
State boredom	Mark, Iqbal, Czerwinski, and Johns (2014)
Mindfulness	Baym, Wagman, and Persaud (2020); Bauer, Loy, Masur, and Schneider (2017)
State fear-of-missing-out	Elhai, Rozgonjuk, Liu, and Yang (2020)
Device-specific factors	
Stable characteristics	
Longer-term abstinence	Baym, Wagman, and Persaud (2020)
Smartphone resistance	Ribak and Rosenthal (2015)
Operating systems and embedded digital wellbeing functionalities	Lyngs et al. (2019); Specker Sullivan and Reiner (2019)
App installed, including digital wellbeing apps	Hiniker et al. (2016); Lyngs et al. (2019); Specker Sullivan and Reiner (2019)
App settings/features	Lyngs et al. (2020); Fitz et al. (2019)
Momentary characteristics	
Short-term abstinence	Eijnden, Doornwaard, and Bogt (2017)
Device mere presence	Przybylski and Weinstein (2012); Johannes, Veling, Verwijmeren, and Buijzen (2018)
Notifications	Johannes, Veling, Verwijmeren, and Buijzen (2018)

(*Continued*)

Table 1 (continued)

Person-specific factors	
Algorithmic curation	Horeck, Jenner, and Kendall (2018)
Post-play function	Horeck, Jenner, and Kendall (2018)
Device-induced behaviors	
Media repertoires	Stragier, Hendrickson, Vanden Abeele and De Marez (2019)
Habitual checking routines	Bayer, Campbell and Ling (2016)
Binge behaviors	Flayelle, Maurage, Vögele, Karila, and Billieux (2019)
Context-specific factors	
Stable characteristics	
Times and places with clear boundaries	Baron and af Segerstad (2010)
Momentary characteristics	
Competing goals & obligations, potentially from competing social roles	Hofmann, Reinecke, and Meier (2016); Chesley (2005)
Real and perceived pressure to (dis-)connect	Licoppe and Smoreda (2005); Quan-Haase and Collins (2008)
Availability and reciprocity norms	Hall and Baym (2012); Laursen (2005); Taylor and Harper (2003)
Formal and informal rules, expectations, policies, punishments, and rewards	Piszczek (2017)
Socio-cultural transformations of society	
Commodification of attention	Specker Sullivan and Reiner (2019); Williams (2018)
Acceleration	Rosa (2013); Wajcman (2008, 2015)
(Control) Responsibilization	Vanden Abeele, de Wolf and Ling (2018)

multimediality (Schrock, 2015). Although the choice for a particular device, app or app settings is often personally motivated, such choices may have a durable impact on experiences of digital wellbeing. For instance, the choice for a "dumb phone" might self-protect individuals against the (feared) impact of overconnection (Morrison & Gomez, 2014; see Table 1 for more factors).

Not all our device interactions are the straightforward result of choices. System features such as notification systems, for instance, depend on external parties that "notify." Notifications embody mobile technologies' interactive and dialogical nature (cf. Gergen, 2002). They alert the user of potentially rewarding, dynamically updated, information (Oulasvirta, Rattenbury, Ma, & Raita, 2011), such as that others attempt to engage with them (Bayer, Campbell, & Ling, 2016). This dynamic element may affect digital wellbeing experiences, for instance by activating a state of vigilance in the user (Johannes et al., 2018).

Devices-specific factors may also influence digital wellbeing via their contribution to distinct behavioral patterns, such as fragmentation and habituation (Bayer, Campbell, & Ling, 2016; Deng et al., 2019). These are associated with dynamic content applications and system features such as haptic feedback features (Bayer et al., 2016; Oulasvirta et al., 2011). Similarly, notifications (Bayer et al., 2016; Schnauber-Stockmann et al., 2018), post-play functions and algorithmic curation (Horeck, Jenner, & Kendall, 2018) can become gateways to lengthier usage sessions and binge behaviors—sometimes referred to as "going down the rabbit hole" (Collier, 2016). Such events can affect digital wellbeing, for example by inducing feelings of guilt or shame over one's procrastination (cf. Du, van Koningsbruggen, & Kerkhof, 2018; Reinecke & Hofmann, 2016).

We do not interact with their devices in a vacuum, however: The interactive and dialogical nature of digital media implies that our use of them cannot be considered in separation from our social context.

Context-specific factors: a culture of connectivity

We live in a context of ubiquitous connectivity now that persons—and increasingly also objects—have become individually addressable. As a result, we must negotiate how to respond to the demands and expectations stemming from this addressability (Vanden Abeele et al., 2018). Some contexts come with time and/or place constraints on connectivity that can be anticipated, and are therefore relatively stable: During flights or in movie theatres, connectivity is constrained and sometimes even prohibited. In other contexts, such as a formal board meeting, rules may be more implicit but nonetheless expected. When contexts set clear boundaries for connectivity, they may impact our experienced digital wellbeing: Forced (dis-)connectivity may be enjoyed or missed, and meaningful or meaningless.

In other contexts, bounds to connectivity may be less clear, requiring a more active negotiation. There may be solitary contexts in which digital connectivity needs to be negotiated because it competes with personal goals and obligations (Hofmann, Reinecke, & Meier, 2016), for instance, when using digital media while studying. Facing such goal conflicts, people have to weigh (often short-term) rewards from media use against more remote goals such as obtaining a degree or acquiring a new skill.

Other situations that may require a negotiation over connectivity may stem from our membership to social groups and institutional contexts. People perform various social roles in such groups and institutions. Because mobile connectivity affords them to activate these social roles irrespective of space and time, roles may blur. Thus, individuals have to negotiate their connectivity in accordance to the momentary goals and obligations pertaining to each role (Vanden Abeele et al., 2018). A parent must negotiate, for example, whether a work email is urgent enough to give it priority over playing with their child.

In the same vain, people may experience pressure from normative expectations concerning availability and reciprocity in their groups and institutions (Hall & Baym, 2012; Laursen, 2005; Licoppe & Smoreda, 2005; Quan-Haase & Collins, 2008; Taylor & Harper, 2003). These expectations are often tacit, but in institutional contexts these may be formalized as rules and policies such as those concerning telework or email-after-work-hours (e.g., Piszczek, 2017). Digital wellbeing may depend on the demands that these expectations place on one's (dis-)connectivity. Especially when demands from one's social groups and institutional contexts conflict, digital wellbeing may suffer. Expectations, rules and polices surrounding connectivity can reproduce underlying power hierarchies (e.g., Licoppe & Smoreda, 2005), so that, for exanple, employees perceive normative pressure to respond to their employer's emails after work hours, resulting in the experience "availability stress" (cf. Steele, Hall, & Christofferson, 2020) in response to email notifications. They may keep responding to these emails nonetheless, out of fear for a negative evaluation.

Finally, distinct from the above solitary, group and institutional contexts mentioned above and in Table 1, we may also consider the impact of broader socio-cultural transformations on digital wellbeing. Addictive design is indicative of an increasing commodification of our attention by "invisible virtual employers" who often—without our explicit consent or even awareness—blur our roles as consumer and worker (Van Dijck, 2014; Vanden Abeele et al., 2018; Williams, 2018). We may also look at processes of acceleration (Rosa, 2013; Wajcman, 2015) and individual responsibilization (Vanden Abeele et al., 2018) as broader contexts that shape digital wellbeing experiences.

Digital wellbeing interventions: disrupting the system?

According to Thrift (2004), repetitive patterns in our way of doing things often reveal invisible "performative infrastructures" that characterize the "track-and-trace" model of contemporary society (Thrift, 2004). Representing digital wellbeing as a dynamic system makes such performative infrastructures visible in the form of pathways between person-, device- and context-specific factors that interact to produce experiences of digital wellbeing. Digital wellbeing interventions, then, can be understood as potential *disruptors* of the system via their effects on these pathways. Recent work of Baym et al. (2020), for example shows how a period of Facebook abstinence led to greater mindful scrolling—which solved some (but not all) issues with overconnection.

Recent scholarly work within the Human-Computer Interaction (HCI) community is of value here. Scholars have classified various relevant features in these interventions (e.g., Roffarello & De Russis, 2019), identified mechanisms explaining why features "work"—or not (e.g., Lyngs et al., 2019), and developed agendas for researching the design and development of digital wellbeing interventions (e.g., Cecchinato et al., 2019; Hiniker et al., 2016). These efforts align with the adoption of a dynamic systems approach when they acknowledge the complex and person-specific nature of digital wellbeing, and its contingency on personal characteristics

and preferences, contexts of use and design choices embedded in technology (e.g., Hiniker et al., 2016; Lyngs et al., 2019; Lyngs et al., 2020). Future research in this area will benefit from an additional focus on within-person fluctuations, and the potential idiosyncracy of these mechanisms. This can also help to differentiate the various levels at which interventions may be addressed, such as the level of the technology (e.g., a digital tool that limits connectivity), the individual (e.g., in the shape of self-imposed restrictions on connectivity), the group (e.g., household screen use rules) and the institution (e.g., workplace policies). Research might identify that disruption occurs in multiple pathways simultaneously, thereby potentially amplifying or dampening an intervention's total effect. Digital detoxes, for example, may reduce availability stress, but simultaneously activate users' fear of missing out, leading to a zero sum effect on a user's appreciation of connectivity.

Researching digital wellbeing: methodological implications

A dynamic system approach to digital wellbeing can foster discussion on digital media use effects. In such a dynamic system approach, antecedents and outcomes still matter. Dynamic and stable factors may influence individual system components and repeated experiences of (a lack of) digital wellbeing may have longer-term consequences for an individual's wellbeing. However, by assuming intra-individual variability rather than a one-size-fits-all pattern, and by accounting for the ambivalence that individuals may experience in relation to ubiquitous connectivity—grateful in one moment, and frustrated the next—it overcomes limitations of extant research approaches.

A dynamic system approach to digital wellbeing has empirical implications. It requires innovative data collection techniques and research methodologies that can expose repetitions in our way of doing things, so that we can lift the veil on the technological unconsciousness (cf. Thrift, 2004). This implies that methods relying on self-reports of media behavior are not an optimal choice: They are notoriously inaccurate as the frequent, fragmented and habitual nature of media behaviors makes it difficult to retrieve them from memory (Vanden Abeele, Beullens, & Roe, 2013). Moreover, inaccuracies in self-reported media use also correlate with psycho-social wellbeing (Sewall et al., 2020), casting doubt on the validity of self-reported associations between screen time and wellbeing.

Device logging and mobile experience sampling are promising alternatives. These data collection techniques can capture *in situ* experiences, and can assess idiosyncratic manifestations of digital wellbeing: Device logging can document patterns in digital media use behaviors, identifying bursts of activity as well as repetitive behaviors occurring daily, weekly, and over longer durations (Stragier, Hendrickson, Vanden Abeele & De Marez, 2019). Additionally, relevant dynamic device- and context specific factors, such as the amount of incoming notifications and the spatio-temporal context of device use, can be logged. Mobile experience sampling, a systematic data collection technique based on the diary method

(Csikszentmihalyi & Larson, 2014), can inform about individuals' momentary experiences in a low-threshold and non-time-consuming way (Karnowski, 2013). Data about their momentary cognitive/affective states and situational contexts can be used to build models that explain how processes take place within an individual (i.e., are idiosyncratic), how processes are linked over different time scales, and to what extent processes differ across individuals (Keijsers & van Roekel, 2018).

Both smartphone logging and mobile experience sampling are promising tools to unearth temporal, non-linear, and reciprocal relationships (Whitlock & Masur, 2019). The implication for media effects researchers is that they will have to embrace the computational turn in media effects studies by, for instance, adopting machine learning techniques to extract "patterned behavior" from device logs, network modelling techniques to examine the dynamic nature of digital wellbeing systems, and advanced time series modelling techniques to examine whether repeated failures in experiencing digital wellbeing predict short-, but also longer-term wellbeing outcomes such as burnout and depression.

Similarly, for interpretive-critical scholarship these data collection techniques imply that researchers must embrace the developing digital ethnographic turn in culture studies, using novel approaches such as "appnography" or log/experience sampling data as cultural probes. Appnography approaches apps as intermediaries of culture: An analysis of such hybrid offline-online digital spaces can reveal how users, app features and contexts work together in (re-)producing ideologies and power structures (Cousineau, Oakes, & Johnson, 2019). To gain greater insight of the *in situ* experiences of individuals, device logs represent "snapshots" that can probe users to reflect on prior digital wellbeing experiences (Kaufmann, 2018). Additionally, researchers can embrace qualitative alternatives to experience sampling, such as asking individuals to document momentary experiences via mobile messaging, using words, pictures, video, emoji, hashtags, etc. (Kaufmann & Peil, 2019) to help reveal what digital wellbeing means to individual users, and how digital wellbeing experiences intersect with broader aspects of culture.

Conclusion

When building representations of reality, scholars need to consider how to conceptually and empirically approach the phenomenon of interest. Current research on the relationship between digital media use and wellbeing is in an impasse, because conceptual models appear inadequate to capture the complexity of the relationships that individuals have with digital media, and empirical approaches lead to inconsistent findings and are criticized for lacking methodological rigor. I argue that we can overcome this impasse by building a new theory of digital wellbeing that focuses on momentary experiences of balance between connectivity and disconnectivity. These experiences arise out of interactions between persons, devices and contexts that can be modelled and empirically investigated as pathways in a dynamic system of wellbeing.

A dynamic system approach to digital wellbeing can bring new insight into the mechanisms that lead people to experience problems with digital media use. Moreover, it can help understand under which circumstances digital wellbeing interventions such as digital detox programs or screen time tools are more or less successful.

Notes

1 For example, often inspired by anecdotal observation (Billieux et al., 2015), ordinary behaviors such as "dancing," or "selfie taking" are transformed into a pathology by developing a diagnostic screening tool and using it in a large population to confirm their incidence (e.g., Balakrishnan & Griffiths, 2018; Maraz, Urbán, Griffiths, & Demetrovics, 2015). The screening tools, however, sometimes screen for harmless—if not positive aspects of the behavior. This procedure become more than a fad when scholars plea for formal inclusion of these assessments in psychiatric diagnostic manuals (e.g., Bragazzi & Del Puente, 2014). A recent systematic review of problematic smartphone use scales by Harris et al. (2020) does an excellent job of identifying the many issues associated with current measurement instruments.

2 On the contrary, in a society where media use is integrated deeply into every social domain, the physical world may even cast a shadow on pleasurable or meaningful experiences with technology.

3 Note that a recent study by Johannes, Dora, and Rusz (2019) supports the notion that social media apps are perceived as high in reward, but refutes the idea that these rewards capture attention.

References

Aagaard, J. (2020). Digital akrasia: A qualitative study of phubbing. *AI & Society*, *35*, 237–244. doi:10.1007/s00146-019-00876-0

Aalbers, G., McNally, R. J., Heeren, A., de Wit, S., & Fried, E. I. (2019). Social media and depression symptoms: A network perspective. *Journal of Experimental Psychology: General*, *148*(8), 1454–1462. doi:10.1037/xge0000528.supp

Andreassen, C. S. (2015). Online social network site addiction: A comprehensive review. *Current Addiction Reports*, *2*(2), 175–184. doi:10.1007/s40429-015-0056-9

Anrijs, S., Bombeke, K., Durnez, W., Van Damme, K., Vanhaelewyn, B., Conradie, P., … Ponnet, K. (2018). *MobileDNA: Relating physiological stress measurements to smartphone usage to assess the effect of a digital detox.* Paper presented at the International Conference on Human-Computer Interaction.

Ardes, A. (2018). Google and the Rise of 'Digital Well-Being'. *Wired Magazine.* Retrieved from https://www.wired.com/story/google-and-the-rise-of-digital-wellbeing/.

Balakrishnan, J., & Griffiths, M. D. (2018). An exploratory study of "selfitis" and the development of the selfitis behavior scale. *International Journal of Mental Health and Addiction*, *16*(3), 722–736. doi:10.1007/s11469-017-9844-x

Baron, N. S., & af Segerstad, Y. H. (2010). Cross-cultural patterns in mobile-phone use: Public space and reachability in Sweden, the USA and Japan. *New Media & Society*, *12*(1), 13–34. doi:10.1177/1461444809355111

Bauer, A. A., Loy, L. S., Masur, P. K., & Schneider, F. M. (2017). Mindful instant messaging: Mindfulness and autonomous motivation as predictors of well-being in smartphone communication. *Journal of Media Psychology: Theories, Methods, and Applications*, *29*(3), 159–165. doi:10.1027/1864-1105/a000225

Bayer, J. B., & Campbell, S. W. (2012). Texting while driving on automatic: Considering the frequency-independent side of habit. *Computers in Human Behavior*, *28*(6), 2083–2090. doi:10.1016/j.chb.2012.06.012

Bayer, J. B., Campbell, S. W., & Ling, R. (2016). Connection cues: Activating the norms and habits of social connectedness. *Communication Theory*, *26*(2), 128–149. doi:10.1111/comt.12090

Baym, N. K., Wagman, K. B., & Persaud, C. J. (2020). Mindfully scrolling: Rethinking Facebook after time deactivated. *Social Media + Society*, *6*(2). doi:10.1177/2056305120919105

Billieux, J. (2012). Problematic use of the mobile phone: A literature review and a pathways model. *Current Psychiatry Reviews*, *8*(4), 299–307. doi:10.2174/157340012803520522

Billieux, J., Schimmenti, A., Khazaal, Y., Maurage, P., & Heeren, A. (2015). Are we overpathologizing everyday life? A tenable blueprint for behavioral addiction research. *Journal of Behavioral Addictions*, *4*(3), 119–123. doi:10.1556/2006.4.2015.009

Billieux, J., Van der Linden, M., & Rochat, L. (2008). The role of impulsivity in actual and problematic use of the mobile phone. *Applied Cognitive Psychology*, *22*(9), 1195–1210. doi:10.1002/acp.1429

Bragazzi, N. L., & Del Puente, G. (2014). A proposal for including nomophobia in the new DSM-V. *Psychology Research and Behavior Management*, *7*, 155–160. doi:10.2147/PRBM.S41386

Büchi, M., Festic, N., & Latzer, M. (2019). Digital overuse and subjective well-being in a digitized society. *Social Media + Society*, *5*(4), 1–12. doi:10.1177/2056305119886031

Carr, N. (2010). *The shallows: What the Internet is doing to our brains*. New York: W. W. Norton & Company.

Castells, M., Fernandez-Ardevol, M., Qiu, J. L., & Sey, A. (2009). *Mobile communication and society: A global perspective*. Cambridge, MA: MIT Press.

Cecchinato, M. E., Rooksby, J., Hiniker, A., Munson, S., Lukoff, K., Ciolfi, L., . . . Harrison, D. (2019). *Designing for digital wellbeing: A research & practice agenda*. Paper presented at the Extended Abstracts of the 2019 CHI Conference on Human Factors in Computing Systems.

Charlton, J. P., & Danforth, I. D. (2007). Distinguishing addiction and high engagement in the context of online game playing. *Computers in Human Behavior*, *23*(3), 1531–1548. doi:10.1016/j.chb.2005.07.002

Chesley, N. (2005). Blurring boundaries? Linking technology use, spillover, individual distress, and family satisfaction. *Journal of Marriage and Family*, *67*(5), 1237–1248. doi:10.1111/j.1741-3737.2005.00213.x

Collier, R. (2016). Mental health in the smartphone era. *CMAJ*, *188*(16), 1141–1142. doi:10.1503/cmaj.109-5336

Cousineau, L. S., Oakes, H., & Johnson, C. W. (2019). Appnography: Modifying ethnography for app-based culture. In D. Parry, C. Johnson, & S. Fullagar (Eds.), *Digital dilemmas* (pp. 95–117). Cham, Switzerland: Palgrave Macmillan.

Csikszentmihalyi, M., & Larson, R. (2014). Validity and reliability of the experience-sampling method. In Csikszentmihalyi M. (ed.), *Flow and the foundations of positive psychology* (pp. 35–54). Dordrecht, the Netherlands: Springer.

Cummins, R. A., Eckersley, R., Pallant, J., Van Vugt, J., & Misajon, R. (2003). Developing a national index of subjective wellbeing: The Australian Unity Wellbeing Index. *Social Indicators Research*, *64*(2), 159–190. doi:10.1023/A:1024704320683

Davidson, B. I., & Ellis, D. A. (2019). *Avoiding irrelevance: The manifestation and impacts of technophobia in psychological science*. Preprint. PsyArXiv.

Deci, E. L., Ryan, R. M. (2008). Hedonia, eudaimonia, and well-being: an introduction. *Journal of Happiness Studies*, *9*(1), 1–11. doi:10.1007/s10902-006-9018-1

Deng, T., Kanthawala, S., Meng, J., Peng, W., Kononova, A., Hao, Q., . . . David, P. (2019). Measuring smartphone usage and task switching with log tracking and self-reports. *Mobile Media & Communication*, *7*(1), 3–23. doi:10.1177/2050157918761491

Diener, E. (1994). Assessing subjective well-being: Progress and opportunities. *Social Indicators Research*, *31*(2), 103–157. doi:10.1007/BF01207052

Diener, E., Suh, E. M., Lucas, R. E., & Smith, H. L. (1999). Subjective well-being: Three decades of progress. *Psychological Bulletin*, *125*(2), 276–302.

Dscout. (2016). Mobile touches: Dscout's inaugural study on humans and their tech. Retrieved from https://blog.dscout.com/mobile-touches

Du, J., van Koningsbruggen, G. M., & Kerkhof, P. (2018). A brief measure of social media self-control failure. *Computers in Human Behavior*, *84*, 68–75.

Duke, É., & Montag, C. (2017). Smartphone addiction, daily interruptions and self-reported productivity. *Addictive Behaviors Reports*, *6*, 90–95. doi:10.1016/j.abrep.2017.07.002

Eijnden, R. V. D., Doornwaard, S., & Bogt, T. T. (2017). OP-117: Are smartphone dependence symptoms related to FoMO, craving and withdrawal symptoms during smartphone abstinence? Findings from a natural experiment. *Journal of Behavioral Addictions*, *6*, 56.

Elhai, J. D., Levine, J. C., Dvorak, R. D., & Hall, B. J. (2016). Fear of missing out, need for touch, anxiety and depression are related to problematic smartphone use. *Computers in Human Behavior*, *63*, 509–516. doi:10.1016/j.chb.2016.05.079

Elhai, J. D., Rozgonjuk, D., Liu, T., & Yang, H. (2020). Fear of missing out predicts repeated measurements of greater negative affect using experience sampling methodology. *Journal of Affective Disorders*, *262*, 298–303. doi:10.1016/j.jad.2019.11.026

Eyal, N. (2014). *Hooked: How to build habit-forming products*. New York, USA: Penguin.

Fitz, N., Kushlev, K., Jagannathan, R., Lewis, T., Paliwal, D., & Ariely, D. (2019). Batching smartphone notifications can improve well-being. *Computers in Human Behavior*, *101*, 84–94. doi:10.1016/j.chb.2019.07.016

Flayelle, M., Maurage, P., Vögele, C., Karila, L., & Billieux, J. (2019). Time for a plot twist: Beyond confirmatory approaches to binge-watching research. *Psychology of Popular Media Culture*, *8*(3), 308–318. doi:10.1037/ppm0000187

Franchina, V., Vanden Abeele, M. M. P., Van Rooij, A., Lo Coco, G., & De Marez, L. (2018). Fear of missing out as a predictor of problematic social media use and phubbing behavior among Flemish adolescents. *Int. J. Environ. Res. Public Health*, 15, 2319. doi:10.3390/ijerph15102319

Gergen, K. J. (2002). The challenge of absent presence. In J. E. Katz & M. A. Aakhus (Eds.), *Perpetual contact: Mobile communication, private talk, public performance* (pp. 227–241). Oxford, England: Oxford University Press.

Griffiths, M. D. (2005). A 'components' model of addiction within a biopsychosocial framework. *Journal of Substance Use*, *10*(4), 191–197. doi:10.1080/14659890500114359

Griffiths, M. D. (2019). The evolution of the components model of addiction and the need for a confirmatory approach in conceptualizing behavioral addictions. *Düşünen Adam: The Journal of Psychiatry and Neurological Sciences*, *32*, 179–184. doi: 10.14744/DAJPNS.2019.00027

Hall, J. A., & Baym, N. K. (2012). Calling and texting (too much): Mobile maintenance expectations,(over) dependence, entrapment, and friendship satisfaction. *New Media & Society*, *14*(2), 316–331. doi:10.1177/1461444811415047

Harris, B., Regan, T., Schueler, J., & Fields, S. A. (2020). Problematic mobile phone and smartphone use scales: A systematic review. *Frontiers in Psychology*, *11*, 672. doi: 10.3389/fpsyg.2020.00672

Headey, B., & Wearing, A. (1989). Personality, life events, and subjective well-being: Toward a dynamic equilibrium model. *Journal of Personality and Social Psychology*, *57*(4), 731–739. doi:10.1037/0022-3514.57.4.731

Henderson, L. W., & Knight, T. (2012). Integrating the hedonic and eudaimonic perspectives to more comprehensively understand wellbeing and pathways to wellbeing. *International Journal of Wellbeing*, *2*(3), 196–221. doi:10.5502/ijw.v2i3.3

Hiniker, A., Hong, S., Kohno, T., & Kientz, J. A. (2016). *MyTime: Designing and evaluating an intervention for smartphone non-use*. Paper presented at the Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems, San Jose, CA.

Hofmann, W., Reinecke, L., & Meier, A. (2016). Self-control as a moderator of the effects of media use on well-being. In L. Reinecke & M. B. Oliver (Eds.), *The Routledge handbook of media use and well-being: International perspectives on theory and research on positive media effects* (pp. 211–222). New York: Routledge.

Horeck, T., Jenner, M., & Kendall, T. (2018). On binge-watching: Nine critical propositions. *Critical Studies in Television*, *13*(4), 499–504. doi:10.1177/1749602018796754

Huang, C. (2010). Internet addiction: Stability and change. *European Journal of Psychology of Education*, *25*(3), 345–361. doi:10.1007/s10212-010-0022-9

Huta, V. (2016). An overview of hedonic and eudaimonic well-being concepts. In L. Reinecke & M. B. Oliver (Eds.), *Handbook of media use and well-being: International perspectives on theory and research on positive media effects* (pp. 14–33). New York: Routledge.

ITU. (2017). *ICT Facts and Figures 2017*. Retrieved from https://www.itu.int/en/ITU-D/Statistics/Documents/facts/ICTFactsFigures2017.pdf.

Jiang, J. (2018). *How Teens and Parents Navigate Screen Time and Device Distractions*. Retrieved from http://assets.pewresearch.org/wp-content/uploads/sites/14/2018/08/21153052/PI_2018.08.22_teens-screentime_FINAL.pdf:.

Johannes, N., Dora, J., & Rusz, D. (2019). Social smartphone apps do not capture attention despite their perceived high reward value. *Collabra: Psychology & Marketing*, *5*(1), 1–14. doi:10.1525/collabra.207

Johannes, N., Veling, H., Verwijmeren, T., & Buijzen, M. (2018). Hard to resist? The effect of smartphone visibility and notifications on response inhibition. *Journal of Media Psychology: Theories, Methods, and Applications*, *31*(3), 214–225. doi:10.1027/1864-1105/a000248

Kardefelt-Winther, D. (2014). The moderating role of psychosocial well-being on the relationship between escapism and excessive online gaming. *Computers in Human Behavior*, *38*, 68–74. doi:10.1016/j.chb.2014.05.020

Kardefelt-Winther, D. (2017). Conceptualizing Internet use disorders: Addiction or coping process? *Psychiatry and Clinical Neurosciences*, *71*(7), 459–466. doi:10.1111/pcn.12413

Kardefelt-Winther, D., Heeren, A., Schimmenti, A., van Rooij, A., Maurage, P., Carras, M., . . . Billieux, J. (2017). How can we conceptualize behavioural addiction without pathologizing common behaviours? *Addiction*, *112*(10), 1709–1715. doi:10.1111/add

Karnowski, V. (2013). Befragung in situ: Die Mobile Experience Sampling Method (MESM). In W. Möhring & D. Schlütz (Eds.), *Handbuch standardisierte Erhebungsverfahren in der Kommunikationswissenschaft* (pp. 235–247). Wiesbaden, Germany: Springer.

Kaufmann, K. (2018). The smartphone as a snapshot of its use: Mobile media elicitation in qualitative interviews. *Mobile Media & Communication*, *6*(2), 233–246. doi: 10.1177/2050157917743782

Kaufmann, K., & Peil, C. (2019). The mobile instant messaging interview (MIMI): Using WhatsApp to enhance self-reporting and explore media usage in situ. *Mobile Media & Communication*, *8*(2), 229–246. doi:10.1177/2050157919852392

Kaye, L. K., Orben, A., Ellis, D. A., Hunter, S. C., & Houghton, S. (2020). The conceptual and methodological mayhem of "screen-time". *International Journal of Environmental Research and Public Health*, *17*, 3661. doi:10.3390/ijerph17103661

Keijsers, L., & van Roekel, E. (2018). Longitudinal methods in adolescent psychology: Where could we go from here? And should we? In *Reframing adolescent research* (pp. 70–91). London, UK: Routledge.

Lanaj, K., Johnson, R. E., & Barnes, C. M. (2014). Beginning the workday yet already depleted? Consequences of late-night smartphone use and sleep. *Organizational Behavior and Human Decision Processes*, *124*(1), 11–23. doi:10.1016/j.obhdp.2014.01.001

Laursen, D. (2005). Please reply! The replying norm in adolescent SMS communication. In R. Harper, L. Palen, & A. Taylor (Eds.), *The inside text* (pp. 53–73). Dordrecht, The Netherlands: Springer.

Lee, U., Lee, H., & Park, J. (2019). *Positive Computing for Digital Wellbeing*. Retrieved from http://mentalhealth.media.mit.edu/wp-content/uploads/sites/15/2019/04/CMH2019_paper_41.pdf

Li, D., Zhang, W., Li, X., Zhen, S., & Wang, Y. (2010). Stressful life events and problematic Internet use by adolescent females and males: A mediated moderation model. *Computers in Human Behavior*, *26*(5), 1199–1207. doi:10.1016/j.chb.2010.03.031

Licoppe, C., & Smoreda, Z. (2005). Are social networks technologically embedded? *Social Networks*, *27*(4), 317–335. doi:10.1016/j.socnet.2004.11.001

Ling, R. (2012). *Taken for grantedness: The embedding of mobile communication into society*. MIT Press.

Ling, R. (2017). A brief history of individual addressability: The role of mobile communication in being permanently connected. In P. Vorderer, D. Hefner, L. Reinecke, & C. Klimmt (Eds.), *Permanently online, permanently connected* (pp. 24–31). London, England: Routledge.

Ling, R., & Lai, C. H. (2016). Microcoordination 2.0: Social coordination in the age of smartphones and messaging apps. *Journal of Communication*, *66*(5), 834–856. doi: 10.1111/jcom.12251

Loid, K., Täht, K., & Rozgonjuk, D. (2020). Do pop-up notifications regarding smartphone use decrease screen time, phone checking behavior, and self-reported problematic

smartphone use? evidence from a two-month experimental study. *Computers in Human Behavior*, *102*, 22–30. doi:10.1016/j.chb.2019.08.007

Lukoff, K., Yu, C., Kientz, J., & Hiniker, A. (2018). What makes smartphone use meaningful or meaningless? *Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies*, *2*(1), 1–26.

Lyngs, U., Lukoff, K., Slovak, P., Binns, R., Slack, A., Inzlicht, M., . . . Shadbolt, N. (2019). *Self-control in cyberspace: Applying dual systems theory to a review of digital self-control tools*. Paper presented at the Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems.

Lyngs, U., Lukoff, K., Slovak, P., Seymour, W., Webb, H., Jirotka, M., . . . Shadbolt, N. (2020). *'I Just Want to Hack Myself to Not Get Distracted': Evaluating Design Interventions for Self-Control on Facebook*. arXiv Preprint.

Maraz, A., Urbán, R., Griffiths, M. D., & Demetrovics, Z. (2015). An empirical investigation of dance addiction. *PLoS One*, *10*(5), 1–13. doi:10.1371/journal.pone.0125988

Mark, G., Iqbal, S. T., Czerwinski, M., & Johns, P. (2014). *Bored Mondays and focused afternoons: The rhythm of attention and online activity in the workplace*. Paper presented at the Proceedings of the SIGCHI Conference on Human Factors in Computing Systems.

Mark, G., Iqbal, S., Czerwinski, M., & Johns, P. (2015). *Focused, aroused, but so distractible: Temporal perspectives on multitasking and communications*. Paper presented at the Proceedings of the 18th ACM Conference on Computer Supported Cooperative Work & Social Computing.

Mason, B. (2018). *Digital wellbeing in the twenty-first century*. Retrieved from https://digitalsocial.eu/images/upload/42-D3.4%20Trend%20-%20Digital%20Wellbeing_p002-018_split.pdf.

McDaniel, B. T., & Drouin, M. (2019). Daily technology interruptions and emotional and relational well-being. *Computers in Human Behavior, 99, 1–8.* doi:10.1016/j.chb.2019.04.027

Miller, J. (2014). The fourth screen: Mediatization and the smartphone. *Mobile Media & Communication*, *2*(2), 209–226. doi:10.1177/2050157914521412

Morrison, S. L., & Gomez, R. (2014). Pushback: Expressions of resistance to the "evertime" of constant online connectivity. *First Monday*, *19*(8). doi:10.5210/fm.v19i8.4902

Ophir, Y., Lipshits-Braziler, Y., & Rosenberg, H. (2019). New-media screen time is not (necessarily) linked to depression: Comments on Twenge, Joiner, Rogers, and Martin (2018). *Clinical Psychological Science*, *8*(2), 374–378. doi:10.1177/2167702619849412

Orben, A., & Przybylski, A. K. (2019). The association between adolescent well-being and digital technology use. *Nature Human Behaviour*, *3*(2), 173–182. doi:10.1038/s41562-018-0506-1

Orben, A., & Przybylski, A. K. (2020). Reply to: Underestimating digital media harm. *Nature Human Behaviour*, *4*(4), 349–351. doi:10.1038/s41562-020-0840-y

Oulasvirta, A., Rattenbury, T., Ma, L., & Raita, E. (2011). Habits make smartphone use more pervasive. *Personal and Ubiquitous Computing*, *16*(1), 105–114. doi:10.1007/s00779-011-0412-2

Paul, L., & Talbott, E. (2017). *Global Mobile Consumer Survey 2016: UK Cut.* Retrieved from https://www2.deloitte.com/uk/en/pages/technology-media-and-telecommunications/articles/digital-wellbeing.html.

Pies, R. (2009). Should DSM-V designate "Internet addiction" a mental disorder? *Psychiatry (Edgmont)*, *6*(2), 31–37.

Piszczek, M. M. (2017). Boundary control and controlled boundaries: Organizational expectations for technology use at the work–family interface. *Journal of Organizational Behavior*, *38*(4), 592–611. doi:10.1002/job.2153

Pontes, H. M., Kuss, D. J., & Griffiths, M. D. (2015). Clinical psychology of Internet addiction: A review of its conceptualization, prevalence, neuronal processes, and implications for treatment. *Neuroscience & Neuroeconomics*, *4*, 11–23. doi:10.2147/NAN.S60982

Przybylski, A. K., & Weinstein, N. (2012). Can you connect with me now? How the presence of mobile communication technology influences face-to-face conversation quality. *Journal of Social and Personal Relationships*, *30*(3), 237–246. doi:10.1177/0265407512453827

Quan-Haase, A., & Collins, J. L. (2008). I'm there, but I might not want to talk to you. *Information, Communication & Society*, *11*(4), 526–543. doi:10.1080/13691180801999043

Reinecke, L., & Hofmann, W. (2016). Slacking off or winding down? An experience sampling study on the drivers and consequences of media use for recovery versus procrastination. *Human Communication Research*, *42*(3), 441–461. doi:10.1111/hcre.12082

Reinecke, L., Klimmt, C., Meier, A., Reich, S., Hefner, D., Knop-Huelss, K., … Vorderer, P. (2018). Permanently online and permanently connected: Development and validation of the Online Vigilance Scale. *PLoS One*, *13*(10), e0205384. doi:10.1371/journal.pone.0205384

Ribak, R., & Rosenthal, M. (2015). Smartphone resistance as media ambivalence. *First Monday*, *20*(11). doi:10.5210/fm.v20i11.6307

Roffarello, A. M., & De Russis, L. (2019). *The race towards digital wellbeing: Issues and opportunities*. Paper presented at the Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems.

Rosa, H. (2013). *Social acceleration: A new theory of modernity*. New York, USA: Columbia University Press.

Ryan, R. M., & Deci, E. L. (2001). On happiness and human potentials: A review of research on hedonic and eudaimonic well-being. *Annual Review of Psychology*, *52*(1), 141–166. doi:10.1146/annurev.psych.52.1.141

Schnauber-Stockmann, A., Meier, A., & Reinecke, L. (2018). Procrastination out of habit? The role of impulsive versus reflective media selection in procrastinatory media use. *Media Psychology*, *21*(4), 640–668. doi:10.1080/15213269.2018.1476156

Schrock, A. R. (2015). Communicative affordances of mobile media: Portability, availability, locatability, and multimediality. *International Journal of Communication*, *9*, 1229–1246. doi:1932–8036/20150005

Sewall, C. J., Bear, T. M., Merranko, J., & Rosen, D. (2020). How psychosocial well-being and usage amount predict inaccuracies in retrospective estimates of digital technology use. *Mobile Media & Communication*, *8*(3), 379–399. doi:10.1177/2050157920902830

Shmotkin, D. (2005). Happiness in the face of adversity: Reformulating the dynamic and modular bases of subjective well-being. *Review of General Psychology*, *9*(4), 291–325. doi:10.1037/1089-2680.9.4.291

Specker Sullivan, L., & Reiner, P. (2019). Digital wellness and persuasive technologies. *Philosophy & Technology*. doi:10.1007/s13347-019-00376-5

Starcevic, V., Billieux, J., & Schimmenti, A. (2018). Selfitis, selfie addiction, twitteritis: Irresistible appeal of medical terminology for problematic behaviours in the digital age. *The Australian and New Zealand Journal of Psychiatry*, *52*(5), 408. doi:10.1177/0004867418763532

Steele, R. G., Hall, J. A., & Christofferson, J. L. (2020). Conceptualizing digital stress in adolescents and young adults: Toward the development of an empirically based model. *Clinical Child and Family Psychology Review*, *23*(1), 15–26. doi:10.1007/s10567-019-00300-5

Stragier, J., Hendrickson, A., Vanden Abeele, M. M. P., & De Marez, L. (2019). *Unlock, chat, lock. A Markov chain analysis to unveil how smartphone use unfolds in everyday life.* Paper presented at the ICA.

Sutton, T. (2017). Disconnect to reconnect: The food/technology metaphor in digital detoxing. *First Monday*, *22*(6). doi:10.5210/fm.v22i6.7561

Taylor, A. S., & Harper, R. (2003). The gift of the gab?: A design oriented sociology of young people's use of mobiles. *Computer Supported Cooperative Work (CSCW)*, *12*(3), 267–296.

Thrift, N. (2004). Remembering the technological unconscious by foregrounding knowledges of position. *Environment and Planning D: Society and Space*, *22*(1), 175–190. doi:10.1068/d321t

Twenge, J. M. (2017). Have smartphones destroyed a generation? *The Atlantic.* Retrieved from https://www.theatlantic.com/magazine/archive/2017/09/has-the-smartphone-destroyed-a-generation/534198/.

Twenge, J. M., Haidt, J., Joiner, T. E., & Campbell, K. W. (2020). Underestimating digital media harm. *Nature Human Behaviour*, *4*(4), 346–348. doi:10.1038/s41562-020-0839-4

Twenge, J. M., Joiner, T. E., Rogers, M. L., & Martin, G. N. (2018). Increases in depressive symptoms, suicide-related outcomes, and suicide rates among US adolescents after 2010 and links to increased new media screen time. *Clinical Psychological Science*, *6*(1), 3–17. doi:10.1177/2167702617723376

Van der Linden, M. (2015). Commentary on: Are we overpathologizing everyday life? A tenable blueprint for behavioral addiction research. Addictions as a psychosocial and cultural construction. *Journal of Behavioral Addictions*, *4*(3), 145–147. doi:10.1556/2006.4.2015.025

Van Dijck, J. (2014). Datafication, dataism and dataveillance: Big Data between scientific paradigm and ideology. *Surveillance & society*, *12*(2), 197–208. doi:10.24908/ss.v12i2.4776

Van Koningsbruggen, G. M., Hartmann, T., Eden, A., & Veling, H. (2017). Spontaneous hedonic reactions to social media cues. *Cyberpsychology, Behavior, and Social Networking*, *20*(5), 334–340. doi:10.1089/cyber.2016.0530

Van Rooij, A. J., & Kardefelt-Winther, D. (2017). Lost in the chaos: Flawed literature should not generate new disorders: Commentary on: Chaos and confusion in DSM-5 diagnosis of Internet Gaming Disorder: Issues, concerns, and recommendations for clarity in the field (Kuss et al.). *Journal of Behavioral Addictions*, *6*(2), 128–132. doi:10.1556/2006.6.2017.015

Vanden Abeele, M. M. P., Abels, M., & Hendrickson, A. T. (2020). Are parents less responsive to young children when they are on their phones? A systematic naturalistic observation study. *Cyberpsychology, Behavior, and Social Networking, 23(6), 363–370.* doi:10.1089/cyber.2019.0472

Vanden Abeele, M. M. P., Beullens, K., & Roe, K. (2013). Measuring mobile phone use: Gender, age and real usage level in relation to the accuracy and validity of self-reported mobile phone use. *Mobile Media & Communication*, *1*(2), 213–236. doi:10.1177/2050157913477095

Vanden Abeele, M. M. P., De Wolf, R., & Ling, R. (2018). Mobile media and social space: How anytime, anyplace connectivity structures everyday life. *Media and Communication*, *6*(2), 5–14. doi:10.17645/mac.v6i2.1399

Vorderer, P., Krömer, N., & Schneider, F. M. (2016). Permanently online–Permanently connected: Explorations into university students' use of social media and mobile smart devices. *Computers in Human Behavior*, *63*, 694–703. doi:10.1016/j.chb.2016.05.085

Wajcman, J. (2008). Life in the fast lane? Towards a sociology of technology and time. *British Journal of Sociology*, *59*(1), 59–77. doi:10.1111/j.1468-4446.2007.00182.x

Wajcman, J. (2015). *Pressed for time: The acceleration of life in digital capitalism*. Chicago, IL: University of Chicago Press.

Whitlock, J., & Masur, P. K. (2019). Disentangling the association of screen time with developmental outcomes and well-being: Problems, challenges, and opportunities. *JAMA Pediatrics*, *173*(11), 1021–1022. doi:10.1001/jamapediatrics.2019.3191

Wilcockson, T. D. W., Osborne, A. M., & Ellis, D. A. (2019). Digital detox: The effect of smartphone abstinence on mood, anxiety, and craving. *Addictive Behaviors*, *99*, 106013. doi:10.1016/j.addbeh.2019.06.002

Williams, J. (2018). *Stand out of our light: Freedom and resistance in the attention economy*. Cambridge, England: Cambridge University Press.

Yousafzai, S., Hussain, Z., & Griffiths, M. (2014). Social responsibility in online videogaming: What should the videogame industry do? *Addiction Research & Theory*, *22*(3), 181–185. doi:10.3109/16066359.2013.812203

Yu, L., & Shek, D. T. L. (2013). Internet addiction in Hong Kong adolescents: A three-year longitudinal study. *Journal of Pediatric and Adolescent Gynecology*, *26*(3), S10–S17. doi:10.1016/j.jpag.2013.03.010