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"With Kind Regards?": The Relationship Between Digital Work Communication and Mental Health**

Abstract

There is a growing interest in exploring the potential benefits and risks of digital work communication (DWC) for employers and employees. While some studies view the use of DWC as a demand that threatens employees' mental health, others regard it as a resource that provides health benefits. The empirical evidence has been ambiguous, offering support for both assumptions but with limited explanations. Our study contributes to the ongoing discourse by examining the extent of DWC and the advantages and disadvantages associated with its use, including positive (increased flexibility) and negative (a lack of flexibility, the need to be constantly available, overload, and loss of personal contact) perceptions. Using a sample of 4,422 employees in 160 German work organisations, we conducted moderation and mediation analyses in structural equation modelling and found that more DWC was associated with poorer mental health. Although both negative and positive perceptions were directly related to mental health, they also moderated and mediated the relationship between the DWC and mental health. In conclusion, our research demonstrated that it is not the use of DWC alone that is harmful to mental health, but rather its intensity and the circumstances in which it is used.

Keywords: employees, information and communication technologies (ICT), job demands-resources (JD-R), technology, well-being
(JEL: I10, J28, J81, O33)

Introduction

The adoption of digital work communication (DWC) has gained prominence most recently during the global COVID-19 pandemic, offering employees more opportunities to work from home (Alipour et al., 2021; Felstead & Reuschke, 2020). Yet, even prior to the pandemic, interactions via email, software applications, and even

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more complex internal and external digital communication platforms had become a routine aspect of work for many employees and employers (Messenger et al., 2017; Sivunen & Laitinen, 2019). As interpersonal interactions constitute a large part of organisations (Ferris et al., 2009), concerns about the potential benefits and risks of DWC for employers and employees have been raised. While productivity has traditionally been a focus (Polák, 2017), attention has also shifted to include mental health and well-being concerns (Berg-Beckhoff et al., 2017; Day et al., 2010).

In general, employee mental health is positively linked to workplace communication (Eguchi et al., 2012; Honda et al., 2016). However, DWC differs fundamentally from other forms of communication, especially face-to-face interactions, as it allows for asynchronous communication, rapid information exchange, and flexibility in time and location (Barber & Santuzzi, 2015; Bordi et al., 2018; Day et al., 2010). Based on theoretical models, conclusions regarding DWC are mixed: On one hand, the use of information and communication technology (ICT) and the associated use of DWC is often considered a work demand, mostly within the job demands-resources (JD-R) model (Bakker & Demerouti, 2007). This suggests that it has negative implications for mental health (Day et al., 2012; Ninaus et al., 2021). On the other hand, within the same theoretical framework, especially in the context of flexible work, DWC can also be seen as a work resource (Bordi et al., 2018; Carlson et al., 2017; Day et al., 2012; Day et al., 2010; Derks & Bakker, 2010; Marsh et al., 2022) and thus be positively linked to mental health. Although most studies suggest negative associations between DWC and mental health, certain empirical studies indicate no relationship between DWC and health outcomes or even a positive association (for reviews, see, for instance, Berg-Beckhoff et al., 2017; Baumeister et al., 2021). An illustration is a study involving a representative sample of the Swedish working population, where repeated exposure to ICT demands at work over two time points was linked to worse self-rated health (Stadin et al., 2019). Similarly, based on cross-sectional designs, a positive association was found between increased email volume and emotional exhaustion among Australian workers (Brown et al., 2014) and higher work-related stress among American workers aged 18 years or older (Mano & Mesch, 2010). In contrast, a study conducted in Israel suggested lower levels of exhaustion in the intervention group as opposed to the control group subsequent to the implementation of ICT (Chen et al., 2009). Using cross-sectional data from a German cohort study of individuals born in 1959 and 1965, Borle et al. (2021) found that ICT usage by itself did not have a significant association with mental health. The inconsistent findings within the theoretical and empirical literature raise the question of the distinct mechanisms involved in the relationship between different aspects of DWC usage and health outcomes, including mental health. Thus, our research aimed to investigate the precise conditions in which the use of DWC may either serve as a resource or create a demand in terms of the JD-R model, with the objective of enhancing comprehension of the association between DWC and mental health and

the underlying mechanisms. Accordingly, we explored two possible explanations for the inconsistent empirical results: Firstly, researchers frequently study the use of ICT, which incorporates various elements of DWC, ranging from basic computer usage, information retrieval, and working with software to the specific aspect of digital communication (Berg-Beckhoff et al., 2017). Therefore, findings from prior studies are liable to conflate a multitude of mechanisms which cannot be ascribed to individual aspects of technology usage and their potential impact on mental health. We strive to contribute to the ongoing debate and address the heterogeneity of findings on ICT, following suggestions from previous research to adopt a more nuanced perspective of ICT (Baumeister et al., 2021). Therefore, while previous research has often concentrated on ICT usage as a whole (e.g., Day et al., 2012), we particularly concentrate on communication via ICT (digital communication).

Secondly, taking inspiration from the notion of technostress (Tarafdar et al., 2011; La Torre et al., 2019), we propose that the explanation for the relationship between DWC and mental health may not be solely attributed to its usage but rather to the extent (or intensity) of DWC and circumstances surrounding its use. To determine under which conditions DWC has a negative, positive, or no effect on employees' mental health – in other words when it can be viewed as a work resource or a work demand (Day et al., 2012; Day et al., 2010) – we explored several avenues. Initially, we assessed the extent of DWC usage in proportion to the entire work communication to account for variations in the intensity of its use. By doing this, we considered the actual usage of DWC instead of restricting our research to general attitudes or motivations (Borokhovski et al., 2018). Additionally, we differentiated between positive and negative perceptions concerning the usage of DWC. As a favourable aspect, we used employees' perceptions of enhanced flexibility by using DWC. Flexibility concerning time and place is by far the most frequently discussed benefit of DWC. It is not only connected to increased productivity (Choudhury et al., 2021) but also to improved work-life balance and greater well-being (Nijp et al., 2012). Regarding negative perceptions, constant availability and overload were considered as two dimensions of technostress (Tarafdar et al., 2011), which have also been recognised as potential demands with reference to the JD-R model (Day et al., 2012). Furthermore, following the conservation of resources approach (Hobfoll, 1989), we suggest that the absence of a resource can serve as an added stressor, implying that the loss of personal contacts and the lack of flexibility will have a detrimental effect on mental health.

Thirdly, we investigated whether these perceptions moderate or mediate the relationship between the extent of DWC usage and mental health. By analysing if different perceptions of DWC could account for the detrimental or advantageous health implications of different degrees of DWC usage, we sought to deepen the knowledge of the mechanisms underlying this relationship. We also inquire whether the usage of a specific extent of DWC occurs in combination with positive or negative perceptions (moderation) or whether different degrees of usage correspond

to distinct perceptions that could ultimately elucidate divergences in the mental health of employees (mediation).

To address our three research questions, we used structural equation modelling, encompassing moderation and mediation analyses. The study was conducted using linked employer-employee data based on a cross-sectional sample of 4,422 employees from 160 large German companies. The data included detailed information on the participants' DWC usage regarding email, software applications and digital platforms to communicate with both their supervisors and their colleagues, as well as their perceptions of the DWC usage. As the random sample of employees was representative of employees in large German work organisations (at least 500 employees), this study also adds to the existing research by drawing our sample from different industries and occupations. In contrast to previous studies, which relied on limited case studies, small sample sizes, or were confined to selected occupations or organisational contexts, our study enables us to draw conclusions regarding the relationship between DWC and mental health across a diverse workforce and in different organisational settings.

Literature Review: DWC and Mental Health

The Benefits and Risks of DWC

Digital work communication (DWC) can be defined as communication with colleagues and supervisors using various digital information and communication technologies (ICT). These ICT include "technology that provides access to information through telecommunications, such as the internet, wireless networks, cell phones, and other communication media" (Berg-Beckhoff et al., 2017, p. 160). Due to the diverse array of technologies and application scenarios, numerous effects of ICT use have been studied (Baumeister et al., 2021; Berg-Beckhoff et al., 2017). Some studies utilise broad measures, such as internet use, to examine the effects of ICT (Leung, 2011). Others differentiate between stationary and mobile computer work (Korpinen et al., 2015) or investigate email communication specifically (Derks & Bakker, 2010). We aim to focus on technology-mediated interpersonal communication in the workplace, hence on communication via different ICT. Our definition of DWC excludes other application scenarios of ICT, such as the use of the internet or smartphones for information gathering. Therefore, while DWC may be a component of ICT use, not all ICT use involves DWC.

Compared to face-to-face interactions or the telephone, which are more established forms of technology-enabled distance communication, DWC via email, software applications, or more complex digital platforms is a relatively recent addition to workplace communication processes (O'Driscoll et al., 2010). To contextualise the understanding of DWC as either a demand or a resource in the workplace, we draw upon the JD-R model (Bakker & Demerouti, 2007). This model suggests that working conditions can be divided into two categories: job demands and job

resources. *Job demands* are linked to physical or mental effort and may generate strain. This, in turn, represents a cost to employees, which can ultimately result in negative health outcomes. *Job resources* are the components of jobs that directly assist employees in achieving goals, promoting personal growth, or indirectly alleviating the strain imposed by job demands, thereby positively impacting the mental health of employees (Bakker & Demerouti, 2007). Consequently, numerous empirical studies have thoroughly established the adverse consequences of job demands and the beneficial impact of job resources (e.g., Bakker et al., 2005; Brauchli et al., 2015).

In principle, the JD-R model allows us to understand DWC both as a demand and as a resource (Baumeister et al., 2021; Bordi et al., 2018; Carlson et al., 2017; Day et al., 2012; Day et al., 2010; Derks & Bakker, 2010; Marsh et al., 2022). A typical example of work-related communication's demand side is emotionally taxing interactions with clients or co-workers (Bakker & Demerouti, 2014). Social resources are explicitly mentioned as important job resources in the JD-R model (Demerouti et al., 2001). However, to elucidate under which conditions DWC acts as a demand or resource, further elaboration on the digital nature of DWC is imperative. It is crucial to comprehend the distinct characteristics of DWC in comparison to other forms of communication, especially face-to-face interactions.

While written digital communication is argued to be more efficient and flexible as it allows for rapid information exchange and is independent of time and place (e.g., Barber & Santuzzi, 2015; Bordi et al., 2018; Day et al., 2010), its use has led to changes in the way employees communicate at work. Due to a lack of non-verbal information and situational context, the exchange of information is often incomplete (McKenna & Bargh, 2000), increasing the risk of misunderstandings and less effective communication (Derks & Bakker, 2010; Friedman & Currall, 2003; Walther et al., 2005). In addition, although emails can be read at any time, research has indicated that employees respond to emails as promptly as phone calls (Jackson et al., 2003). However, with the steady increase in the number of emails and electronic messaging over the past few decades, DWC is likely to bring about more interruptions compared to face-to-face communication, challenging employees to manage the overwhelming amount of information and communication opportunities (Mano & Mesch, 2010).

In addition, DWC, whether verbal or written, prioritises the exchange of information over the employee's multifaceted nature (Taskin & Edwards, 2007). Consequently, as compared to face-to-face communication, it is less probable to address sensitive social matters, foster vibrant team dynamics, or encourage informal social support, but more likely to promote social exclusion (Cooper & Kurland, 2002; Knights & McCabe, 2003; Wiesenfeld et al., 2001). Thus, the question remains under which concrete circumstances DWC emerges as a resource or a demand in terms of the JD-R model and, subsequently, how it is linked to the mental health

of employees. To take a closer look at different conditions of using DWC, the following sections will explore further (a) how positive (enhanced flexibility) as well as negative (constant availability, overload, loss of personal contacts, lack of flexibility) perceptions of DWC can be explained, and (b) how these positive and negative perceptions of DWC constitute mechanisms that potential hazards and advantages of DWC for the employees' mental health.

Enhanced Flexibility as a Resource

DWC expands communication opportunities not only within organisations but also beyond organisational boundaries (Sivunen & Laitinen, 2019). It makes communication visible and facilitates knowledge sharing and organisational learning (Sivunen & Laitinen, 2019). Characterised by very fast real-time communication, DWC creates new forms of collaboration, as team members can be informed of who is available at any given moment (Quan-Haase et al., 2005). It thus allows asynchronous communication among employees working apart from each other, either in different company locations or across different time zones (Barber & Santuzzi, 2015; Day et al., 2010; Wang et al., 2020). Further, DWC can streamline communication and information exchange among employees collaborating in the same workspace (for instance, by collaboratively editing a document) (Sivunen & Laitinen, 2019). By far, the most widely discussed advantage of DWC is the enhanced flexibility of working time and place, as employees can communicate remotely from anywhere and at any time on lightweight devices such as laptops or smartphones.

Accordingly, DWC facilitates greater flexibility for employees, who are able to organise work independently in terms of location and time, offering them an increased level of control over their schedules (Bordi et al., 2018; Carlson et al., 2017; Dragano & Lunau, 2020; Karimikia & Singh, 2019). Flexibility is a crucial job resource as it aids employees in managing job demands and is positively associated with (mental) well-being (Bakker et al., 2005; Park & Searcy, 2012; Thompson & Prottas, 2006). In particular, having a high level of flexibility is not only directly beneficial to health but can also mitigate the adverse health implications of DWC (Schieman & Young, 2013). Therefore, it could be suggested that DWC might have positive health effects when linked to enhanced flexibility.

Constant Availability, Overload, and Loss of Personal Contacts Demands

Despite the evident advantages of DWC, it is often viewed as a risk to employees, and some suggest that it is a technology-driven demand in particular (Marsh et al., 2022). This can be explained within the framework of *technostress* (Tarafdar et al., 2011), which defines technostress as a "situation of stress experienced by the individual because of an inability to adapt to the introduction of new technology in a healthy manner" (Tarafdar et al., 2011, p. 105). The concept is founded

on the general assumptions of the transactional model of stress (Lazarus & Folkman, 1984). The model proposes that stress arises from demanding conditions ("stressors") and the individual's evaluation of them. Thus, the impact of DWC on mental health should depend on the circumstances in which it is used and how employees perceive it (Tarafdar et al., 2011; for empirical evidence, see Ayyagari et al., 2011; Dragano & Lunau, 2020; La Torre et al., 2019). Our research focuses on two of the original technostress dimensions described by Tarafdar et al. (2011): Firstly, techno-*invasion*, which involves employees' being constantly connected to work and the intrusion into their leisure time due to DWC (which we refer to as "*constant availability*"). Second, techno-*overload*, i.e., "too much" information, multitasking across multiple communication channels, or interruptions that result in overload as employees attempt to accomplish more than they can handle. In addition, we explore two additional dimensions of technostress: firstly, we accentuate the significance of social connections for work communication, highlighting the potential *loss of personal contacts* due to the limitations of digital communication. Secondly, we propose that a *lack of flexibility* as a counterpart to (enhanced) flexibility could be an additional demand.

Constant Availability

In response to the fast pace of DWC, employees may develop norms of responsiveness and feel pressured to meet these norms by speeding up their response to incoming messages. As a result, they may feel obligated to be constantly available, even beyond conventional working hours (Sivunen & Laitinen, 2019). Furthermore, DWC has the potential to provoke frequent interruptions in the shape of notifications and messages (Fonner & Roloff, 2012). Therefore, employees need to establish boundaries, not only in regard to their availability whilst at the workplace but, more significantly, in separating their work and private lives outside the workplace (Kossek, 2016). Supervisors can act as role models when it comes to setting these boundaries (Stempel et al., 2022). Still, as more mobile communication devices are increasingly utilised, the boundaries between work and private life are slowly disappearing (Peters & Allouch, 2005). Therefore, constant connectivity is negatively related to employees' well-being when they are unable to disconnect from work (Büchler et al., 2020; Schieman & Young, 2013). In particular, engaging outside of work hours and feeling obligated to be constantly available have been linked to distress and sleep issues (Chesley, 2014; Schieman & Young, 2013).

Overload

Furthermore, the increased intensity of technological multitasking could eventually result in an excessive work overload due to the difficulties of processing cognitive information (Reinsch et al., 2008) and the potential for information overload (Mano & Mesch, 2010). Many studies highlight that in the digital age, individuals are connected in multiple ways via numerous devices and applications, all of which

require employees' attention. Employees are expected to engage in a range of communication channels and to reply to a multitude of electronic messages (Barley et al., 2011), potentially feeling obliged to respond rapidly to messages from co-workers or supervisors. This "telepressure" has been associated with feelings of overload (Barber & Santuzzi, 2015, p. 172). Even though it is assumed that employees using DWC can respond to communications at their own pace (see flexibility argument), interruptions caused by emails and messages are counterproductive (Jackson et al., 2003), with a high intensity of DWC resulting in job tension (Steffensen et al., 2022). Moreover, DWC usage tends to increase the pace of daily work activities (Thulin & Vilhelmson, 2021), and it is also associated with a heavier workload (Day et al., 2012) and work intensification, which may account for its adverse effects on mental health (Borle et al., 2021). Notably, receiving large numbers of emails is associated with overload, which in turn is related to emotional exhaustion (Brown et al., 2014; Day et al., 2012).

Loss of Personal Contacts

As Day et al. (2012) discuss, emails and text messaging can result in ineffective communication and a greater probability of miscommunication, which may be associated with increased stress. Reliance on electronic forms of communication can complicate the coordination of work tasks by reducing opportunities for direct feedback and inhibiting lively teamwork processes (Knights & McCabe, 2003). In addition, miscommunication can cause interpersonal conflict, whether intentionally or unintentionally (Day et al., 2012). However, it is widely accepted that positive social relationships significantly contribute to an individual's good health, including work-related social support (House et al., 1988; De Lange et al., 2004). In the JD-R model, interpersonal relationships function as direct resources for providing emotional and practical support (Bakker & Demerouti, 2007). Conversely, relationships of lower quality and less social support are linked to poorer mental health (Rydstedt et al., 2012). Despite the ability to express emotions through emoticons (Riordan & Glikson, 2020) and the potential to develop relationships despite geographical distances (Wilson et al., 2008), DWC may restrict the advantageous aspects of social interaction (Sivunen & Laitinen, 2019). Not only can it impede communication (Stich et al., 2015), but it can also prompt users to perceive a decrease in work-related connections. Although DWC provides employees with many opportunities to reach out to others and build extensive networks, these networks may be especially weak ties (Zhang & Venkatesh, 2013). DWC also decreases personal face-to-face interactions with direct co-workers or supervisors, potentially leading to a reduced sense of belonging and social support (Wang et al., 2020). Such indirect interactions are thus less likely to contain the affective components that foster supportive, high-quality relationships (Golden, 2006; Wayne et al., 1997). In addition, employees may be less visible to their co-workers and supervisors (Cooper & Kurland, 2002). As electronic interactions become more

formalised and focused on the exchange of very specific information (Taskin & Edwards, 2007), they are less likely to include critical discussions of sensitive topics. Therefore, when difficult issues arise, socio-emotional support may no longer be accessible (Wiesenfeld et al., 2001).

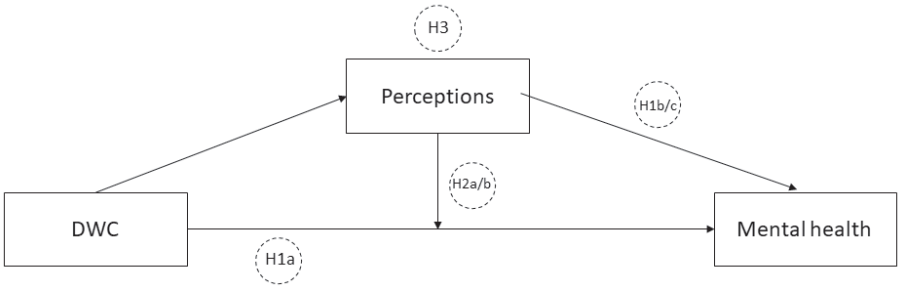
Lack of Flexibility as an Additional Demand

As previously mentioned, the enhanced flexibility provided by DWC could be the most promising employee benefit. Nevertheless, DWC usage does not inevitably result in greater flexibility. For instance, employees may still be restricted by specific working hours (e.g., business hours) and/or negligible opportunities to work from home despite ample DWC. This issue may worsen due to the necessity to reply to co-workers or supervisors within specific timeframes, which limits time flexibility even during work hours. Collaborating with co-workers or customers across different time zones imposes additional limits on time flexibility for certain employees. Moreover, the sheer volume of DWC is likely to restrict individual flexibility because of constant interruptions and the urge to frequently check for incoming messages, especially when contrasting DWC with other forms of communication (Giurge & Bohns, 2021; Steffensen et al., 2022). Furthermore, if employees can only use DWC for a limited portion of their overall work communication, they may not reap the benefits from flexibility, as other forms of communication may outweigh the benefits of DWC. Thus, although flexibility can be a valuable asset to employees, it is crucial to consider the repercussions when employees who engage in DWC are not afforded the flexibility benefits, particularly as it is expected to be provided as a standard practice of DWC. According to the conservation of resources approach (Hobfoll, 1989), it is "psychologically more harmful for individuals to lose resources than it is helpful for them to gain the resources that they lost" (Halbesleben et al., 2014, p. 1335). Therefore, flexibility is considered a common and, at the same time, an important resource that should always be present in DWC. Its absence should be even more concerning than its availability. This conclusion is supported by previous research showing that low levels (or lack) of job flexibility are generally associated with poorer mental health (Smith et al., 2008).

Hypotheses

We suggest six hypotheses about the direct, moderating, and mediating effects of DWC usage and perceptions, as summarised in Figure 1.

Figure 1. Overview of Hypotheses



Direct Effects (Basic Hypotheses)

As discussed, we assume that not the use of DWC per se poses a risk to mental health. Instead, such risk depends on the extent and conditions of use (Wang et al., 2020). In accordance with general stress assumptions and the idea that the more demanding aspects of DWC are stressful to employees, the greater the exposure to these stressors (Borle et al., 2021), we assume that especially a great extent of DWC would be negatively associated with mental health. In particular, we postulate that the higher the share of DWC in an employee's work communication overall, the more likely it is that employees will experience its (extensive) use as a stressor and that their mental health will be negatively impacted. As DWC continues to expand, the inquiry is whether employees can familiarise themselves with its use. However, during the time of the study, DWC was considered less significant than face-to-face communication. Consequently, it is plausible to interpret its utilisation as a source of stress.

Moreover, based on our detailed elaborations in the previous sections, an employee's perception that DWC is associated with demands such as the need for constant availability, the loss of personal contacts, and work overload will have a direct negative relationship with their mental health. Conversely, a positive perception of having enhanced flexibility will have a positive association with their mental health.

Hypothesis 1a: A greater extent of DWC is directly related to the poorer mental health of employees.

Hypothesis 1b: The positive perception of enhanced flexibility through the use of DWC is directly related to the better mental health of employees.

Hypothesis 1c: The negative perceptions of constant availability, overload, and loss of personal contacts through the use of DWC are directly related to the poorer mental health of employees.

Moderation and Mediation Effects

We suggest that perceptions of DWC can act as moderators or mediators in the relationship between DWC usage and mental health. Regarding moderation, we argue that negative perceptions reinforce the negative health effects of greater extents of DWC, while positive perceptions can (partially) buffer the negative effects of DWC. Thus, DWC may be particularly negatively related to poorer mental health when it is also perceived as demanding because of constant availability, overload, loss of personal contacts, or lack of flexibility. In contrast, DWC should have less or even no impact on mental health for those employees who do not perceive it as demanding. When DWC is perceived to provide enhanced flexibility, a greater extent of DWC should be less negatively or not at all related to mental health.

Hypothesis 2a: A higher share of DWC is positively associated with mental health for those employees who perceive it to provide enhanced flexibility in time and place.

Hypothesis 2b: A higher share of DWC is negatively associated with mental health for those employees who perceive it to be linked to constant availability, overload, loss of personal contacts, or lack of flexibility.

The mediation assumption suggests that the extent of DWC affects whether employees perceive flexibility, the need for constant availability, the loss of personal contacts, or overload to a greater or lesser degree. Depending on these distinct perceptions, DWC is *indirectly* associated with either better or worse mental health. In other words, perceptions can explain the connection between DWC and mental health. For instance, the greater the extent of DWC usage, the more multitasking and information processing becomes necessary, potentially leading employees to experience more overload. In this case, DWC would be related to poorer mental health. Regarding the loss of personal contacts, the more days DWC takes up, the less time there is available for face-to-face interactions and higher-quality relationships. Due to reduced personal contact, DWC is likely to be linked with poorer health. In turn, the more DWC is used in comparison with other forms of work communication, the more its potential for flexibility can be utilised in arranging work obligations flexibly in time and place because less coordination to schedule face-to-face meetings or on-site appointments is required. As a result of the increased flexibility, DWC will be positively related to mental health.

Hypothesis 3: The extent of DWC usage has a negative indirect relation to mental health based on perceptions of the need for constant availability, loss of personal contacts, and overload, and it has a positive indirect relation to mental health based on the perception of enhanced flexibility.

Methodology

Sample

We used the third wave (2018/19) of a representative-linked employer-employee panel in Germany (LEEP-B3) (Diewald et al., 2014). The LEEP-B3 sample included large organisations (with at least 500 employees who were subject to social insurance) and was based on a disproportionate (i.e., stratified by industry and region) and random sampling strategy, as well as a random sample of employees within these organisations. Information on DWC was collected only in the third wave of the employee survey. Data collection involved computer-assisted telephone interviews supplemented by paper-and-pencil questionnaires. The sample consisted of 160 work organisations and 5,350 employees who could be linked to these workplaces. From this initial sample, 928 observations (17.3 %) were excluded from our target sample because the subjects could not communicate digitally at all and, therefore, could not systematically answer questions about DWC. This reduced the final analysis sample to 4,422 employees.

The final analysis sample comprised 47 % women and 53 % men. The average age was 45 years (range = 20 to 59 years), and 47 % of the employees had a university (of applied sciences) degree. Most of the subjects were technicians or equivalent non-technical workers (34.3 %) or academic professionals (30.6 %). Of the remaining respondents, 14.8 % were office workers, 6.7 % were craftsmen or similarly skilled workers, 5.8 % were plant and machine operators and assemblers, 4.2 % were service and sales workers, and 3.6 % were managers. Of the participants, 46.9 % were employed in the credit and insurance business and administration sector, 28.1 % were in manufacturing, and 18.5 % worked in the social and public services sector; 6.5 % had jobs in trade, hospitality, or transport. The respondents worked, on average, 39.4 hours per week, including overtime; 32 % worked from home at least from time to time, and 35 % of the employees had some type of supervising responsibilities.

Measures

Mental health was measured using a German version of the SF-12 six-item summary scale (Andersen et al., 2007), including items such as "During the last four weeks, how often did it happen that you felt downhearted and low?" and "During the last four weeks, how often did you have a lot of energy? [reversed]". The Mental Health Component score (MCS) was generated by conducting a confirmatory factor analysis in structural equation modelling on all 12 items for the mental and physical health subdimensions ($\chi 2$ [45] = 1314.44, $p<0.001$, RMSEA = 0.070, CFI = 0.951, TLI = 0.928). Based on the six items mental health items, the MCS score factor was calculated, with higher values indicating better mental health. In contrast to the conventional orthogonal scoring method, this type of analysis allowed us to correlate the physical and mental health factors, thus reflecting the more realistic

assumption that mental and physical health may influence each other (Tucker et al., 2014). Consistent with the original approach, the MCS score was standardised to a sample mean of 50 and a standard deviation of 10, ranging from 5.2 to 62.5.

The extent of DWC: Following our definition of DWC, we measured DWC in terms of the use of emails and digital applications or platforms for work-related communication with supervisors and co-workers. To assess the ratio of DWC to other work communication, we measured the extent of DWC. We included the frequency of different forms of communication with supervisors (four items) and co-workers (four items) based on 5-point Likert scales ranging from "never" to "several times a day." To calculate the digital communication portion (*total use of DWC*), we summed the frequencies of using emails and of using digital applications and platforms for interacting with supervisors and co-workers (example items: "How often do you communicate with your supervisor about your work via email?"; "How often do you communicate about your work with colleagues via digital communication platforms or apps?"). To compute the *overall work communication*, we also added the frequencies of using face-to-face communication and telephone communication to the DWC sum index (example item: "How often do you communicate face-to-face with your supervisor about your work?"). The *total use of DWC* was then divided by the *overall work communication* to get the *extent of DWC*. The *extent of DWC* was then multiplied by 10 to make interpretations easier, which resulted in a variable that ranged from 0 to 10 (DWC = 0 to 100 % of overall communication). Using the share of DWC out of overall communication allowed us to account for general differences in the prevalence of communication between individuals, positions, or jobs.

Perceptions of DWC: We considered the degree to which the use of DWC was associated with four different perceptions, each measured on 5-point Likert scales ranging from "Does not apply at all" (0) to "Applies completely" (4). As a positive aspect, we used the perception of *enhanced flexibility* in time and place ("By using digital information and communication technology, I am more flexible in terms of workplace and time"). For the negative or demanding aspects, we asked to what degree employees perceived the use of DWC to be related to *constant availability* ("By using digital information and communication technology, I have to be constantly available"), loss of personal contacts ("The use of digital information and communication technology replaces personal contacts"), and *overload* ("Due to the use of digital information and communication technology, I feel overwhelmed by the mass of information and communication"), respectively.

Controls: We controlled for several work-related selection effects in mental health: actual working hours, including overtime; hourly wages (logarithmic); physical work strain (1 = Yes); occupation represented by the ISCO (International Standard Classification of Occupations) categorisation (ILO, 2016); industry sector based on the German Classification of Economic Activities (WZ 2008; Destatis, 2022); and

working from home at least occasionally (1 = Yes). Our analyses also controlled for overall work communication. As for sociodemographic and family characteristics, we considered an employee's age and age squared, as it can be assumed that the correlation between age and mental health is non-linear; parental status (having children) (1 = Yes), gender (0 = Man, 1 = Woman), and education (0 = vocational training or lower; 1 = university (of applied sciences) degree).

Analytical Strategy

The multivariate statistical analyses were performed using structural equation modelling with robust clustered standard errors (by the company) to account for the multilevel structure of the data of employees who were nested within organisations. We used full information maximum likelihood (FIML) estimations to exploit the full sample (N = 4,422) and include cases with randomly missing values on any of the control variables (202 cases in total). All analyses were re-estimated using listwise missing deletion; however, the results differed, if at all, only at the second or third decimal place, and the significance of the coefficients did not change.

To test our basic assumption about the relationship between DWC and mental health (*Hypothesis 1a*), we estimated the effects of the extent of DWC on mental health, including all control variables (Table 2). We then added the perceptions of enhanced flexibility, constant availability, loss of personal contacts, and overload to the predictions (*Hypotheses 1b and 1c*). To test the *moderation Hypotheses 2a and 2b*, we then added interactions between the extent of DWC and the four perceptions (Figure 2). In the final step (Table 3), we estimated direct, indirect, and total effects to test the mediation effect (*Hypothesis 3*) (Little et al., 2007; MacKinnon et al., 2004).

To ensure the robustness of our findings, we conducted several additional analyses. We tested for the nonlinearity of the DWC variables. Moreover, we considered that DWC is likely to be correlated with working from home. Indeed, we found a positive and statistically significant correlation between the extent of DWC and working from home (0.360, $p<0.001$), suggesting that DWC was a part of working from home but that not all employees who used DWC to a great extent also worked from home. In addition, the relationship between DWC and mental health remained significant, and the coefficients did not change significantly when working from home was controlled for, suggesting an isolated effect of DWC on mental health.

Results

On average, DWC accounted for about 36 % of employees' overall work communication (Table 1), with a wide range of results (from 6 % to 80 %). Also, for half the employees, DWC accounted for more than 36 % (median) of their work communication, but only 10 % reported that half or more of their communication was in

digital form. In terms of employees' perceptions of DWC, the positive aspect of enhanced flexibility was, on average, the greatest. The mean levels of perceived demands were very similar, with the loss of personal contacts being the most common, followed by overload. Constant availability was the least important, based on simple descriptive frequencies. There were significant correlations between all perceptions of DWC and the extent of DWC, as well as the mental health of employees. The extent of DWC, however, was not correlated with mental health. In addition, all perceptions of DWC were correlated with each other, but only to a small to moderate degree.

Table 1. Means, Standard deviations, and correlations between the main study variables (N = 4,422)

	Study variables	Mean	SD	(1)	(2)	(3)	(4)	(5)
(1)	Mental health	50.24	0.15	-				
(2)	Extent of digital work communication	3.56	0.02	0.01				
(3)	Perception of enhanced flexibility	2.16	0.02	0.09***	0.31***			
(4)	Perception of constant availability	1.31	0.02	-0.13***	0.16***	0.19***		
(5)	Perception of overload	1.44	0.02	-0.23***	0.12***	0.07***	0.31***	
(6)	Perception of loss of personal contacts	1.49	0.02	-0.11***	0.15***	0.14***	0.28***	0.26***

Note. Pearson correlations, two-tailed significance: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Consistent with *hypothesis 1a*, structural equation modelling revealed a negative relationship between the extent of DWC and mental health (Table 2): The greater the extent of DWC, the significantly poorer the employee's mental health. In alignment with our hypotheses concerning perceptions of DWC (*Hypotheses 1b and 1c*), the perception of enhanced flexibility was positively related to mental health. The more DWC was accompanied by perceptions of the need for constant availability, overload, and loss of personal contacts, the poorer the employees' mental health. In a direct comparison, the strongest effect was estimated for the perception of overload, which was at least three times higher than the other three perceptions. In addition, the direct effect of the extent of DWC became smaller when we included the employees' perceptions, supporting the idea that these perceptions may represent possible mediating processes.

Table 2. Relationship Between the Extent of Digital Work Communication/Perceptions of Digital Work Communication (DWC) and Mental Health, Based on Structural Equation Modelling (N = 4,422)

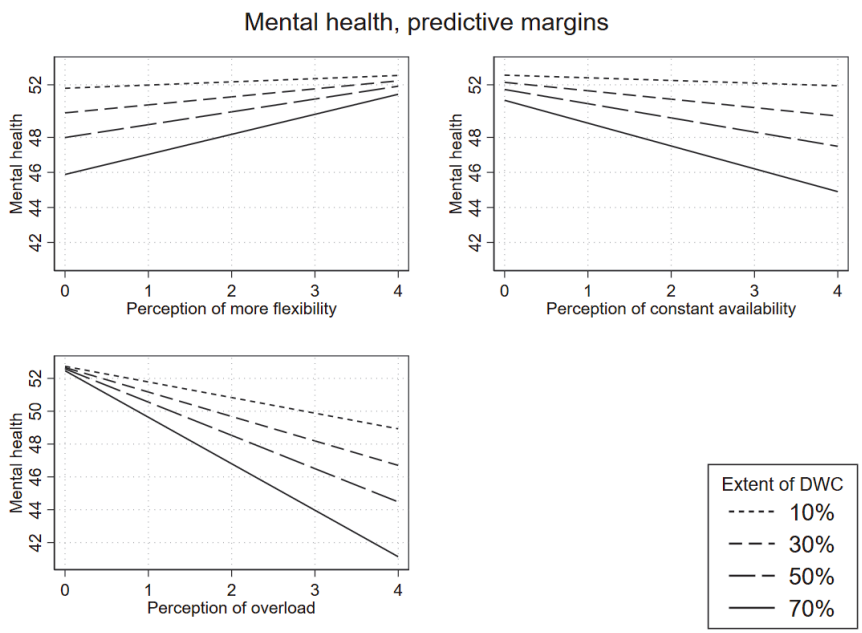
	Mental health			
	Extent of DWC		Perceptions of DWC	
	Coef.	*SE*	*Coef.*	*SE*
Extent of DWC usage	-0.618***	(0.140)	-0.401**	(0.142)
Perceptions due to DWC usage				
Enhanced flexibility			0.509***	(0.118)
Constant availability			-0.587***	(0.131)
Overload			-1.617***	(0.131)
Loss of personal contacts			-0.365**	(0.133)
Controls				
Overall work communication	0.050	(0.040)	0.073+	(0.039)
Working hours (incl. overtime)	0.018	(0.018)	0.036*	(0.017)
Working from home *(ref. = no)*	0.996**	(0.376)	0.349	(0.362)
Physically demanding work *(ref. = no)*	-2.900***	(0.336)	-2.091***	(0.318)
Hourly wages (log.)	2.610***	(0.467)	2.563***	(0.454)
Occupation *(ref. academic professionals)*				
Managers	0.581	(0.736)	0.466	(0.690)
Technicians or non-technical workers of equal rank	-0.317	(0.381)	-0.358	(0.375)
Office workers	-0.032	(0.429)	-0.346	(0.421)
Service and sales workers	-1.300	(0.855)	-1.325	(0.957)
Craftsmen or similarly skilled workers	0.764	(0.548)	0.557	(0.534)
Plant and machine operators and assemblers	-0.899	(0.792)	-1.181	(0.769)
Economic sector *(ref. manufacturing)*				
Trade, hospitality, and transport.	1.301	(0.787)	1.491	(0.772)
Credit and insurance business and administration	0.495	(0.405)	0.461	(0.389)
Social and public services	0.549	(0.502)	0.316	(0.524)
Gender *(ref. male)*	-1.272***	(0.337)	-0.993**	(0.332)
Age	-0.208	(0.156)	-0.079	(0.146)
Age squared	0.002	(0.002)	0.001	(0.002)
Education – university (of applied sciences) degree *(ref. vocational degree or lower)*	0.608	(0.323)	0.451	(0.312)
Parental status (having a child) *(ref. = no)*	1.040***	(0.311)	0.945**	(0.307)
Constant	48.593***	(3.555)	46.009***	(3.440)

Note. * p < 0.05, ** p < 0.01, *** p < 0.001. Robust clustered standard errors (SE) in parentheses. Model fit: (1) SRMR: 0.000, (2) SRMR: 0.000; other fit statistics not valid because the model was fit with variance-covariance of the estimator (vce) (clustered).

To test the *moderation hypotheses 2a and 2b*, we added interactions between the extent of DWC and all the perceptions of DWC to the predictions. We observed statistically significant interactions for the perceptions of enhanced flexibility, con-

stant availability, and overload (illustrated in the margins plots in Figure 2), yet not for the loss of personal contacts. The more flexibility was enhanced due to the use of DWC, the lower the negative effect of DWC on mental health. When flexibility was perceived to be high or very high, the differences between different extents of DWC were no longer significant. This suggests that perceived flexibility may act as a buffer against the negative effects of DWC. However, we also found evidence to support the hypothesis of a lack of resources. If employees did not perceive flexibility to be enhanced, those who had higher shares of DWC had noticeably poorer mental health compared with those with lower levels of DWC.

Figure 2. Predictive Margins of Mental Health Based on the Interactions of the Extent of DWC and Perceptions of Enhanced Flexibility, Constant Availability, and Overload (N = 4,422)



Note. The predictive margins shown here were calculated from structural equation modelling, including all controls (see Table 3). Data from LEEP-B3. 2018/19; authors' own calculations.

When constant availability was not perceived, the extent of DWC did not matter for mental health – that is, regardless of what degree DWC contributed to employees' overall work communication, their mental health did not vary. However, the more employees perceived DWC to be connected to constant availability, the greater the differences in mental health. The same finding held true for the

perception of overload but with even stronger differences in mental health when overload was high.

Finally, to investigate the *mediation hypothesis 3*, we calculated the direct, indirect, and total effects of DWC on mental health (Table 3)**.** We found positive relationships between the extent of DWC and all perceptions of DWC (direct effects), indicating that the greater the involvement of DWC in work communication, the higher the perceived flexibility. However, it was also associated with a greater perception of constant availability, overload, and loss of personal contacts. The mediation assumptions for the relationship between the extent of DWC and mental health through all perceptions were also supported. Although the direct effects of the extent of DWC on mental health were larger in the direct comparison, we identified a small indirect positive effect via the perception of enhanced flexibility and indirect negative effects through the demanding perceptions. Hence, the results support *mediation hypothesis 3*. The indirect effects through constant availability accounted for 21 % of the total effect, those via overload accounted for 27 %, and those via loss of personal contacts accounted for 23 % of the total effect, indicating that these perceptions partially mediated the relationship between DWC and mental health.

Table 3. Direct, Indirect, and Total Effects of Digital Work Communication (DWC) on Mental Health, Based on Structural Equation Modelling (N = 4,422)

	Direct effects		Indirect effects		Total effects	
	Coef.	SE	Coef.	SE	Coef.	SE
Perceptions of DWC						
Enhanced flexibility	0.113***	(0.020)			0.113***	(0.020)
Constant availability	0.127***	(0.023)			0.127***	(0.023)
Overload	0.088***	(0.018)			0.088***	(0.018)
Loss of personal contacts	0.171***	(0.020)			0.171***	(0.020)
Mental health						
Mediator: Perception of enhanced flexibility	0.339**	(0.118)			0.339**	(0.118)
Extent of DWC	-0.657***	(0.144)	0.038*	(0.015)	-0.619***	(0.140)
Mediator: Perception of constant availability	-1.015***	(0.123)			-1.015***	(0.123)
Extent of DWC	-0.489***	(0.137)	-0.128***	(0.028)	-0.617***	(0.140)
Mediator: Perception of overload	-1.887***	(0.130)			-1.887***	(0.130)
Extent of DWC	-0.454**	(0.140)	-0.167***	(0.036)	-0.621***	(0.140)
Mediator: Perception of loss of personal contacts	-0.842***	(0.130)			-0.842***	(0.130)
Extent of DWC	-0.476**	(0.139)	-0.144***	(0.028)	-0.620***	(0.140)

Note. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Robust clustered standard errors (SE) in parentheses. Controlled for overall work communication, working hours, working from home, physically demanding work, hourly wages, occupation, economic sector, gender, age, age squared, education, and parental status (having a child).

Discussion

Our research showed that the extensive use of DWC *can* pose a risk to employees' mental health, especially when it takes up a large portion of employees' overall work communication. Previous research has often defined the simple use of DWC as a demand, but it has also been debated whether it can serve as a resource instead (Baumeister et al., 2021; Bordi et al., 2018; Carlson et al., 2017; Day et al., 2010; Day et al., 2012; Derks & Bakker, 2010; Marsh et al., 2022). We contributed to uncovering whether DWC should be understood as a demand or a resource in terms of the JD-R model (Bakker & Demerouti, 2007) by demonstrating that the context of DWC usage matters for how its use is linked to positive or negative perceptions, in accordance with the assumptions of technostress (Tarafdar et al., 2011). Our findings indicated that the demanding aspects of DWC were associated with worse mental health, particularly due to perceptions of constant availability, overload, or loss of personal contacts. Additionally, our findings support the presence of both moderating and mediating processes in the relationship between DWC and mental health. When the demands were not perceived as such, the extent of DWC use did not matter for employees' mental health. However, the more negative perceptions occurred, the more strongly DWC was detrimental to mental health. Regarding mediation, we observed that DWC was indirectly related to DWC through all perceptions. This backs the notion that a higher amount of DWC is related to poorer mental health because it is associated with more demanding perceptions of its use. Thus, our results add to the theoretical idea that it is not the adoption of DWC technology in itself that jeopardises mental health but rather the circumstances of its implementation (Tarafdar et al., 2011). Empirically, our findings suggest that the most harmful aspect of DWC for mental health was the technostress dimension overload. However, our study also offers a theoretical contribution to the existing literature on technostress by highlighting that the loss of personal contacts and a lack of flexibility can be additional technology-induced stressors that are relevant to employees' mental health.

In terms of the resource perspective on DWC, the aspect of flexibility in time and place proved to be by far the most promising. Our findings indicated that perceptions of flexibility were comparably high and were more frequently experienced than perceptions of demands. On one hand, the perception of enhanced flexibility was linked to better mental health and buffered the negative effects of DWC. Additionally, we discovered indirect positive effects of DWC on mental health through the perception of enhanced flexibility. On the other hand, a substantial issue arises when flexibility is not part of DWC. In this situation, higher levels of DWC were negatively associated with mental health. Furthermore, in direct comparison, while enhanced flexibility via DWC was most prevalent, its benefit appeared to be significantly smaller than the potential harm of perceived demands.

A major advantage of the JD-R model lies in its flexibility stemming from its broad framing of job demands and job resources. This allows for the covering of all work-related characteristics under the umbrella of the theoretical concept (Bakker & Demerouti, 2014). In terms of DWC, it facilitates the incorporation and discourse of novel advancements in the world of work towards the emergence of new and/or modifications of pre-existing demands and resources. Our findings suggest that DWC can function as a resource *and* a demand, depending on how and under which circumstances it is used. This aligns with the conclusions of existing studies on the use of ICT (Baumeister et al., 2021; Bordi et al., 2018; Carlson et al., 2017; Day et al., 2012; Day et al., 2010). Consequently, in terms of theoretical implications, it is not beneficial to try to push DWC into one corner or the other; instead, research should focus on the specific conditions and perceptions of its use. It is paramount to comprehend the underlying explanations for future research using the JD-R model, as it will aid investigations into the health implications of newly developed technologies that are relevant to DWC, such as advanced interactive platforms and human-machine interactions.

In addition to contributing to theoretical and empirical debates on DWC, the finding regarding (the lack of) flexibility is especially crucial in the overall discourse on the flexibilisation of work. Merely providing flexibility to employees using DWC – or in digitalised workplaces more generally – is insufficient to enhance their mental health and well-being. Possible demands linked with the use of DWC should be taken into account more thoroughly, as they can easily counter or even destroy the positive effects of resources. This has important practical implications for employers regarding the regulation of the use of DWC. According to certain studies, it may be advisable for employers to restrict the use of smartphones in particular (Rademacher et al., 2021). However, our results indicated that employers should also encourage face-to-face contact. Given that different employees have different perceptions of the same level of DWC usage, our research also emphasises the necessity for organisations to establish adaptable policies that can accommodate individual employee situations and various DWC usage scenarios. Despite the potential risks of DWC, its benefits are evident, not only for employees but also for employers. A further intrusion of DWC into workplaces is hardly inevitable, particularly given the ongoing importance of working from home after the COVID-19 pandemic. As our results clearly demonstrate, it is not the extent of DWC per se that threatens the mental health of employees but rather the circumstances in which it is used. In practice, employers should reflect on whether the policies and technologies mainly used for DWC in the company are more likely to enhance the resource or demands aspects of DWC to promote a healthy use of it. For instance, in smaller teams, video conferencing may be better suited to support stronger personal interactions among employees than asynchronous forms of DWC. In addition, encouraging frequent face-to-face communication at the workplace can aid in mitigating the adverse impacts linked to DWC. Nevertheless, the establishment of ethical guidelines and

codes of behaviour is crucial to offer direction and prevent problematic aspects of DWC, including expectations of availability and experiences of overload.

Although our study contributes to the existing empirical and theoretical research on DWC usage, it is important to acknowledge its limitations. From a theoretical perspective, we drew upon the concept of technostress to investigate the relationship between techno-overload and techno-invasion and their impact on the mental health of employees. However, we did not consider the remaining dimensions of technostress, and thus, we were unable to test the complete theoretical model. Nevertheless, our aim was not to investigate the model itself but rather to apply general ideas to the subject of DWC usage and to explore the loss of personal contacts and the lack of flexibility as additional and previously understudied dimensions of technology-related stressors. Future research could benefit from incorporating further measures of additional dimensions of technostress in the context of DWC. This would aid in gaining a better understanding of the particular mechanisms which connect digital technologies to mental health risks and advantages. This could increase general knowledge about the job demands and resources involved in DWC usage but also contribute to the ongoing debate on which employees perceive DWC as more of a stressor or a resource under which conditions. In this regard, researchers in this area of research should not only identify various stressors but also engage in a more in-depth discussion of the potential resources involved in DWC usage beyond the commonly emphasised aspect of flexibility. Regarding our empirical analyses, we were limited by the availability of solely cross-sectional data on the use and perceptions of DWC. Therefore, we cannot make any assumptions about causality in the relationship between DWC and mental health. To draw more reliable causal conclusions, it is necessary to pursue longitudinal research designs in future studies. Especially because of the rise in DWC during the COVID-19 pandemic, it may be presumed that employees are becoming accustomed to using DWC and developing strategies to manage any potential adverse consequences more effectively. In future research, it would be of interest to evaluate whether the strain linked to DWC usage may have increased during the pandemic or, conversely, whether a familiarisation effect can be found. To unravel more complex mechanisms in the relationship between DWC and mental health, further research should distinguish between distinct communication tools, specific applications of these tools as well as distinct usage patterns across varying work organisations and/or employee subgroups.

Conclusion

In conclusion, our research demonstrated that DWC is not inherently a demand or resource. Instead, its impact is largely dependent on how extensively it is used and how the use is perceived by employees. The COVID-19 pandemic has recently illustrated the economic potential of DWC, but our study revealed its risks to em-

ployees' mental health. It is most likely that DWC will remain an important issue for both employees and employers, necessitating an understanding of underlying mechanisms that affect mental health. Particularly, given the growing prevalence and diversity of DWC (especially when it is employed for working from home), it appears overly reductionist to compare its simple usage with no usage at all. Instead, one must consider the intensity and the conditions of its use to disentangle the different mechanisms involved in the relationship between DWC and mental health.

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