

The practical paradox of technology: The influence of communication technology use on employee burnout and engagement

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ABSTRACT

Technological advancements in the workplace frequently have produced contradictory effects by facilitating accessibility and efficiency while increasing interruptions and unpredictability. We combine insights from organizational paradoxes and the job demands–resources model to construct a framework identifying positive and negative mechanisms in the relationship between communication technology use (CTU) and employee well-being, operationalized as work engagement and burnout. In this study of Dutch workers, we demonstrate that CTU increases well-being through positive pathways (accessibility and efficiency) and decreases well-being through negative pathways (interruptions and unpredictability). We highlight the importance of (1) investigating CTU resources and demands simultaneously to grasp the relationship between CTU and employee well-being, and (2) considering CTU's downsides to successfully implement new communication technologies and flexible work designs.

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Email, mobile telephones, and laptops are among the most commonly used technologies by organizations adopting flexible work arrangements (FWAs; Hoonakker & Korunka, 2014). The use of communication technology enables an extensive range of work styles and preferences allowing employees to work both during and outside of regular office hours in their preferred locations. Organizations are increasingly incorporating these features into their work designs by introducing flexible work schedules (Kelly & Moen, 2007; Kelly, Moen, & Tranby, 2011; Leslie, Manchester, Park, & Mehng, 2012), open office environments (McElroy & Morrow, 2010), telecommuting arrangements (Gajendran & Harrison, 2007; Gajendran, Harrison, & Delaney-Klinger, 2015), compressed work weeks (Brough & O'Driscoll, 2010), and teleconferencing facilities (Denstadli, Julsrud, & Hjorthol, 2012; Hing Lo, Van Breukelen, Peters, & Kok, 2014). Despite the increased adoption of communication technologies and flexible work practices, organizations (e.g., Volkswagen and BMW) and

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broader communities (e.g., Germany and trade unions in France) have implemented policies to limit employees' email access during off-job hours because of its detrimental effects on employee well-being (Anderson, Griswold, & McIntyre, 2014; Vasagar, 2013).

In general, communication technology use (CTU) has been found to have both distinct advantages (e.g., communication efficiency and accessibility; Cavazotte, Lemos, & Villadsen, 2014; Chesley, 2010; Jarvenpaa & Lang, 2005; Matusik & Mickel, 2011; Mazmanian, Orlikowski, & Yates, 2013; Rennecker & Godwin, 2005) and disadvantages (e.g., interruptions and unpredictability; Chesley, 2014; Fonner & Roloff, 2012; Perlow, 2012; Rennecker & Godwin, 2005; Thomas et al., 2006) for employees. Due to technological advancements, information can be efficiently accessed and exchanged across physical and temporal boundaries (Rennecker & Godwin, 2005), which makes the flexible organization of work possible. Employees feel empowered by CTU because it allows them to establish a connection to their work from different locations (Middleton, 2007), from which they can control their work throughout the day (Allen & Shoard, 2005; Mazmanian et al., 2013; Valcour & Hunter, 2005) and achieve time efficiencies (Govindaraju & Seward, 2005; Matusik & Mickel, 2011). However, CTU can also unintentionally contribute to increasing work interruptions and an accumulation of unanticipated/unpredictable tasks (Fonner & Roloff, 2012; Thomas et al., 2006), which can negatively affect well-being (Chesley, 2014; Diaz, Chiaburu, Zimmerman, & Boswell, 2012). Email use can lead to stress due to fear of overload and loss of control (Barley, Meyerson, & Grodal, 2011), and email and other communication media (videoconferencing and instant messaging) are also associated with stress from interruptions (Fonner & Roloff, 2012). Thus, CTU benefits but can also strain employee well-being. However, empirical research has not yet evaluated these opposing dynamics in the context of CTU and employee well-being. In this study, we introduce a model that identifies how the concurrent advantages and challenges of CTU explain the relationship between CTU and well-being. We also compare these parallel pathways to evaluate differences in the effect strengths of CTU advantages and challenges as they relate to employee well-being. Researchers are increasingly adopting a tension-based research lens to investigate opposite tendencies that potentially negate one another (e.g., Jarvenpaa & Lang, 2005). Contradictions and paradoxes are extensively investigated in the context of organizations (Smith & Lewis, 2011), flexible work designs (Putnam, Myers, & Gailliard, 2014) and communication practices (Fonner & Roloff, 2012; Leonardi, Treem, & Jackson, 2010; Mazmanian et al., 2013; Rennecker & Godwin, 2005). In accordance with Smith and Lewis (2011), we define a paradox as "contradictory yet interrelated elements that exist simultaneously and persist over time" (p. 386). For example, technology use can cause interrelated but opposing consequences by facilitating efficient work processes and accessibility while enabling interruptions and unpredictability that can obstruct work (Fonner & Roloff, 2012; Jarvenpaa & Lang, 2005; Perlow, 2012; Rennecker & Godwin, 2005; Stohl & Cheney, 2001).

Drawing on previous studies on organizational paradoxes, we introduce "the practical paradox of technology" to investigate the opposing mechanisms that underpin the relationship between CTU and employee well-being. We draw on the job demands-resources (JD-R) model to link the literature on paradoxes to employee well-being. The JD-R model describes how perceived job conditions (job resources and demands) influence feelings of work-related burnout and work engagement (Bakker & Demerouti, 2007; Bakker, Demerouti, & Sanz-Vergel, 2014; Maslach, Schaufeli, & Leiter, 2001).

Burnout is a stress syndrome characterized by high and persistent levels of exhaustion; exhaustion is the central quality of burnout and one of its core dimensions (Bakker et al., 2014; Mäkikangas et al., 2014; Maslach et al., 2001). Conversely, work engagement is a positive and fulfilling work-related state of mind characterized by “vigor,” or energy toward one’s work. Vigor is one of the core dimensions of work engagement (Bakker et al., 2014; Mäkikangas et al., 2014). We argue that CTU produces a specific set of advantages (i.e., resources) and disadvantages (i.e., demands) related to the well-being outcomes of employee burnout and engagement. Therefore, the objective of this study is to examine the relationship between CTU and employee well-being while considering the indirect influence of CTU-related resources and demands. Specifically, drawing on the recent literature, we regard efficient communication and accessibility as resources and interruptions and unpredictability as demands related to CTU and well-being (Cavazotte et al., 2014; Chesley, 2014; Matusik & Mickel, 2011; Mazmanian et al., 2013; Perlow, 2012).

This study contributes to the literature in three ways. First, we propose a theoretical model that integrates the opposing effects of CTU and evaluates their effects on employee well-being. Based on the previous literature on paradoxes (Fonner & Roloff, 2012; Mazmanian et al., 2013; Putnam et al., 2014; Rennecker & Godwin, 2005), we argue that the use of communication technology simultaneously leads to both efficiency and accessibility *and to* interruptions and unanticipated tasks that are generated by received messages (Perlow, 2012; Thomas et al., 2006). Second, based on the JD–R model (Demerouti, Bakker, Nachreiner, & Schaufeli, 2001), we argue that the paradoxical consequences of CTU can be regarded as CTU resources and demands that affect employee well-being. The CTU resources and demands that are derived from the literature on CTU at work (Fonner & Roloff, 2012; Mazmanian et al., 2013; Perlow, 2012) are linked to two central tenets of employee well-being: burnout and work engagement (Bakker et al., 2014). Third, the JD–R model entails two processes: job resources are predominantly predictors of motivational concepts, such as work engagement, whereas job demands are known to primarily induce health-related problems, such as burnout (Bakker, Demerouti, De Boer, & Schaufeli, 2003; Bakker, Demerouti, & Schaufeli, 2003; Crawford, LePine, & Rich, 2010; Nahrgang, Morgeson, & Hofmann, 2011). We test whether this notion holds in the context of CTU and its related resources and demands by contrasting the indirect effects on burnout and work engagement.

Therefore, this study is the first to argue that the paradoxical mechanisms of CTU should be viewed as resources and demands that influence two essential facets of employee well-being. Specifically, we examine the significant indirect effect of CTU demands and resources on the relationship between CTU and well-being, which adds to the literature by emphasizing that the relationship between CTU and well-being is more complex than previously established and that opposing mediating factors must be considered. To elucidate the relationship between CTU and well-being, we identify specific communication-related demands and resources that are experienced by employees by virtue of their CTU.

Theoretical perspectives

Organizational paradoxes and CTU

The literature on CTU in the workplace frequently discusses multiple paradoxes (Cascio, 2007; Fonner & Roloff, 2012; Gajendran & Harrison, 2007; Jarvenpaa & Lang, 2005;

Leonardi et al., 2010; Mazmanian et al., 2013; Pearlson & Saunders, 2001; Putnam et al., 2014). A paradox results when the pursuit of a specific goal requires actions that (partly) negate this goal (Stohl & Cheney, 2001). In other words, a paradox consists of contradictory but interrelated elements that exist concurrently. The lens of paradox can be used to unify the various and contradictory research findings in this area. An important paradox revealed in the literature is the autonomy-control paradox or the autonomy paradox, which can be expressed as follows: as employees' CTU helps them gain the autonomy and flexibility to work anywhere at any time, they simultaneously lose autonomy due to the increased expectations of continuous connectivity and responsiveness that are also associated with CTU (Mazmanian et al., 2013; Michel, 2011; Putnam et al., 2014). This paradox is in line with the empowerment/enslavement paradox (Jarvenpaa & Lang, 2005), which occurs as employees' use of communication technology creates a sense of empowerment by providing them flexibility in when and where to work while simultaneously producing anxiety invoked by the unpredictability of incoming messages and the pressure to be "always on." The "cycle of responsiveness" described by Perlow (2012) can be understood as an expression of these paradoxes. This cycle occurs as employees' CTU increases in their work routines, which causes their colleagues and/or clients to become accustomed to immediate responses and to increase their contact with them, leading employees to constantly monitor their devices to prevent missing unexpected work developments (Perlow, 2012). In the end, this process creates an "always-on" culture.

Another important paradox regarding CTU is the proposed connectivity paradox. Leonardi et al. (2010) suggest that the use of communication technology diminishes the perception of distance to colleagues but simultaneously enhances expectations of constant connectivity for employees. These effects create a paradox in which the potential benefits of telecommuting are negated by the same technologies that made the flexible work arrangement possible (Leonardi et al., 2010). Fonner and Roloff (2012) investigated this paradox by examining "social presence" and "stress from interruptions" as potential mediators of the relationship between CTU and organizational identification. Their findings indicate that interruption-related stress explains the negative relationship between CTU and organizational identification but does not support a relationship linking CTU, social presence, and identification. Thus, additional research is necessary to understand the contradictory outcomes associated with CTU.

CTU facilitates flexibility by providing the means to communicate efficiently and be accessible from different locations and at different times. However, CTU can lead to interruptions and unpredictable work developments. Thus, engaging in CTU for work seems both to provide employees with job resources (e.g., efficiency and accessibility) and to expose them to job demands (e.g., unpredictability and interruptions). To understand the effect of CTU on employee well-being, we must consider both these resources and demands. Toward this end, we use the JD-R model as our theoretical underpinning.

The JD-R model and CTU-related resources and demands

The JD-R model is based on the premise that each employee experiences job demands and has limited job resources (Demerouti et al., 2001). The demands and resources that individual employees encounter or have access to vary according to the job and how it is

organized. Demands include physical, psychological, and social aspects of the job that require physical and/or psychological effort on the part of employees, and, as a result, are associated with physiological and/or psychological depletion (Bakker & Demerouti, 2007). Examples of job demands include time pressure, workload, and the environmental conditions of the job. Resources are physical, psychological, and/or social work characteristics that help employees achieve work goals and reduce job demands and their subsequent physiological and psychological costs in addition to stimulating personal growth and development (Schaufeli, Bakker, & Van Rhenen, 2009). Examples of resources include autonomy, participation in decision-making, and different types of support. According to the JD–R model, resources motivate employees, allowing them to address demands more effectively. When the organizational or social environment lacks resources, employees have less self-regulatory power to cope with the effects of heavy demands. Withdrawal from work or a decline in work engagement may occur as a self-protecting mechanism. Previous studies have established that heavy job demands exhaust employees' mental and physical resources and may lead to burnout-related symptoms, whereas inadequate job resources can undermine work engagement (Bakker & Demerouti, 2007; Bakker et al., 2014).

The JD–R model distinguishes between a motivational process and a health impairment process. The former describes how job resources increase work engagement. The latter refers to the detrimental effects of job demands, which produce symptoms of work-related burnout (Bakker et al., 2014). The JD–R model assumes that the specific combination of job resources and demands is predictive of work engagement and burnout (Bakker & Demerouti, 2007). Jobs that are demanding but that provide adequate resources produce active employees. Those employees are highly engaged and have few burnout complaints. Conversely, when job demands are high and resources inadequate, employees can develop burnout. Work settings that require low effort but also provide few resources minimize work engagement (Bakker & Demerouti, 2007). We argue that the rationale of the JD–R model will be supported when applied in the context of workplace CTU and when specific CTU-related resources and demands are considered.

CTU-related resources

We propose that efficient communication and accessibility are valuable resources associated with CTU. Recent qualitative and quantitative studies support the ideas that work-related CTU enables employees to communicate more efficiently and that being accessible to others increases their sense of professional competence and control (Cavazotte et al., 2014; Chesley, 2010; Jarvenpaa & Lang, 2005; Matusik & Mickel, 2011; Mazmanian et al., 2013; Rennecker & Godwin, 2005). Communication efficiency is regarded as enhanced control over information and interactions, and, as such, minimizes communication delays (see Mazmanian et al., 2013; Rennecker & Godwin, 2005). Accessibility refers to being available when needed by others. Being accessible is experienced as essential to helping others and being a competent, flexible, and accountable worker (Mazmanian et al., 2013).

A study by Chesley (2010) showed that more frequent CTU increased the experience of being an efficient worker. This finding is reinforced in qualitative studies. For example, Cavazotte et al. (2014) discuss lawyers who use mobile devices provided by their company. The lawyers appreciated the device because it facilitated efficient

communication with clients and colleagues, regardless of time and place, and increased their accessibility. Matusik and Mickel (2011) interviewed employees from different occupational settings and described similar findings. These employees explained that CTU helped them save time, stay connected, and rapidly respond to business partners. Participants in the Mazmanian et al. (2013) study described similar benefits of CTU and noted the convenience of accessibility, even when they chose to work from home on a project. Hence, CTU at work provides the advantage of enhanced communication efficiency and accessibility. Recent studies indicate that CTU itself and these CTU-related resources are associated with increased work satisfaction (Diaz et al., 2012), work effectiveness (Chesley, 2010), and work engagement (Ten Brummelhuis, Bakker, Hetland, & Keulemans, 2012). The diary study of Ten Brummelhuis et al. (2012) shows that effective and efficient communication and connectivity enhance work engagement and decrease employee exhaustion. Here, we suggest that communication efficiency and accessibility can be regarded as CTU-related resources and can thus affect employee well-being. We propose the following hypotheses:

Hypothesis 1a: CTU is negatively related to employee burnout through enhanced communication efficiency.

Hypothesis 1b: CTU is positively related to work engagement through enhanced communication efficiency.

Hypothesis 2a: CTU is negatively related to employee burnout through enhanced accessibility.

Hypothesis 2b: CTU is positively related to work engagement through enhanced accessibility.

CTU-related demands

The CTU literature also reveals that technology use at work is associated with specific CTU-related demands. Two primary demands of CTU are unpredictability and interruptions (Cavazotte et al., 2014; Chesley, 2014; Fonner & Roloff, 2012; Jarvenpaa & Lang, 2005; Matusik & Mickel, 2011; Mazmanian et al., 2013; Perlow, 2012; Rennecker & Godwin, 2005; Thomas et al., 2006). CTU enables unpredictability by allowing for instantaneous information exchange and inquiries that multiply the receiver's tasks (Jarvenpaa & Lang, 2005; Perlow, 2012; Thomas et al., 2006). In their research on email use, Thomas et al. (2006) refer to this phenomenon as unstable requests, stating that "recipients may be exposed to unstable requests more often and iteratively because the nature of the medium allows organizational members to send requests easily, quickly, and absent any feedback from receivers" (p. 266). Jarvenpaa and Lang (2005) also address this issue with regard to the mobile telephone. They conclude that the unpredictability and uncertainty of incoming telephone calls demand sudden attention, which may counteract the power that users derive from the technology.

An interruption is defined as "a synchronous interaction which is not initiated by the recipient, is unscheduled, and results in the recipient discontinuing their current activity" (Rennecker & Godwin, 2005, p. 250). Several studies associate CTU at work with an increase in unpredictable/unexpected demands and interruptions due to the conversational nature of communication through different media. For example, Perlow (2012) describes how technology facilitates the accumulation of unanticipated and unpredictable tasks that are generated by incoming messages (see also Thomas et al., 2006). This accumulation of questions and messages can deplete an employee's energy over the

course of the day and lead to an extended and exhausting workday (e.g., Derks & Bakker, 2014). Messages received on a smartphone during unpredictable hours can interrupt nonwork activities and may explicitly request a rapid response (Cavazotte et al., 2014). Employees often monitor their mobile devices until late at night to ensure that they do not miss unforeseen work developments (Matusik & Mickel, 2011). Clearly, the possibility of monitoring work developments during on- and off-job hours has altered expectations (Towers, Duxbury, Higgins, & Thomas, 2006). Thus, employees feel compelled to check for unpredictable work developments during on- and off-job hours. Furthermore, communication technology facilitates different channels to interrupt employees in their work process (Chesley, 2014; Fønner & Roloff, 2012). Fønner and Roloff (2012) state that abundant and data-intensive communication technologies prevent employees from sustaining a sense of distance from co-workers and clients. Increased CTU exposes employees to a greater number of interactions that interfere with their work routine (e.g., colleagues' requests for help; Perlow & Weeks, 2002) during times when postponed interaction would be beneficial for their workflow. Consequently, CTU is associated with interruption-related stress (Fønner & Roloff, 2012), feelings of being overwhelmed by work, and psychosomatic complaints (Chesley, 2014). Therefore, unpredictability and interruptions, as CTU-related demands, are hypothesized to affect the relationship between CTU and employee well-being:

Hypothesis 3a: CTU is positively related to employee burnout through increased work unpredictability.

Hypothesis 3b: CTU is negatively related to work engagement through increased work unpredictability.

Hypothesis 4a: CTU is positively related to employee burnout through increased interruptions.

Hypothesis 4b: CTU is negatively related to work engagement through increased interruptions.

The motivational process versus the health impairment process

Job resources and demands provoke two distinct processes, the motivational process and the health impairment process. The central assumption is that job resources are the primary antecedents of motivational concepts, such as commitment and work engagement, and that job demands are the most important predictors of health problems, such as exhaustion and psychosomatic health complaints (Bakker, Demerouti, De Boer, et al., 2003; Bakker, Demerouti, & Schaufeli, et al., 2003; Crawford et al., 2010; Nahrgang et al., 2011). The rationale behind these two processes is that job resources fulfill basic psychological needs, such as the needs for autonomy, relatedness, and competence (Bakker et al., 2014), whereas job demands cost energy and therefore lead to depletion (i.e., a state of exhaustion). In a study among nutrition production employees, Bakker, Demerouti, De Boer, et al. (2003) applied the JD-R model and tested the motivational and health impairment process; they found that job resources resulted in stronger commitment to the organization and that job demands increased burnout symptoms. This finding was reinforced with a larger sample among employees working in a call center (Bakker, Demerouti, & Schaufeli, et al., 2003). In the context of safety at work, Nahrgang et al. (2011) conducted an extensive meta-analysis, which confirms the motivational process and health impairment process but also provides strong evidence for the cross-

paths linking job resources to burnout and job demands to work engagement. Based on these prior studies, similar patterns are anticipated in the context of CTU and its assumed CTU resources and demands. In other words, it is expected that CTU resources activate motivational outcomes, such as work engagement, to a greater extent than health-related consequences, such as burnout symptoms. With regard to CTU demands, they are anticipated to trigger the health impairment process and therefore be a more important predictor of burnout symptoms compared to work engagement. These expectations result in the following hypotheses:

Hypothesis 5a: The relationship between CTU and work engagement is stronger through CTU-related resources, compared to CTU-related demands.

Hypothesis 5b: The relationship between CTU and burnout is stronger through CTU-related demands, compared to CTU related resources.

Method

Sample and procedure

Data were collected by MSI research using the Toluna panel.¹ An online survey was administered. Email invitations were sent to 1,579 Dutch employees who worked on a part- or full-time basis in an organization with at least 50 employees. A total of 663 Dutch employees from a wide range of industries and occupations completed the survey between May 16 and May 25, 2014. The response rate was 41.99%. The average age of the respondents was 45.37 years ($SD = 11.40$); 50.2% were female, and 44.2% had earned an advanced degree, which closely resembled the overall Dutch workforce (whose average age is 41.4 years old and 33% of whom possess an advanced degree). The sample is also representative of the Dutch workforce in terms of average working hours per week (33.07); our respondents indicated that they worked 36.49 hours per week ($SD = 7.77$).² A total of 25.5% of the participants held management positions. The majority were employed in one of the following sectors: health care (19.6%), government/public administration (13.9%), industry (9.4%), business services (8.9%), trade/commercial services (8.3%), education/science (8.0%), and financial services (5.1%).

Measures

The latent constructs in the model were measured with multiple indicators that varied from three to six items. [Table 1](#) includes the bivariate correlations and alpha coefficients (α range 0.76–0.91), and [Figure 1](#) shows all the standardized factor loadings.

Burnout and engagement

Burnout was measured by examining its core dimension— emotional exhaustion—which is the central feature of burnout and the most distinct manifestation of this syndrome. Exhaustion represents the individual stress dimension of burnout and refers to feeling overextended and depleted of emotional and physical resources (Mäkikangas et al., 2014; Maslach et al., 2001). To measure this construct, the five items of the subdimension “emotional exhaustion” of the Dutch version of the Maslach Burnout Inventory were employed (MBI-NL; see Maslach & Jackson, 1981; Schaufeli & Van Dierendonck, 1994;

Table 1. Correlations and descriptive statistics.

Variable	M (SD)	1	2	3	4	5	6	7	8	9	10	11	12	13
1. CTU	3.14 (1.07)	.84												
2. Accessibility	3.96 (0.76)	.33*	.79											
3. Efficient communication	3.67 (0.74)	.30*	.49*	.78										
4. Unpredictability	3.56 (1.00)	.17*	.13*	.06	.84									
5. Interruptions	2.72 (0.99)	.31*	.11*	.10*	.37*	.87								
6. Burnout	2.84 (1.12)	-.10*	-.22*	-.30*	.32*	.26*	.89							
7. Engagement	5.10 (1.14)	.17*	.35*	.37*	-.03	-.0	-.53*	.83						
8. Sex	1.50 (0.50)	-.11*	.10*	.11*	-.01	-.08	-.03	.01	-					
9. Age	45.37 (11.40)	.02	.14*	.04	-.04	-.10*	-.15*	.17*	-.28*	-				
10. Work experience	22.72 (11.98)	.05	.16*	.06	.01	-.06	-.16*	.19*	.29*	.85*	-			
11. Hours per week	36.49 (7.77)	.22*	.03	-.03	.15*	.12*	.03	.08*	-.34*	.07	.13*	-		
12. Managerial position	1.75 (0.44)	-.23*	-.06	-.06	-.12*	-.21*	-.01	-.13*	.22*	.00	-.03	-.18*	-	
13. Organization size	n/a	.07	-.02	.02	.08*	.08*	.01	-.04	-.04	.07	.10*	-.04	-.08*	-

Notes: $N = 663$. Values on the diagonal in bold represent reliabilities (α).

*Significance at $p < .05$.

Schutte, Toppinen, Kalimo, & Schaufeli, 2000). Factor loadings ranged from .75 to .87, this scale included items such as “I feel mentally exhausted at work.”

In contrast to burnout, work engagement is characterized by a high level of energy. Engagement was tapped using its core dimension, which measures the reverse of exhaustion, that is, vigor (Mäkikangas et al., 2014). Vigor is defined as high levels of energy and mental resilience while working. To measure vigor, five items of the Utrecht Work Engagement Scale were employed (UWES; Schaufeli & Bakker, 2004; Schaufeli et al., 2009; Schaufeli, Salanova, González-Romá, & Bakker, 2002). Vigor was measured using items such as “At my work, I feel bursting with energy.” Factor loadings ranged from .68 to .87.

CTU resources and demands

The measurement of efficient communication, accessibility, and interruptions was derived from the Communication Quality Scale (CQS) constructed by Ten Brummelhuis et al. (2012). *Efficient communication* was conceptualized as the extent to which communication enables effortless, functional, and timely communication, using four items, such as “I do not waste time when communicating with colleagues or customers.” The factor loadings of these items ranged from .66 to .81. *Accessibility* was assessed by three items and refers to the ease and pace with which an employee can be reached by colleagues. Sample items include “It is easy for my colleagues to reach me.” The factor loadings of these items ranged from .74 to .75. The concept *interruptions* evaluated communication in which the employee is interrupted while performing his or her work, using three items with factor loadings ranging from .66 to .93. A sample item is “At work, I frequently receive telephone calls at inconvenient times.” The notion of *unpredictability* was based on the work of Perlow (2012) and measures the degree to which employees experience unforeseen work tasks, using a three-item scale, including “At work, I may be assigned additional tasks at any time.” The factor loadings ranged from .70 to .92.

Communication technology use

This measure evaluates the control and use of the most prevalent interactive workplace communication technologies, email and (smart)phones (D’Urso & Pierce, 2009; Purcell & Rainie, 2014). Items represent the extent to which the employee can decide which communication media to use and when (e.g., control in scheduling telephone calls). We measured this construct using four items based on the New Ways of Working scale (Ten Brummelhuis, Halbesleben, & Prabhu, 2011). Sample items include “I can decide as to when I send or reply to emails.” The factor loadings of these items ranged from .69 to .86. This construct and the construct unpredictability were measured with scales that have not yet been validated; therefore, we cross-validated these constructs using an independent sample, and these cross-validation results are presented with the CFA model.

Control variables

In the model, we controlled for sex, which was measured as a dichotomous variable (1 = *male*; 2 = *female*), and age, which was measured as a continuous variable. We also controlled for the following work-related characteristics: (a) managerial position (0 = *no management position*; 1 = *management position*); (b) actual working hours per week, (c) years of working experience, and (d) organization size (measured by five categories: 1: less than

50; 2: between 51 and 100; 3: between 101 and 500; 4: between 501 and 1,000; 5: more than 1,000).

Analysis

We employed structural equation modeling (SEM) to test our hypotheses using AMOS. Incremental and absolute fit indices are presented to gauge the model fit (Hu & Bentler, 1999). Two incremental fit indices are used to evaluate the model fit: the Tucker-Lewis Index (TLI) and the Comparative Fit Index (CFI). Model fit indices of $>.95$ indicate good model fit (Hu & Bentler, 1999). Two absolute fit indices are examined: a standardized version of the root mean squared residual (SRMR) and the root mean square of approximation (RMSEA), with cut-off values of ≤ 0.08 and ≤ 0.05 , respectively, which indicate a close model fit (Kline, 2011). The χ^2 statistic primarily serves as a relative measure to evaluate model fit between the retained and alternative models or the nested models using a $\Delta\chi^2$ test (Hu & Bentler, 1999; Kline, 2011).

We employed bootstrapping to estimate model parameters and standard errors by extracting 2,000 bootstrap samples from the data to calculate all the parameter estimates and confidence intervals. We used bootstrapping to calculate confidence intervals to compare the regression weights of indirect pathways (i.e., contrasting effects). Contrasting effects are calculated to determine which paths should be given statistical credence (e.g., the indirect path on engagement through accessibility versus the indirect paths on engagement through interruptions and unpredictability).

Results

Multivariate assumption and common method variance

Curve estimations were conducted for all the relationships in the model and indicated that all these relationships were linear and could thus be tested using a covariance-based algorithm, such as that used in AMOS. The high correlation observed between burnout and engagement is there “by design,” as are the correlations between interruptions and unpredictability and efficient communication and accessibility (González-Romá, Schaufeli, Bakker, & Lloret, 2006). Nevertheless, these correlations raise the possibility of multicollinearity. We consulted the variance inflation factor (VIF) and discovered no problems with multicollinearity.

Common method bias was assessed due to the cross-sectional nature of the data. First, a factor analysis extracting a single factor for all the observed indicators in our model was conducted, which explains 24.58% of the variance. This result indicates the absence of common method variance. Subsequently, we conducted a Harman’s single-factor test in AMOS to determine the common method variance of our model, which was 7.29%. Finally, we employed the CFA marker technique (Williams, Hartman, & Cavazotte, 2010) by adding the marker variable “Aesthetics”³ to the CFA analysis. This variable is unrelated to other variables in the model; thus, any shared variance is likely due to common method bias. Following this analysis, common method variance decreased to 3.61%. These results indicate that common method variance is not a problem in our data.

CFA measurement model

Our initial measurement model with unit-loading indicators to scale latent constructs indicates reasonable model fit: χ^2 (356) = 1,008.84; CFI = 0.93; TLI = 0.94; SRMR = 0.05, and RMSEA = 0.053 (CI: 0.049, 0.056). An alteration to the model was generated by omitting two indicators from the CTU construct due to low factor loadings. Based on the .60 cutoff point proposed by Kline (2011), the indicators “I use new media communication (videoconferencing /social media) optimally in my work process” (.43) and “I communicate using my smartphone and/or laptop to work more efficiently” (.52) were omitted from the final model. The final measurement model convincingly demonstrates good model fit: χ^2 (303) = 731.49; CFI = 0.96; TLI = 0.95; SRMR = 0.05, and RMSEA = 0.046 (CI: 0.042, 0.051). The retained model shows significant model improvement ($\Delta\chi^2$ (53) = 277.04, $p < .001$).

Discriminant validity was assessed through cross-factor correlations. The highest between-factor correlation was $-.57$ between engagement and burnout, which was not surprising (González-Romá et al., 2006). There was another high correlation (.49) between the two CTU-related resources, which is also consistent with previous studies (JD-R model; Demerouti et al., 2001). All the other correlations ranged from $-.30$ to $.37$ (Table 1), which convincingly demonstrates the distinctiveness of the latent constructs in the model (Kline, 2011). Convergent validity was assessed by examining factor loadings and squared multiple correlations. All the loadings on the intended latent constructs were significant and sizable. The measurements ranged from 0.65 to 0.93 (Figure 1), indicating satisfactory convergent validity (Kline, 2011). In sum, the retained measurement model

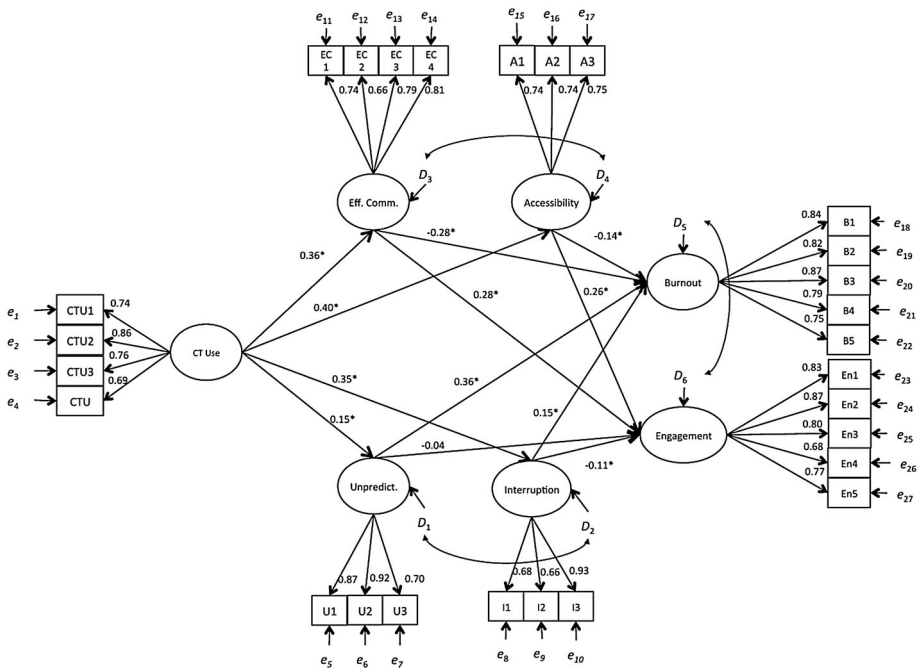


Figure 1. Structural regression model.

Note: $N = 663$. Significance levels are flagged. * $p < .05$, ** $p < .01$ and *** $p < .001$.

adequately measures all the latent constructs in the model, and further examination of the structural model is justified.

We employed a second independent sample of Dutch workers ($n = 404$) to cross-validate the CTU and unpredictability scales. In this sample, 51.7% of the respondents were female. These participants worked an average of 34.06 hours per week ($SD = 8.13$); their average age was 44.36 years ($SD = 11.92$). A CFA model including both variables that suggests good model fit, $\chi^2(13) = 28.48$; CFI = 0.98; TLI = 0.97; SRMR = 0.04, and RMSEA = 0.054 (CI: 0.27, 0.083), was employed to assess convergent and discriminant validity. All the factor loadings ranged between .57 and .84 on the intended latent construct. The correlation between the latent factors was .24. These results support the validity of the scales developed to measure the constructs (i.e., CTU $\alpha = 0.78$ and unpredictability $\alpha = 0.76$).

Hypotheses testing

Structural model

The structural model fits the data: $\chi^2(309) = 739.81$; CFI = 0.96; TLI = 0.95; SRMR = 0.04, and RMSEA = 0.046 (CI: 0.042, 0.050). From a JD–R perspective, and empirically substantiated by our CFA, efficient communication and accessibility, and unpredictability and interruptions are distinct yet interrelated factors representing two working conditions, respectively, job resources and job demands. As such, job resources (efficient communication and accessibility) were allowed to correlate, as were job demands (unpredictability, interruptions; Bakker, Demerouti, & Euwema, 2005). In addition, it has been argued that burnout and engagement are independent yet negatively correlated states of mind (e.g., Schaufeli & Bakker, 2004) and as such were also allowed to correlate. Figure 1 presents the overall structural model with standardized path coefficients. Table 2 provides the bootstrapping estimates for the indirect effects, including the confidence intervals.

Model presentation

Figure 1 presents the final model with standardized pathway estimates. Table 2 provides the bootstrapping results of all the indirect pathways and discloses the mechanisms that facilitate the relationships between CTU and employee burnout and engagement. CTU yields a significant and negative indirect effect on burnout through perceptions of efficient communication ($b^* = -0.110$, $p < .001$), as hypothesis 1a predicted, and a significant positive effect on engagement through efficient communication ($b^* = 0.110$, $p < .001$), as reflected in hypothesis 1b. Additionally, CTU was positively related to engagement through accessibility ($b^* = 0.112$, $p < .001$) and negatively related to burnout through accessibility ($b^* = -0.060$, $p = .008$), which supports hypotheses 2a and 2b.

We hypothesized opposite effects for CTU on burnout and engagement through job demands, that is, interruptions and unpredictability. Hypothesis 3a is supported because CTU positively affects burnout through unpredictability ($b^* = 0.058$, $p = .001$). Conversely, the results indicate a lack of support for hypothesis 3b because the indirect effect of CTU on engagement through unpredictability is not significant ($b^* = -0.006$, $p = .264$). The parameter estimate indicates a trend in the hypothesized direction. Both

Table 2. Specific indirect pathways using bootstrapping.

	Bootstrapping		BC 95% CI		<i>p</i>	
	Estimate	SE	Lower	Upper		
Indirect effect $x \rightarrow m \rightarrow y$						
<i>H1a</i>	CTU → Efficient communication → Burnout	-.110	.027	-.171	-.065	.001
<i>H1b</i>	CTU → Efficient communication → Engagement	.110	.026	.064	.168	.001
<i>H2a</i>	CTU → Accessibility → Burnout	-.060	.026	-.117	-.015	.008
<i>H2b</i>	CTU → Accessibility → Engagement	.112	.029	.062	.176	.001
<i>H3a</i>	CTU → Unpredictability → Burnout	.058	.019	.024	.099	.001
<i>H3b</i>	CTU → Unpredictability → Engagement	-.006	.007	-.080	-.010	.264
<i>H4a</i>	CTU → Interruptions → Burnout	.054	.018	.024	.096	.001
<i>H4b</i>	CTU → Interruptions → Engagement	-.040	.017	-.084	-.012	.007
Contrasts						
	Efficient comm. vs. Unpredictability on burnout	-.052	.032	-.112	.006	.070
	Efficient comm. vs. Interruptions on burnout	-.056	.031	-.122	.000	.049
	Accessibility vs. Unpredictability on burnout	-.002	.027	-.062	.058	.941
	Accessibility vs. Interruptions on burnout	-.006	.031	-.067	.051	.809
	Efficiency vs. Unpredictability on engagement	.104	.030	.056	.163	.001
	Efficiency vs. Interruptions on engagement	.071	.030	.013	.134	.019
	Accessibility vs. Unpredictability on engagement	.106	.030	.055	.171	.001
	Accessibility vs. Interruptions on engagement	.073	.032	.012	.139	.012

Notes: BC, bias corrected; CI, confidence interval. Entries represent unstandardized coefficients. $N = 663$.

hypotheses 4a and 4b are supported. The results indicate that CTU positively affects burnout through interruptions ($b^* = 0.054$, $p < .001$) and negatively affects engagement through interruptions ($b^* = -0.040$, $p = .007$). The model explains 30.8% of the variance in burnout and 23.9% of the variance in engagement. All the r -square values for the endogenous variables are represented in Figure 1.

Tests of mediation

Based on our hypotheses the model in Figure 1 implicitly assumes full mediation between CTU and well-being through CTU-related resources and demands. All (a) $X \rightarrow M$ and (b) $M \rightarrow Y$ paths were significant (see Figure 1), with the exception of the effect (b path) between unpredictability and engagement. These significant a and b paths represent the indirect effects through CTU-related resources and demands, as indicated by the bootstrapping results (see Table 2). In the model without the mediators the effects of CTU on engagement $b^* = 0.206$, BC 95% [.106; .291] $p = .001$; and CTU on burnout $b^* = -0.127$, BC 95% [-.221; -.037] $p = .005$, are both significant. In the model with the mediators the direct effect of CTU on engagement decreased to; $b^* = 0.040$, BC 95% [-.075; .159] $p = .499$; and the direct effect of CTU on burnout decreased to, $b^* = -0.091$, BC 95% [-.200; .023] $p = 0.102$. The absence of significant direct effects supports the assumption of full mediation implied by our hypothesized model. In the final model the direct effects are excluded since (a) this would imply partial mediation and (b) this model is more parsimonious.

Contrast of indirect effects

An examination of the strengths of indirect pathways helps determine which path of the paradoxical relationship has more credence. According to the JD-R model, the motivational process assumes that job resources exhibit a stronger influence on engagement

than job demands (H5a). In turn, the health impairment process assumes that job demands should influence burnout to a greater extent than job resources (H5b). To examine these suppositions, the indirect effects of CTU on burnout and engagement were contrasted.

Specifically, we examined whether the size of one indirect effect differs from those of other indirect effects by linking the same pair of independent and dependent variables. The contrasts in Table 2 present comparisons of indirect effects. Because we compare opposite effects (negative versus positive), the contrasting estimate denotes the difference in effect strength in which the sum of pairwise paradoxical pathways should significantly differ from zero to denote a difference in effect magnitude.

The motivational process embedded in the JD-R model is assessed by pairwise comparisons of indirect effects linking CTU with engagement (H5a). The contrast between the indirect effect of unpredictability and the indirect effect of efficient communication is significant ($b^* = 0.104$, BC 95% [.056; .163] $p < .001$). Similarly, the contrast between unpredictability and accessibility is also significant ($b^* = 0.106$, BC 95% [.055; .171] $p < .001$). Thus, the results show that the indirect effects of CTU on engagement through effective communication and accessibility are significantly larger in magnitude than the effects of the opposing indirect pathway through unpredictability. Similarly, the indirect effect through efficient communication is larger in magnitude than its counterpart through interruptions ($b^* = 0.071$, BC 95% [.013; .134] $p = .019$). The indirect effect of CTU on engagement through accessibility is also larger than the indirect effect through interruptions ($b^* = 0.073$, BC 95% [.012; .139] $p = .012$). Hence, the results support hypothesis 5a.

To test the health impairment process, we examined the indirect effects between CTU and burnout. The indirect effect between CTU and burnout through efficient communication is significant ($b^* = -0.110$, $p < .001$). The opposite path in this paradox is represented by the effect of CTU on burnout through unpredictability and interruptions. The indirect effect of CTU on burnout through unpredictability is significant ($b^* = 0.058$, $p = .001$). When these indirect effects are compared, the following nonsignificant point estimate ($b^* = -0.052$, BC 95% [-.112; .006] $p = .070$) is obtained, indicating that the two indirect effects opposed here cannot be distinguished in terms of magnitude. The contrast between the indirect pathways through efficient communication and interruptions yields a significant point estimate ($b^* = -0.056$, BC 95% [-.122; .000] $p = .049$), indicating that the indirect effect through efficient communication is stronger than that through interruptions. Further examinations of pairwise contrasts between the indirect effect of CTU on burnout show that the indirect effects do not significantly differ. The contrast between the indirect effects through accessibility versus unpredictability ($b^* = -0.002$, BC 95% [-.062; .058] $p = .941$) and accessibility versus interruptions ($b^* = -0.006$, BC 95% [-.067; .051] $p = .809$) cannot be distinguished in terms of the effect magnitude. Hence, the health impairment process reflected in hypothesis 5b is not supported.

Additionally, *post hoc* analyses were conducted to examine the contrasting effects of demands and resources on burnout and engagement. Specifically, we test whether job demands have a stronger influence on burnout than on engagement and whether job resources have a stronger influence on engagement than on burnout. The results indicate that the effect of CTU on engagement through accessibility, is larger than the effect of CTU on burnout through accessibility ($b^* = 0.053$, BC 95% [.002; .107] $p = .040$), which

is in accordance with JD–R model expectations. For efficient communication, the effect of CTU on engagement and burnout cannot be distinguished in terms of magnitude ($b^* = 0.000$, BC 95% [−.047; .042] $p = .998$). The predictions of the JD–R model were also partially supported regarding job demands. We discovered that the effect of CTU through unpredictability influences burnout to a greater extent than engagement ($b^* = 0.051$, BC 95% [.023; .094] $p = .001$). However, the parameter estimates of the effects through interruption on burnout and engagement were equivalent ($b^* = 0.014$, BC 95% [−.019; .051] $p < .381$).

Control variables and alternative models

The control variables sex, age, years of work experience, managerial position, working hours per week, and organizational size were consecutively modeled. All the parameters presented in the final model held true when controlling for these variables. This result indicates that the control variables had no influence on the overall findings; as such, we excluded these variables from the final model for reasons of parsimony.

Model fit statistics for alternative models were examined to determine whether these models correspond with the data for alternative explanations. Model deterioration was assessed using a $\Delta\chi^2$ test. First, we re-specified our structural model as a CFA. This model represents the unanalyzed associations between factors (i.e., covariances) that are not directional. Model fit indices suggest significant model deterioration compared with the retained structural model ($\Delta\chi^2 = 25.72$, $p < .001$). Additionally, we estimated a reversed model using burnout and engagement to explain CTU through our mediators, thus reversing the causal directionalities (Kline, 2011). The overall fit of the model suggests an inferior fit to the data compared with the retained model ($\Delta\chi^2 = 28.54$, $p < .001$).

Discussion

To understand better the divergent well-being outcomes associated with technology use at work, we argue that the opposing consequences of CTU, which have been previously identified in the literature, should be evaluated as CTU-related resources and demands that ultimately affect employee well-being. CTU enables employees to communicate quickly and efficiently, regardless of time and space (Cavazotte et al., 2014; Mazmanian et al., 2013; Rennecker & Godwin, 2005). However, CTU can simultaneously hinder the work process due to increases in interruptions and unpredictable work developments (Chesley, 2014; Fonner & Roloff, 2012; Perlow, 2012; Thomas et al., 2006). Consistent with the JD–R model, our results show that CTU is related to employee well-being through these opposing mechanisms. This study highlights the importance of considering both CTU resources *and* demands to understand fully the influence of CTU on employee well-being. In this section, we summarize some of the core contributions of the study.

First, our findings confirm that technology use at work is related to specific resources and demands. Our quantitative results support previous qualitative research suggesting that CTU helps employees efficiently handle communication both in and outside the office (Mazmanian et al., 2013) to efficiently perform tasks (Cavazotte et al., 2014) and save time (Matusik & Mickel, 2011). Our findings are also aligned with research linking CTU to accessibility by showing that employees use technology to stay in touch with

colleagues and ensure that projects move forward in their absence (Mazmanian et al., 2013) and that CTU enables a sense of dynamism, control, and greater availability and visibility with peers and clients (Cavazotte et al., 2014). Moreover, our results support previous qualitative findings regarding demands. Consistent with Perlow (2012) and Thomas et al. (2006), we demonstrate that CTU at work enhances unpredictable workloads and an accumulation of unforeseen and additional tasks. Our results regarding the relationship between CTU and interruptions resonate with an expanding body of literature demonstrating that CTU can derail the flow of activities directed toward accomplishing tasks (Chesley, 2014; Fonner & Roloff, 2012). Our study contributes to the literature by identifying these outcomes of CTU as CTU-related resources and demands.

Second, this study establishes the crucial role of these resources and demands in explaining the relationship between CTU and well-being. Technology use and employee well-being are positively associated through enhanced accessibility and communication efficiency but are negatively related through increased interruptions and unpredictability. Specifically, CTU fosters greater efficiency and accessibility in work communication and processes, which helps explain how technology use reduces employee burnout and enhances work engagement. CTU also fosters interruptions, which helps explain how technology use contributes to an increase in employees' work-related burnout and a decrease in work engagement. The unpredictable work to which CTU gives rise also helps explain the relationship between technology use and burnout. However, our study found no indirect relationship linking CTU to engagement through the unpredictability of work. Because unpredictability is regarded as a CTU-related demand, this finding might be explained by the JD-R model, which posits that job demands are primarily predictive of burnout symptoms, whereas job resources are primarily predictive of work engagement (Bakker et al., 2014). Another explanation might be the distinction between challenge demands and hindrance demands. Crawford et al. (2010) found in their meta-analysis that challenge demands have a positive influence on both burnout and engagement, whereas hindrance demands enhance burnout and decrease engagement. Although we did not find a significant positive relationship between unpredictability and work engagement, unpredictability might serve as a beneficial challenge for employees, with either no loss of or a slight increase in engagement.

Third, the study contributes to the literature by examining the comparative influences of CTU-related resources and demands on work engagement and burnout. The relationship between CTU and work engagement is better explained by the CTU-related resources' efficiency and accessibility than the CTU-related demands' unpredictability and interruptions; this finding is consistent with the JD-R model, which posits that resources predict motivational work outcomes better than demands. With respect to burnout, the indirect paths through CTU-related resources and demands are equal in magnitude, which indicates that the effects of these resources and demands on burnout even one another out. Although this finding is not in line with the health impairment process proposed by the JD-R model, it has both theoretical and practical implications because CTU seems neither helpful nor harmful to employees with regard to the development of burnout symptoms. From a theoretical standpoint, the study findings reinforce the importance of examining both CTU-related resources *and* demands to prevent one-sided conclusions about the effects of CTU on employee well-being. In practice, the study findings emphasize the need for organizations to find ways to enhance the

advantages—and even more important, mitigate the challenges—that are related to CTU at work to facilitate the positive effect of CTU on employee well-being.

Theoretical implications

This study is the first to link the literature on CTU-related paradoxes (Fonner & Roloff, 2012; Jarvenpaa & Lang, 2005; Leonardi et al., 2010; Mazmanian et al., 2013; Pearlson & Saunders, 2001; Putnam et al., 2014) and the JD–R model to map the contradictory pathways between CTU and employee well-being (Bakker et al., 2014). According to the JD–R model, job resources and demands are working conditions that are expected to produce different processes that accumulate and lead to decreased or enhanced employee well-being. These two sets of working conditions correspond to the opposing results from previous studies on CTU at work (Cavazotte et al., 2014; Chesley, 2014; Fonner & Roloff, 2012; Matusik & Mickel, 2011; Mazmanian et al., 2013; Perlow, 2012; Rennecker & Godwin, 2005). Considering the previously recognized advantages and challenges of CTU as the two working conditions job resources and demands proved fruitful by enabling us to model the contradictory findings in the CTU literature and to relate them to employee well-being. As such, this is the first quantitative study that demonstrates paradoxical mechanisms in the relationship between CTU and employee well-being that can coexist yet have unique effects on the different well-being measures of work engagement and job burnout (Bakker et al., 2014).

Our findings also contribute to the literature by highlighting the comparative influences of opposing outcomes associated with technology use on employee well-being. In addition to the premise that job resources and demands characterize two sets of working conditions found in every organizational setting, the JD–R model proposes that resources and demands produce two processes: the motivational process and the health impairment process. The motivational process implies that job resources (compared with demands) are most influential with respect to engagement, and the health impairment process suggests that job demands (compared with resources) are most influential with respect to burnout (Bakker, Demerouti, De Boer, et al., 2003; Bakker, Demerouti, & Schaufeli, et al., 2003; Crawford et al., 2010; Nahrgang et al., 2011). An extensive meta-analysis of 179 studies found support for the motivational process and the health impairment process (Nahrgang et al., 2011). However, job demands were also negatively related to engagement, and job resources were negatively related to burnout. Our study showed comparable results in the context of CTU and additionally investigated the strengths of CTU resources and demands to determine which path of the paradoxical relationship had more weight. As such, this study is the first to test the contrasting effects of the indirect pathways both within the literature on CTU outcomes and in studies on the JD–R model. We found support for the motivational process: the relationship between CTU and work engagement is stronger through CTU-related resources than through CTU-related demands. However, in the context of CTU, we did not find support for the health impairment process: the pathways between CTU and burnout were not significantly stronger through CTU demands than through CTU resources. This finding implies that the advantages of using CTU at work are equally as strong as the disadvantages of using CTU at work with respect to its effect on burnout. These findings underline the importance of studying both CTU-related resources and demands in the relationship between CTU

and employee well-being. Merely studying CTU-related resources would provide a positive narrative, whereas only including CTU-related demands in the model could confirm a negative relationship between CTU and well-being.

Practical implications

As organizations implement new technologies and adopt flexible work arrangements, certain outcomes of technology use should be considered in relation to employee well-being. As employees use technology, they will experience both accessibility and efficiency in their communication and interruptions and unpredictability in their work patterns. To mitigate employee burnout, organizations should focus on sustaining leadership and cultural expectations that support accessibility and efficient communication through technology and protect employees from constant interruptions and excessively unpredictable work schedules. Organizations focusing on increasing employee engagement should do the same, with a particular emphasis on supporting technologies that enable accessibility and efficiency.

Although work-related interruptions and unpredictability are inherent in the workplace—particularly in knowledge work—organizations can facilitate an appropriate balance regarding these demands and the resources that employees must use to cope with these demands. For example, organizations may wish to consider implementing work–life initiatives that help employees prevent information overload and mitigate stress from interruptions (e.g., Fonner & Roloff, 2012; Kossek, Lewis, & Hammer, 2010; Perlow & Porter, 2009).

Organizations must also find a balance between employees being on- and offline (Mazmanian, 2013; Mazmanian et al., 2013; Perlow, 2012). Based on the collective consequences of CTU (Mazmanian et al., 2013; Perlow, 2012), such as shared assumptions and raised expectations, the solution should be realized at least in part on the collective level. Solutions that primarily focus on the individual by helping to find balance—such as “better work, sleep, eat, and exercise”—appear insufficient (Michel, 2011; Perlow & Kelly, 2014; Putnam et al., 2014). Recently, scholars have focused on solutions that are specifically aimed at altering the structure and culture of work to enable better work and lives (Kossek et al., 2010; Perlow & Kelly, 2014; Putnam et al., 2014).

Based on our results, two findings from the previous literature seem particularly relevant. First, the Predictability, Teaming and Open Communication (PTO) intervention may help change the structural expectations of the ideal worker by controlling constant connectivity (Perlow, 2012; Perlow & Kelly, 2014). PTO is a team-level intervention in which team members first set a collective goal that involves creating predictable weekly time off for each team member. The team engages in weekly structured dialogues to discuss progress toward the collective goal. This intervention has enjoyed proven success in enhancing teamwork, work-life balance, and client satisfaction. Although it has not yet been used specifically to improve employee well-being, we expect that it will accomplish this goal by restricting interruptions and unpredictability. Second, Mazmanian (2013, p. 1246) notes “that in certain scenarios it is possible for individuals to develop socially stable heterogeneous patterns of communication that benefit them without having received a top-down mandate, such as a ‘no e-mail Friday.’” Organizations can learn to create congruent frames of heterogeneous communication practices to develop communication norms and circumvent the trap of constant connectivity (Mazmanian, 2013).

Limitations and future research directions

A limitation of our study is that we cannot form conclusions about the causality of the reported relationships among CTU, CTU resources and demands, and employee well-being. Employees who are highly engaged and feel well may have been given more control over their CTU. However, this result seems unlikely because the re-specified and reversed model had a significantly poorer model fit than our final model, implying that the hypothesized causality best fits the data. Other types of research are required to substantiate the causal relationship between CTU and employee well-being. For example, a two-wave study with an eight-month interval (see Dormann & Zapf, 1999) could measure CTU, CTU resources and demands, and employee well-being twice. Another potential limitation is common method bias because we related data on CTU, CTU resources and demands, and employee well-being that were collected from a single source using a survey design. Third-degree factors, such as sleep deprivation or impactful events, may have similarly affected all the variables, thereby exaggerating their correlation. Although we conducted several tests that demonstrate that common method bias does not significantly impact our data, future studies can avoid this possibility by using data from different sources. For example, supervisors or colleagues might assess several aspects of the employee's well-being (e.g., social well-being), or physiological measures might be included. Finally, another potential limitation of this study is the measurement of CTU. Although the measurement captures the most commonly used interactive technologies in the workplace (e.g., D'Urso & Pierce, 2009; Fonner & Roloff, 2012), the inclusion of social technologies in the workplace is occurring at a rapid pace (Treem & Leonardi, 2012). For a more comprehensive assessment of technology use, it may be worthwhile to develop a scale that taps into the use of "new" technologies, such as enterprise social media use, instant messaging, or videoconferencing.

Although we believe that we captured the most important CTU-related resources and demands, we certainly do not claim to be exhaustive. Specific technological innovations may require the incorporation of other CTU resources and demands. To expand the knowledge of the relationships between CTU and employee well-being, we encourage researchers to explore other (paradoxical) processes in this relationship. For example, a CTU-related resource might be an increased possibility for employees to craft their jobs. The use of communication technology gives more latitude in when, where, and how to execute a job, which, in turn, might provide employees with the opportunity for innovative work behavior, such as job crafting, described by Wrzesniewski and Dutton (2001) as "the actions employees take to shape, mold, and redefine their jobs". Job crafting is thought to create advantages, such as enhanced meaning in work, a positive work identity, work engagement, and employability (Tims & Bakker, 2010; Tims, Bakker, & Derks, 2012; Wrzesniewski & Dutton, 2001). An example of a possible CTU-related demand is work-to-nonwork conflict (Butts, Becker, & Boswell, 2015). CTU has not only changed when and where employees work but also blurred the boundaries between work and nonwork domains (Derks, Van Mierlo, & Schmitz, 2014). Employees can have difficulty distracting themselves from work during off-job time due to increased CTU. However, detachment from work during nonwork time is important for employee recovery and health (Butts et al., 2015; Park, Fritz, & Jex, 2011).

Future studies should also examine the balance of CTU outcomes that have the most beneficial influence on well-being. The JD-R model suggests that engagement is predicted by

maintaining a particular balance of demands and resources, such that employees who experience high demands coupled with high levels of resources will be very engaged. Future research might explore the specific balance of demands (interruptions, unpredictability, and other demands) and resources (accessibility, efficiency, and other resources) that best enables engagement and minimizes burnout. These studies should identify the demands that hinder engagement (e.g., that prevent employee growth) and those that strengthen engagement (e.g., challenges that represent opportunities for growth; Crawford et al., 2010).

The findings in the relationship between CTU and employee well-being may be explained by certain conditions in which CTU affects employee well-being. For example, the relationship between CTU and well-being may differ depending on the work environment (Grant & Ashford, 2008). Employees may be enthusiastic about communication technology; however, if the organization does not adequately support that technology, this enthusiasm may also operate as a job demand and diminish employees' well-being (Day, Paquet, Scott, & Hambley, 2012). In this way, managerial CTU may also influence the relationship between CTU and employee well-being. Additionally, the increasing use of communication technology requires greater knowledge about the appropriate leadership styles to adequately support employees. Finally, employees may differ in their motivation and ability to work with communication technologies. Therefore, future studies could examine conditional factors in the CTU-employee well-being relationship.

Recent research points toward more structural, collective, and coordinated actions and solutions regarding time and communication technology management (Michel, 2011; Perlow & Kelly, 2014; Putnam et al., 2014). Additional research is needed on the role of organizational culture and norms in enhancing the advantages and attenuating the challenges of CTU that affect employee well-being.

Notes

1. This panel is ISO27001 certified.
2. Figures derived from the Central Bureau of Statistics (statline.cbs.nl/) and the Dutch Ministry of Education, Culture, and Science (http://www.trendsinebeeld.minocw.nl/grafieken/3_1_2_31.php).
3. This variable measures individuals' interest in the aesthetics of (fine) arts, which is unrelated to the variables in our model (Derived from the Five Factor Model of Personality; McCrae & Costa, 1987).

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