RESEARCH PAPER

# Working from Home with Flexible and Permeable Boundaries

## Exploring the Role of Digital Workplace Tools for Job Satisfaction

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**Abstract** The COVID-19 pandemic forced information workers across the world to work from home. This situation removes the physical boundary between work and home, impacting their work-life balance. How information workers configure the digital workplace (DWP) to manage their workplace boundaries and what effect this has on their individual job satisfaction remains unclear. To close this gap in the literature, 202 information workers completed an online survey. The findings partially confirm existing theory that more work flexibility increases job satisfaction while more work permeability decreases job satisfaction. However, depending on the flexibility and permeability of their work-home boundaries, the frequency with which information workers use DWP tools has cross-over effects on job satisfaction. The findings contribute to boundary theory and the new stream of digital workplace literature.

**Keywords** Boundary theory · COVID-19 pandemic · Digital workplace (DWP) · Job satisfaction · Work-from-home (WFH)

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## 1 Introduction

Mobile technologies allow people to stay connected whenever they want and wherever they want. This ubiquitous connectivity leads to higher expectations of availability also outside working hours (Adkins and Premeaux 2014). Performing work no longer occurs only in the office; therefore, boundaries between work and private life become increasingly flexible and permeable (Ladner 2008). Flexible boundaries describe the phenomenon of shifting work to different times and locations; permeable boundaries relate to carrying work over into one's private life and vice versa (McCloskey 2018a). Even before the COVID-19 pandemic, employees had called for more flexible work models, requiring organizations to design and implement digital workplaces that would provide the necessary communication, coordination, and cooperation tools to enable efficient and effective work conditions (Herrera et al. 2012). A digital workplace (DWP) is "the broad set of technologies and practices involved in employees' digital workplace experience irrespective of physical location; it encompasses, yet also goes beyond, the traditional notions of ICTs" (Marsh et al. 2022, p. 2). Now, DWP tools are essential for effective information work (Attaran et al. 2019), enabling users to share their knowledge, stay connected with other employees, collaborate on projects, and manage their work, all of which influence flexibility and permeable boundaries. The COVID-19 pandemic fueled the blurring of work-home boundaries because DWP tools enabled their permeability. Employees worked from the same space in which they also spend their free time, supervised and homeschooled their children at home when schools closed, switched into a virtual mode, or performed household chores while "at work" (Waizenegger et al. 2020; Mitchell 2021; O Connor et al. 2021). All those

examples emphasize the blurriness of working from home and the associated demands on productive work (Richter 2020).

To enable remote work and stay operational and competitive, many organizations had to upgrade their DWP tools (Richter 2020) resulting in DWP technology use at an all-time high (Diem and Nezik 2020). For example, the video conference tool Zoom reported that its daily meeting participation rose from 10 million in December 2019 to 400 million in April 2020 (Yuan 2020). Companies including Spotify introduced new policies to give employees a choice of working full-time in the office or at home (Business Standard 2021). The research and advisory firm Gartner found that more than 80% of company leaders said they planned to allow their employees to work remotely or at least part-time after the pandemic (Golden 2020). Such shifts toward more work-from-home (WFH) arrangements are likely to stay even after the defeat of the pandemic. With all the investments that organizations made in DWP tools, they will likely need to consolidate their DWP offerings soon (Richter 2020). After all, well-integrated DWP solutions promise considerable business potential; employees who have access to more searchable information spend less time finding relevant information (Attaran et al. 2019).

The broad and quick adoption of DWP tools raises the question of the consequences of WFH for employees' boundaries between work and home and if DWP tools can realize their potential for improved information work. Recent research investigating the collaboration practices among Microsoft remote information workers in the first 6 months of 2020 (WFH mandates first became active in March for most U.S. states) showed that the shift to remote work led to less collaboration and more siloed working groups with less employee access to new information (Yang et al. 2021). Others experienced collaboration challenges, such as work delays or low creativity output, due to ineffective DWP tools or low Internet speed at home (O Connor et al. 2021). Some employees also found switching off from work challenging (Mitchell 2021) as work increasingly popped up on weekday evenings and weekends (O Connor et al. 2021). Consequently, the DWP also has its dark side, such that employees' excessive use of DWP fostered feelings of anxiety and stress (Marsh et al. 2022).

Past research has uncovered considerable knowledge on work-home boundaries (Cousins and Robey 2015; Derks et al. 2016; McCloskey 2018a). The COVID-19 pandemic has made transparent the positive and negative consequences that emerge from widespread WFH mandates (Waizenegger et al. 2020; Mitchell 2021; O Connor et al. 2021). However, it is not yet known whether the effects that pre-pandemic work-home boundary research are

replicable to widespread WFH settings during a pandemic. It is also unclear how the use of DWP tools affects work-home boundaries and work outcomes, such as job satisfaction. Therefore, this study states the following research question: *What effects do flexible and permeable boundaries have on employees' job satisfaction, and what role does the frequency of DWP use frequency play?*.

This research study aims to empirically investigate the effects of flexible and permeable boundaries on job satisfaction when DWP use frequency moderates them. Based on an online survey involving 202 information workers, the findings of this research contributed to the boundary theory literature as we empirically confirmed the positive effect of work flexibility and the negative effect of work permeability on job satisfaction. This study also contributes original findings to boundary theory and the DWP literature, as frequency of DWP use negatively moderated the effects of work flexibility and work permeability, but positively moderated the effects of home permeability on job satisfaction.

This article is organized as follows: We introduce theoretical considerations of work-home boundaries and background on DWP. Then, we present our hypotheses and methods. Then, a summary of our findings follows with a discussion of our contributions and the study's implications. We close with the study's limitations, future research directions, and a conclusion.

## 2 Theory and Background

### 2.1 Work-Home Boundaries

Workspaces share home boundaries that can be more or less permeable (Kanter 1989). Over the last decades, the interest in better understanding work-home boundaries and how to manage them has increased and prompted much research in various directions (Adkins and Premeaux 2014; Chen and Karahanna 2018). Unfortunately, terminological confusion, different names for the same concepts, and often unclearly defined constructs led to limited progress (Allen et al. 2014; McCloskey 2018a) on work-home boundary theorizing. According to boundary theory (McCloskey 2016), boundaries can exist along the dimensions of flexibility and permeability.

*Flexibility*: Hall and Richter (1988) describe *flexibility* as "the extent to which the physical time and location markers, such as working hours and workplace, may be changed" (Hall and Richter 1988, p. 215). Boundaries are flexible when the individual fully controls when and where to work (McCloskey 2016). An example of a flexible boundary is a business owner who could leave work to

attend to personal matters and return later. Conversely, an inflexible boundary does not offer this opportunity – for instance, where and when a security guard can perform their role is severely limited (Ashforth et al. 2000). An example of a permeable boundary is a person who can make private phone calls or have personal visits during work time. A worker with restricted opportunity – no access and no time to switch roles – has an impermeable boundary (Ashforth et al. 2000). Flexible boundaries are nondirectional; when one shifts working time, private time shifts accordingly.

*Permeability*: Permeability describes the degree to which a person physically located in one domain may be psychologically concerned with the other (Hall and Richter 1988, p. 215)**.** When boundaries are permeable, obligations from one role enter the domain of the other role (Allen et al. 2014)**.** High-level work permeability describes situations in which interruptions from home occur while in the work domain. High-level home permeability exists when work-related activities occur in the home domain. For example, a surgeon might not be able to have phone calls with the partner at work (impermeable work boundaries) but still answers emails and performs documentation from the home office (permeable home boundaries). Permeable home and work boundaries can have directionality (McCloskey 2018a). Thus, an individual can have (im)permeable work boundaries, but (im)permeable home boundaries.

While an individual is more likely to steer permeable boundaries, flexible boundaries depend on the employer (Carlson et al. 2010; Daniel and Sonnentag 2016). While some employees embrace the blurring of work-home boundaries and see an opportunity for family life to integrate into the work domain (Bailyn et al. 2001), others fear the high degree of work-family integration caused by fast-growing mobile technologies (Desrochers and Sargent 2004).

By refining permeability into two directional constructs (i.e., work permeability and home permeability), McCloskey (2016) has further advanced boundary theory. However, thus far, these nuances have received little empirical attention in related research. Yet, given the extensive shift to WFH during the Covid-19 pandemic, this differentiation becomes more visible and relevant. Moreover, McCloskey (2016) called for more research examining the actual technology usage in connection with flexibility and permeability boundaries. This research follows this call for research as it investigates the role of DWP tools, introduced next.

## 2.2 Digital Workplace

The first author to mention the DWP was Jeffrey Bier in the late-1990s (Köffer 2015). Over the years, many similar terminologies have emerged, such as virtual workplaces (Greenbaum and Kyng 1992) or digital workspace (Overbeek et al. 2006). The digital workplace refers to an integrated technology platform of tools and services at which employees can effectively perform their work, individually or with others, independent of location (Williams and Schubert 2018, p. 480) and time.

By definition, the DWP refers to a digital, integrated environment in which multiple "tools" are in use, from enterprise resource planning (ERP) software (Dery et al. 2017) to social intranets (Nitschke et al. 2020), employee portals and e-mail systems (Zimmer et al. 2020), virtual meeting tools (Herrera et al. 2012), dashboards, feeds, and alerts, or calendars (Attaran et al. 2019). Traditional organizations often struggle with a working environment, where technologies exist in silos and communication is asynchronous (e.g., email) (Dery et al. 2017). Overcoming such technological barriers is one key DWP objective. Its additional focus on people and their work also characterizes a DWP. Thus, the DWP enables people to engage in productive work, particularly information and knowledge work (Williams and Schubert 2018). Moreover, organizational strategy and design also hold a perspective on DWP (Attaran et al. 2019). To foster an effective DWP, organizational decision-makers must engage in initiatives that foster a collaborative and integrated employee experience (Dery et al. 2017). DWPs also must fit the corporate culture and comply with regulations (Williams and Schubert 2018).

Conceptualizing DWPs can also extend to what they enable: connectivity, collaboration, communication, and coordination (Fuks et al. 2008; Herrera et al. 2012; Sambandam 2019; Kalischko and Riedl 2021). DWP connectivity allows employees to connect with others across the organization, to leverage new information (Herrera et al. 2012; Zigurs and Munkvold 2014; Attaran et al. 2019). Collaboration enables employees to have a platform on which to work together to solve business problems. Communication fosters information exchange and content creation within and across teams (Fuks et al. 2008; Herrera et al. 2012; Attaran et al. 2019; Nitschke et al. 2020). Coordination refers to the management and organization of multiple projects on which employees are currently working (Fuks et al. 2008; Zigurs and Munkvold 2014; Nitschke et al. 2020). Accordingly, a DWP should function as a control center that monitors multiple business processes and employee performance (Sambandam 2019; Kalischko and Riedl 2021).

The quality of a DWP ultimately depends on how well connected, integrated, and accessible its tools are. DWP tools that are only loosely integrated and used sporadically by a minority of employees will likely limit the quality of the DWP. However, frequently used and well-integrated DWP tools bespeaks a high-quality DWP (Marshall 2013). A study on workers in the UK reported that research participants were willing to accept newer workplace technology but, at the same time, were more likely to resign when DWP tools seemed insufficient (Berland 2016).

DWP tools enable the blurring of boundaries between work and family (Lewis and Cooper 1999; Clark 2000; Schieman and Young 2013). Particularly smartphones and laptops gave rise to increased work flexibility because they allowed employees to be mobile (Derks et al. 2016). However, they also increase home permeability (Lewis and Cooper 1999; Derks et al. 2016), which, in turn, can foster conflicts at home and at work, resulting in reduced employee satisfaction. This calls for research to support a good understanding of DWP tools and their role in managing work-home boundaries.

## 3 Hypotheses Development

The gap in understanding the role that DWP tools play for work-home boundaries and the consequences for employees prompts the presentation of hypotheses H1-H3, appearing in Fig. 1 and following the reviewed literature on boundary theory after McCloskey (2016, 2018a). The paper explores the frequency of DWP use (H4) as a potential moderator influencing the relationships between boundaries and job satisfaction. The logic behind the hypothesized relationships follows.

According to boundary theory (McCloskey 2016, 2018a), individuals can have flexible boundaries. Flexibility provides employees the autonomy and freedom to choose the start- and end-times of their work and where to work (Hall and Richter 1988). Employees perceive this

spatial and temporal flexibility as enriching their private lives (Daniel and Sonnentag 2016). For example, a parent could care for a sick child from the home office (spatial flexibility), or a music enthusiast could attend a concert by leaving earlier from work and working overtime another day (temporal flexibility). This increased control over how employees combine their work and home lives fosters satisfaction with the job (Carlson et al. 2010), reducing work-family conflict (Allen et al. 2014).

Particularly during the COVID-19 pandemic, many employees forced to work remotely valued their increased flexibility, scheduling their working hours to accommodate workouts, household chores, dog-walking, or holding meetings with participants in different time zones (Mitchell 2021). The increased work autonomy work flexibility provided was a key contributor to employee well-being (Waizenegger et al. 2020) and benefited task performance. The office environment can promote many work-related interruptions, so employees have difficulties focusing on information work for a prolonged time (Mitchell 2021). Being physically absent from the office environment where work distractions could occur supports focusing on certain tasks. Therefore, controlling one's work schedule and when and where to work can reduce home or work conflict, fostering greater job satisfaction (Carlson et al. 2010). Thus, we hypothesize,

Hypothesis 1 Information workers with more flexible boundaries have more job satisfaction.

Related research has shown that work-home boundary permeability can function negatively (e.g., as interruptions) and positively (e.g., as reminder notifications) (Clark 2000). When home and work boundaries become blurry and permeable, they can raise work-life conflicts (Ashforth et al. 2000; Clark 2000; Allen et al. 2014). For example, a parent sitting in front of the work laptop at the dinner table is subject to family members accusing him or her of not being present. When employees have difficulties separating work from home, they often carry the stress they



Fig. 1 Research model
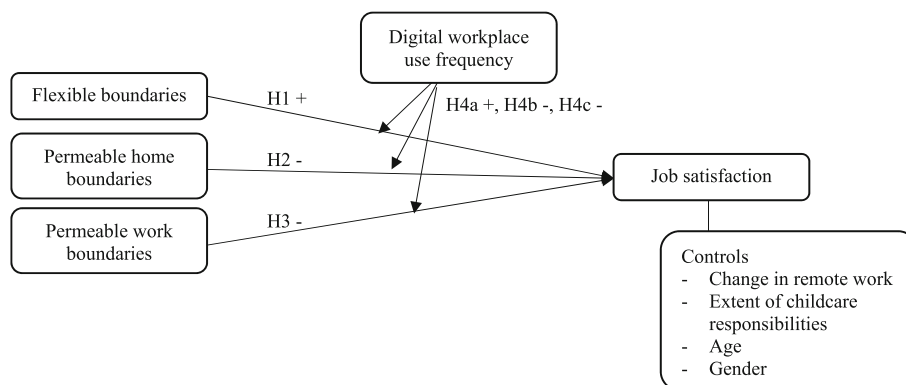
experience at work into their private life, potentially causing problems with family and partners (Mitchell 2021). Providing employees with the technical means to work from home fosters the expectation of availability and timely response to work-related issues (Ladner 2008), expectations that can foster stress and pressure.

Conversely, impermeable boundaries that suggest segregating the two domains generally result in less work-family conflict (Hecht and Allen 2009) and, by default, allow fewer role interruptions (Ashforth et al. 2000). Work problems will hardly affect individuals with impermeable home boundaries during their free time (Liao et al. 2016). Empirical evidence on the consequences of high-level boundary permeability is less clear. McCloskey (2018a) found that greater home permeability leads to greater work-life conflict, whereas more work permeability leads to less work-life conflict. The latter finding contradicts past research. For instance, Hecht and Allen (2009) found that high degrees of work-boundary permeability lead to more work-life conflict and speculated that working at home may drive such effects. Therefore, McCloskey's (2018a) conclusion on work-boundary permeability may hold in office environments, whereas that by Hecht and Allen (2009) fits WFH environments. Since this study primarily investigates work permeability in WFH settings, we build on Hecht and Allen (2009) and expect that more work permeability in WFH settings decreases job satisfaction (Carlson et al. 2010) because work-family conflicts are more likely to arise. Thus, we suggest:

Hypothesis 2 Information workers with more permeable home boundaries have less job satisfaction.

Hypothesis 3 Information workers with more permeable work boundaries have less job satisfaction.

Mobile DWP tools enable work independent of location and time (Richter 2020), but foster blurred boundaries (Lewis and Cooper 1999; Clark 2000; McCloskey 2016). For example, an employee could answer e-mails every morning from the home office (spatial flexibility) and go to the gym afterward, before attending the first meetings in the late morning (temporal flexibility). When information workers have a high degree of work flexibility over their work schedule, their jobs are more satisfying, as they control when and where to work (Carlson et al. 2010; McCloskey 2018b). The use of DWP tools in particular enables flexible remote work (Attaran et al. 2019) and, when used meaningfully, DWP tools can help compartmentalize work and private activities, to keep distractions and overload at a low level (McCloskey 2018b). Yet, when employees make little use of their DWP tools for communication, coordination, and collaboration, even though their work schedules could be flexible, the potential

benefits for improved team collaboration (Attaran et al. 2019) remain unused. Therefore, combining more work flexibility with frequent use of DWP tools should foster job satisfaction.

In contrast, combining the frequent use of DWP tools with permeable work-home boundaries may be detrimental to job satisfaction. During the pandemic, DWP tools allowed better connection and integration of employees within and across teams and enabled more frequent conversations (Waizenegger et al. 2020). However, interacting with others and organizing meetings in WFH environments requires more effort than in the traditional office environment (Mitchell 2021) where meetings can be set in an ad-hoc manner or happen informally at the "water cooler" (Waizenegger et al. 2020). More frequent virtual meetings also resulted in many low-value interactions that induced meeting fatigue (Waizenegger et al. 2020; O Connor et al. 2021). Evidence also shows that using DWP tools in remote work environments was distracting and invited more multi-tasking, a "performance killer" (Mitchell 2021). Managers and leaders with a tendency to micromanage used DWP tools to check in frequently with their employees, sometimes several times an hour (Mitchell 2021). All of these examples show that DWP tools can foster work-related stress and anxiety (Marsh et al. 2022). School closures and low Internet connectivity at home were additional stressors for employees who had to accommodate frequent virtual meetings with child school demands (Waizenegger et al. 2020; Mitchell 2021).

When the degree of an employee's home permeability is high, rising expectations to stay connected during off-hours in the evening, on weekends, or even on a family vacation can increase conflict (Adkins and Premeaux 2014). Combined with the DWP-induced stress, they also decrease satisfaction. Likewise, an employee's high-level work permeability and work-related stress – already present due to the increased frequency of virtual meetings, shared collaborative environments, and frequent check-ins – may combine with additional interruptions from the home domain to exacerbate feelings of stress and anxiety, leading to reduced satisfaction. Therefore, employees who are constantly connected by DWP tools to their work and have high-level home and work permeability should experience a predictable drop in satisfaction. Thus, the following moderation hypothesis is suggested:

Hypothesis 4 Information workers with higher DWP use frequency will strengthen (H4a) the positive effect that flexible boundaries have on job satisfaction and the negative effects that permeable home boundaries (H4b) and permeable work boundaries (H4c) have on job satisfaction.

# 4 Methods

To test the hypothesized relationships, we conducted an online survey study involving 202 participants from a crowdworking platform. We performed a pilot test with 58 individuals in May 2021, to pre-test the questions and assess the reliability and validity of our self-developed construct, DWP use frequency. As the results of the validity and reliability analysis were satisfactory, we collected survey data from 202 Amazon Mechanical Turk workers.

## 4.1 Measures

*Job satisfaction* was assessed with three items adopted from (Cammann et al. 1979), about the general likability of the work performed on the job.

*Work flexibility* was operationalized with three items adopted from McCloskey (2018a), measuring how much control an individual had over work completed at different times or days.

*Home permeability* was operationalized with six items adopted from McCloskey (2018a). The construct measures how open the home life boundary is for interruptions from work life. Low home permeability means that there is little or no contact with work during time at home.

*Work permeability* was operationalized with five items and adopted from McCloskey (2018a). The construct measures how open the work boundary is for interruptions from private life. Low work permeability means that there is little or no contact with home during work time.

*DWP use frequency* was assessed with five items measuring how often respondents use DWP tools for connectivity, communication, coordination, and cooperation. The items were self-developed, building on related literature. A starting point for item development was the 3C model, specifying that computer-supported collaborative work requires technology that enables users to collaborate (joint cooperation in a shared workspace), coordinate (organization of people, resources, and tasks), and communicate (negotiate, make decisions, and discuss) (Ellis et al. 1991; Fuks et al. 2008). We compared this to practitioner reports on DWP technology (Herrera et al. 2012; Marshall 2013), which covered the communication and collaboration dimensions but not the coordination dimension. Instead, Herrera et al. (2012) argued that connectivity across the organization is a key characteristic of DWPs. Finally, we also compared more recent academic literature on DWPs, which also highlighted the dimensions of collaboration, communication, coordination, and access (connectivity) (Attaran et al. 2019; Nitschke et al. 2020). Thus, we created

three items that covered these dimensions. For better comprehension, we included specific DWP tools (e.g., Microsoft SharePoint, Zoom) as examples and assessed the self-developed construct in terms of reliability and validity in the pre-test. Reliability (Cronbach's alpha > 0.7) and validity tests (factor loadings > 0.6, low cross-loadings, pattern matrix) were acceptable and, therefore, we retained the self-developed construct in the survey.

Besides the above-mentioned focal variables, we also measured several control variables: respondent's age, extent of change in remote work due to COVID-19, extent of childcare responsibilities, and gender. Change in remote work was operationalized in the survey with two questions using a slider (0–100), namely, average work time spent working from home now (in %) and average work time spent working from home before the pandemic. The delta of these two values resulted in the change; on average, that was + 43.43% (SD = 39.66). The variable extent of childcare responsibilities builds on the categorical variable "Age of youngest child." The variable was deemed appropriate as an approximation of childcare responsibilities as younger children require more supervision and support than older or no children. All variables were measured using a 7-point Likert scale (see Table 3). For the construct "DWP use frequency," we adopted a frequency scale (1 – never, 2 – very rarely, 3 – rarely, 4 – sometimes, 5 – frequently, 6 – very frequently, 7 – always); for the other constructs, we asked for agreement.

The survey also included an open comment field where respondents could leave open feedback, which we used to better contextualize collected data.

## 4.2 Sample and Common Method Bias

For this study, reaching out to information workers who rely on DWP tools for their communication, collaboration, and cooperation was essential. Therefore, we chose the crowdworking platform Amazon Mechanical Turk, which allows access to millions of people across industry sectors, ages, and education levels.

The final sample consisted of 202 MTurkers, of whom more than 60% were male. About 66% of the respondents were between 25 and 44 years old, more than 82% had a full-time occupation, and 87% had not changed jobs in the past 15 months. An interesting insight is that 57% of the respondents had no child living with them at home or did not have children (see Table 1). Moreover, respondents declared that before the pandemic, they spent about 37.34% of their time working from home, whereas at the time they took the survey, they were working today about 78.74% of their time from home. Notably, at the time of data collection, the U.S. had issued no stay-at-home

**Table 1** Sample demographics

|  | Count | Percent |
|---|---|---|
| *Sex at birth* | | |
| Female | 79 | 39.1 |
| Male | 122 | 60.4 |
| Prefer not to disclose | 1 | 0.01 |
| *Age of youngest child* | | |
| < 3 years | 14 | 6.9 |
| 3–5 years | 20 | 9.9 |
| 6–13 years | 34 | 16.8 |
| 14–17 years | 7 | 3.5 |
| 18 and above | 11 | 5.4 |
| No child is living at my home | 41 | 20.3 |
| I don't have children and I don't care for children | 75 | 37.1 |
| *Age* | | |
| 18–24 | 10 | 5.0 |
| 25–34 | 67 | 33.4 |
| 35–44 | 67 | 33.4 |
| 45–54 | 31 | 15.5 |
| 55 or above | 27 | 13.5 |
| *Work* | | |
| Full-time | 167 | 82.7 |
| Part-time | 20 | 9.9 |
| Self-employed | 15 | 7.4 |
| *Job change last 15 months* | | |
| Yes | 25 | 12.4 |
| No | 177 | 87.6 |
| Work-from-Home (in %) | Mean | SD |
| Pre-pandemic | 37.34 | 39.12 |
| During pandemic | 78.74 | 30.60 |

mandate, but it was recommended (Hale et al. 2021; Our World in Data 2021).

Low data quality is an increasing problem for studies utilizing crowdworkers (Peer et al. 2017; Agley et al. 2021). Therefore, we opened up the survey to only those MTurks who had been accepted to CloudResearch's approved participants list. This list contains MTurks vetted by CloudResearch in terms of paying attention and engagement with the crowd tasks, which should result in higher data quality. In addition, crowdworkers had to have an approval rating higher than 80% and more than 100 HITs approved, and live in the United States. To start the survey, MTurks had to fulfill the following selection criteria: identify themselves as information workers who frequently create, manage, share, receive and use information to perform their work; be 18 years or older; have a full-time/part-time job or be self-employed. Repeated participation was forbidden and checked.

Related research has raised the issue of common method bias (CMB), especially among MTurkers and participants from other crowdworking platforms (Cheung et al. 2017). CMB describes "a systematic error variance shared among the variables measured with and introduced as a function of the same method and/or source" (Richardson et al. 2009, p. 4). Thus, when response and predictor variables are collected using the same method (e.g., surveys), there is a danger that some of the covariation between constructs is due to the chosen method (Podsakoff et al. 2012). If CMB is present in a dataset, it may inflate or deflate the observed relationships (Jakobsen and Jensen 2015).

Several remedies were applied (see also Lowry et al. 2016) to reduce CMB occurrence in the first place. In the introductory text, we reminded participants of the importance of paying attention, answering honestly, and not assuming there were wrong or right answers. We also varied the Likert scale labels (agreement and frequency) to reduce CMB.

We included three attention-check questions throughout the survey to ensure higher internal and construct validity (Cheung et al. 2017): (1) "I can come and go as I wish. In answering this question, please ignore everything else and select very untrue"; (2) "Click 'Strongly agree' to pass this check of your attention"; (3) "In the past 2 years, have you ever traveled, or done any business with entities in Latveria?" (Latveria is a fictional country). The first two attention-check questions were mixed in with the constructs "work flexibility" and "job satisfaction". Only crowdworkers who answered all attention-check questions could complete the survey and be considered in the analysis. We only retained responses from participants who answered all attention-check questions correctly.

Moreover, we included a marker variable (attitude toward blue) and performed the Unmeasured Latent Marker Construct (ULMC) technique as Williams et al. (2010) suggested and Simmering et al. (2015) outlined. The ULMC technique not only enables detecting the presence of CMB in the data; it also allows assessing whether CMB affects relationships among the substantive variables. The technique is performed in multiple steps (see Simmering et al. 2015 for details). Our analysis revealed that a weak CMB was present in the data (model fit of Model C differed from baseline model with $p = 0.05$). The CMB affects all relationships equally (model fit of Model U was not significantly better than that of Model C). Moreover, the CMB did not significantly skew the relationships among the substantive variables and the marker variable (model fit of Model R did not significantly differ). Given these insights, we accept that there is some weak presence of CMB in the data (see Table 2). However, its presence

**Table 2** Results of UMLF technique

| Model | $\chi^2$ (df) | CFI | RMSEA (90% CI) | LT delta of $\chi^2$ | Model comparison |
|---|---|---|---|---|---|
| CFA with marker | 423.50 | 0.916 | 0.062 (0.052, 0.071) | | |
| Baseline | 378.44 | 0.887 | 0.067 (0.053, 0.080) | | |
| Method-C | 374.52 | 0.890 | 0.066 (0.052, 0.080) | 3.9, $df = 1$, $p = 0.05$ | vs. Baseline |
| Method-U | 350.90 | 0.894 | 0.067 (0.053, 0.081) | 23.6, $df = 19$, $p = 0.21$ | vs. Method C |
| Method-R | 347.17 | 0.906 | 0.062 (0.047, 0.076) | 3.7, $df = 10$, $p = 0.95$ | vs. Method U |

did not skew the relationships and, thus, we proceeded with the analysis.

## 4.3 Testing Outliers, Statistical Assumptions, Reliability and Validity

Based on an initial sample of 204 responses, we iteratively performed outlier and assumption tests, as well as reliability and validity analyses. For outlier analysis, we relied on the visual inspection of Q-Q plots, which suggested two highly influential observations. These outliers negatively affected the assumption tests for regression analyses (increased skewness of error variance and negative impact on the Breusch-Pagan test), which is why we dropped them from the sample. As regression analysis relies on several statistical assumptions, we also assessed normality of residuals, homoscedasticity, multi-collinearity, and non-independence of errors (Garson 2012). Normality was visually inspected with a studentized residual plot that showed an acceptable bell-curved distribution. Homoscedasticity was acceptable as the Breusch-Pagan test was insignificant ($p > 0.05$), suggesting that the variance in residuals was similar for all levels of the dependent variable. Finally, non-independence of errors was tested with the Durbin-Watson test and was insignificant ($p > 0.05$). Thus, all assumption tests were passed, so we proceeded with testing reliability and validity.

We determined internal consistency with Cronbach's Alpha (threshold $> 0.7$) (Nunnally and Bernstein 1978), convergent validity with exploratory factor analysis (EFA), and discriminant validity with the Variance Inflation Factor (VIF) statistic (Hair et al. 2010). EFA showed that all items loaded onto their intended constructs without any noteworthy cross-loadings. Six items did not reach a factor loading $> 0.6$, but were higher than 0.4 and, thus, acceptable (Hair et al. 2013). Also, the VIF statistic showed satisfactory results with VIF values between 1.062 and 1.261. Thus, all tests were deemed satisfactory, so reliability and validity can be assumed (Table 3).

## 5 Results

To test the research model, we performed correlation and regression analysis in R.1.3.1073 (see Tables 4, 5).

We ran three regression models to better understand how the effects emerge (see Table 5). Model 1 includes only the control variables. Model 2 includes all independent variables as main effects, which explain about 5.9% of the variance in job satisfaction. Model 3 includes the three hypothesized moderation terms. This model explains 13.6% of the variance in job satisfaction. Next, we report on the result of the hypotheses tests.

Our results (see Model 2 in Table 5) show that more work flexibility leads to more job satisfaction ($\beta = 0.168$, $p < 0.05$, H1 supported) and work permeability to less job satisfaction ($\beta = -0.236$, $p < 0.01$). This supports H1 and H3. However, home permeability ($\beta = 0.044$, $p > 0.05$) was not significantly associated with job satisfaction (H2 is not supported). Of particular interest for this study is to understand the potentially moderating role of DWP use frequency. According to our findings (see Model 3 in Table 5), job satisfaction decreased significantly when respondents used DWP tools more frequently and had more flexible boundaries ($\beta = -0.122$, $p < 0.05$). While the moderation effect is significant, the negative direction is not in line with our theorizing. Therefore, H4a is not supported. Moreover, job satisfaction was greater when information workers used DWP tools more frequently and had more permeable home boundaries ($\beta = 0.138$, $p < 0.05$). This positive moderation effect is not in line with our theorizing and therefore, H4b is not supported. Finally, information workers reported lower job satisfaction when they used DWP tools frequently and had more permeable work boundaries ($\beta = -0.200$, $p < 0.001$). This negative effect is in line with our theorizing and therefore H4c is supported.

In terms of control variables, none were significantly associated with job satisfaction across all models.

### 5.1 DWP Use Frequency as Moderator

We further visually investigated the moderation effects with interaction plots (see Figs. 2, 3, 4). Figure 2 shows the negative moderation effect of work flexibility and DWP

**Table 3** Overview of survey items

| Construct Source | Item | Factor loading | Cronbach's Alpha |
|---|---|---|---|
| Job satisfaction (Cammann et al. 1979) | All in all, I am satisfied with my job | 0.866 | 0.927 |
| | In general, I don't like my job. (rev) | 0.859 | |
| | In general, I like working in my job | 0.935 | |
| Work flexibility (McCloskey 2018a) | Generally, I can control the hours I work | 0.919 | 0.768 |
| | I have some influence over which days I work | 0.652 | |
| | I have flexibility in when I complete my work | 0.591 | |
| Work permeability (McCloskey 2018a) | My friends and family contact me when I am working | 0.681 | 0.718 |
| | I check social media when I am working | 0.461 | |
| | I rarely deal with personal matters when I am working. (reversed) | 0.598 | |
| | I turn off personal mobile devices when I am working. (reversed) | 0.631 | |
| | I´ve asked friends and family to limit their contact with me when I am working. (reversed)* | 0.563 | |
| Home permeability (McCloskey 2018a) | I often deal with work-related issues during non-work time | 0.815 | 0.861 |
| | I check my work email during family/personal time | 0.757 | |
| | I frequently receive work-related communication (email, texts, etc.) during my personal time | 0.758 | |
| | I very rarely turn off my mobile device so I can be available to work | 0.543 | |
| | I frequently work during non-work times | 0.838 | |
| | I ask my employer to limit after-hours contact to emergencies only.* | | |
| DWP use frequency (self-developed) | I … … use tools to simultaneously work with others on one document or project? (e.g. Microsoft SharePoint, Slack, Jira) | 0.772 | 0.815 |
| | …. access tasks and documents from multiple devices? (e.g. laptop, smartphone, tablet) | 0.475 | |
| | … exchange information and expertise with coworkers in a community? (e.g. Intranet, Wikis, Communities) | 0.709 | |
| | … use video conference tools (e.g. Zoom, Microsoft Teams, Skype) | 0.726 | |
| | … use online employee services (absence management, expense claims, approval requests, ticket creation, E-learning) | 0.725 | |

*Items were excluded from analysis

**Table 4** Correlations (N = 202)

| Variable | Mean | SD | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1. Job satisfaction | 5.45 | 1.19 | – | | | | | | | |
| 2. Work flexibility | 4.70 | 1.43 | 0.133 | – | | | | | | |
| 3. Home Permeability | 4.37 | 1.49 | 0.043 | 0.251** | – | | | | | |
| 4. Work Permeability | 4.14 | 1.35 | − 0.203 | 0.080 | 0.304*** | – | | | | |
| 5. DWP use frequency | 4.70 | 1.27 | 0.096 | − 0.203 | 0.123 | 0.016 | – | | | |
| 6. Change in remote work | 41.41 | 41.13 | 0.063 | − 0.167* | 0.010 | − 0.052 | 0.141 | – | | |
| 7. Extent of childcare responsibility | 6.72 | 3.51 | − 0.077 | 0.018 | − 0.046 | 0.008 | − 0.165 | − 0.181 | – | |
| 8. Age | 39.77 | 11.25 | 0.060 | − 0.014 | − 0.068 | − 0.083 | − 0.142 | 0.009 | 0.100 | – |
| 9. Gender | 1.62 | 0.52 | − 0.055 | − 0.044 | − 0.152 | − 0.088 | 0.030 | − 0.074 | 0.131 | − 0.127 |

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$

**Table 5** Results of Regression Analysis

| | Dependent variable: Job Satisfaction | | |
| --- | --- | --- | --- |
| | Model (1): Control model - Estimate (standard error) | Model (2):Main Effects - Estimate (standard error) | Model (3): Moderation Effects - Estimate (standard error) |
| Work flexibility | | 0.168* | 0.746** |
| | | (0.072) | (0.236) |
| Home permeability | | 0.044 | − 0.629* |
| | | (0.071) | (0.266) |
| Work permeability | | − 0.236** | 0.711** |
| | | (0.074) | (0.272) |
| DWP use frequency | | 0.136 | 0.953** |
| | | (0.080) | (0.337) |
| Change in remote work | 0.002 | 0.002 | 0.001 |
| | (0.002) | (0.002) | (0.002) |
| Age | 0.008 | 0.008 | 0.009 |
| | (0.009) | (0.009) | (0.008) |
| Extent of childcare responsibility | − 0.028 | − 0.019 | − 0.024 |
| | (0.029) | (0.028) | (0.027) |
| Gender | − 0.093 | − 0.125 | − 0.160 |
| | (0.194) | (0.191) | (0.184) |
| Work flexibility × DWP use frequency | | | − 0.122* |
| | | | (0.049) |
| Home permeability × DWP use frequency | | | 0.138* (0.056) |
| Work permeability × DWP use frequency | | | − 0.200*** (0.056) |
| Constant | 5.415*** | 4.758*** | 0.978 |
| | (0.536) | (0.865) | (1.730) |
| Observations | 202 | 202 | 202 |
| $R^2$ | 0.014 | 0.097 | 0.183 |
| Adjusted $R^2$ | < 0.000 | 0.059 | 0.136 |
| Residual Std. Error | 1.392 (df = 197) | 1.346 (df = 193) | 1.290 (df = 190) |
| F Statistic | 0.703 (df = 4; 197) | 2.577* (df = 8; 193) | 3.870*** (df = 11; 190) |

Note: $*p < 0.05$; $**p < 0.01$; $***p < 0.001$

use frequency on job satisfaction. The interaction plot reveals that for information workers who use DWP tools frequently, job satisfaction remains rather high and stable no matter whether they have low or high work flexibility. However, when information workers do not use DWP tools frequently and have rather low work flexibility, they have significantly lower job satisfaction. Thus, the most prominent differences exist for information workers with low work flexibility who use DWP infrequently.

Figure 3 visualizes the positive moderation effect between home permeability and DWP use frequency on job satisfaction. When information workers deal with many work-related activities during their home time (higher home permeability), and they use DWP tools more frequently, they show significantly higher job satisfaction compared to information workers who use DWP tools less frequently. This effect is inverted when home permeability boundaries are low. Here, information workers who use DWP tools less frequently reported significantly higher satisfaction than information workers who use DWP tools more frequently.

Figure 4 showcases the negative moderation effect of work permeability and DWP use frequency on job satisfaction. When work permeability is high (home interrupts the work domain) and DWP use frequency is high, information workers reported significantly lower job satisfaction than when their DWP use frequency was low. Also, for work permeability, a cross-over effect exists. Job
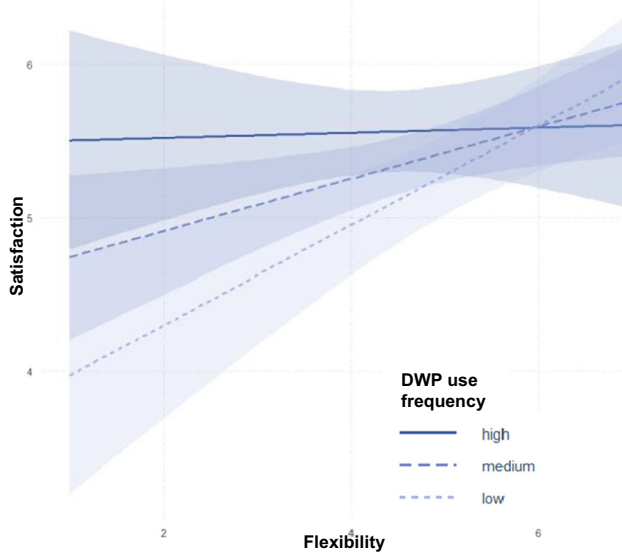
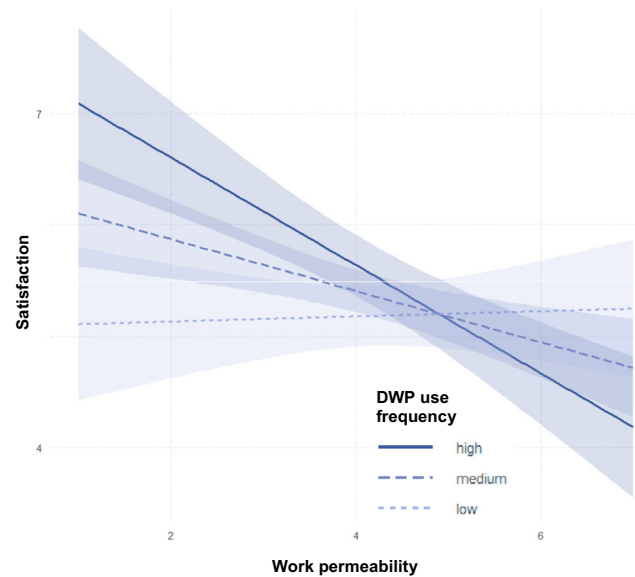**Fig. 2** Moderation plot flexibility × DWP use frequency on job satisfaction



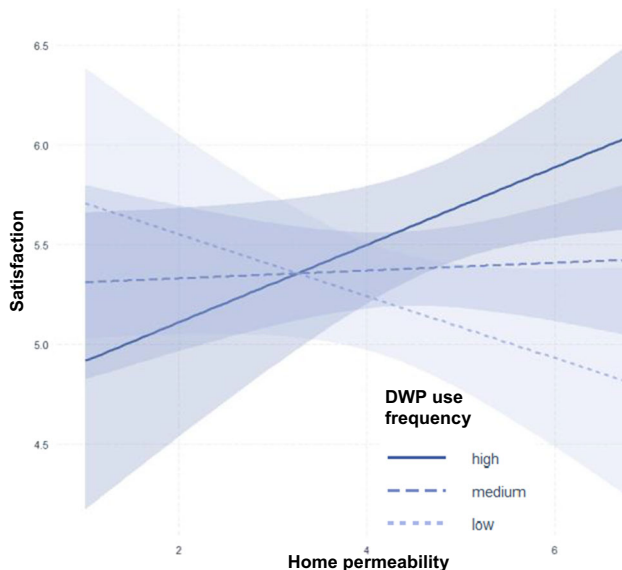**Fig. 4** Moderation plot work permeability × DWP use frequency on job satisfaction



**Fig. 3** Moderation plot home permeability × DWP use frequency on job satisfaction

satisfaction was highest for information workers who are frequent users of DWP tools and have lower work permeability. Job satisfaction for information workers who have lower DWP use frequency remained rather stable between high and low work permeability.

## 6 Discussion and Implications

Our study makes several key contributions to understanding DWP tool use and its role when information workers

work from home. We confirm existing literature on boundary theory (McCloskey 2016, 2018a), which provided the theoretical lens for this study. In line with McCloskey (2016), our findings show that employees are more satisfied with their jobs when they have more flexibility to choose where and when they work (H1). They are less satisfied when private events interrupt their work time (high work permeability, H3). There was no evidence that job satisfaction decreases when work events interrupt home time (high home permeability, H2). However, we found that a more frequent use of DWP tools can significantly strengthen or weaken the relationships between job satisfaction and work flexibility, work permeability, and home permeability (H4a-c). Thus, this study is one of the first to empirically show the moderating role of DWP use frequency and offers the following contributions, which Table 6 summarizes and which are discussed in the following:

First, our findings confirm past research (Hecht and Allen 2009; Carlson et al. 2010; McCloskey 2016, 2018a) that greater work flexibility is directly related with more job satisfaction and greater work permeability is directly related with less job satisfaction. We found no significant relationship between home permeability and job satisfaction. Given our significant moderation effect, which is discussed below, we assume that home permeability and its effect on satisfaction in the context of WFH settings may strongly depend on other situational factors, such as the availability of and use frequency of DWP tools.

Second, countering our theorizing, we find that job satisfaction for information workers who use DWP tools sporadically is very volatile when work flexibility is low or

**Table 6** Key takeaways

*Work flexibility* Information workers who use DWPs frequently feel satisfied, and it does not matter if their work schedules are flexible or not (H4a). Work flexibility in general fosters job satisfaction (H1) as information workers have control over when and where to work

*Home permeability* Some information workers are satisfied when they can separate work from home and, thus, rely less on work-related DWP tools; other information workers are satisfied when they can integrate work with home and, therefore, rely on DWP tools (H4b). Yet, more home permeability does not foster more or less job satisfaction (H2)

*Work permeability* The constant connectivity to work through DWPs is satisfying for information workers who have low work permeability but dissatisfying for workers that have high work permeability (H4c). In general, high work permeability decreases job satisfaction (H3) as events from the home domain interrupt the work domain

*DWP use frequency* Information workers who use DWP tools frequently do not consistently benefit from its communication, collaboration, coordination, and connectivity potential in WFH settings; particularly, when work permeability is high, frequent DWP use may backfire as private interruptions may add private stress to work that could already be stressful (H4c). However, frequent DWP use fosters job satisfaction when home permeability is high so that work-related topics can enter the home domain (H4a)

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high. In fact, job satisfaction was lowest when information workers had little flexibility in their work schedule and did not use DWP tools frequently. In contrast, job satisfaction remained rather high and constant for information workers who were more frequent DWP users, irrespective of their work flexibility. During the COVID-19 pandemic, many employees reported that virtual meetings often clashed with private schedules, which were not always flexible (Waizenegger et al. 2020). Employees who are frequent users of DWP tools and, thus, familiar with features and functionality, could have benefited from collaboration, communication, and coordination affordances of DWPs to accomplish work even though their work-home schedules were fixed. Other employees experienced a stark increase in work flexibility, which led to a considerable shift and rise of work on weekends and traditional weekday off-work hours (O Connor et al. 2021). As a well-integrated, smart digital workplace provides information workers with the appropriate technological capabilities to productively perform work (Attaran et al. 2019), employees that use DWP frequently might have benefited from the 24/7 availability of their DWP and the freedom to choose when to work. But, the high reliance on DWP tools to accomplish work on weekends, early mornings, or evenings could have backfired and fostered also more stress (Marsh et al. 2022), which might have canceled out any boost in job satisfaction.

Third, we found that information workers with frequent DWP use and high home permeability had higher job satisfaction and vice versa. While we anticipated a significant moderation effect, the positive direction of the effect countered our theorizing. An explanation for this may be found in employees' childcare responsibilities. In the underlying dataset, more than 50% of the survey respondents declared that they either do not have children, do not have any childcare responsibilities, or that the child does not live at home. Consequently, work interruptions (e.g., a

phone call, an email) during private time may be acceptable as information workers had no care responsibilities. Also, only about 5% of the study respondents belong to Generation Z, a generation that values a clear separation between work and home (Chillakuri 2020). Another explanation appears in theory on segmenter and integrator preferences. Derks et al. (2016) found that integrators (i.e., employees that have a preference for bringing together their work and home life, high home permeability) with high levels of smartphone use did not experience more work-family conflict; rather the availability of the technology provided them with the control to flexibly meet work and family demands during off-hours. Vice versa, segmenters (i.e., employees who have a preference for keeping private and work life apart, low home permeability) do not use their work devices after work and switch off, reporting greater satisfaction (Derks et al. 2016).

Forth, in line with our theorizing, we found that information workers who are frequent users of DWP tools are less satisfied with their job when their work is often interrupted by private events (high work permeability). Vice versa, when work permeability was low and workers had few private distractions during their working hours, the frequent use of DWP tools led to higher satisfaction. In such settings, information workers likely experience these positive emotions because they can focus on the task at hand and reach out to colleagues via their DWPs without being interrupted and distracted from their home domain (Mitchell 2021).

Finally, we also contribute to the literature stream of DWPs that concerns a better understanding of the positive and negative consequences of DWP tool use (Dery et al. 2017; Becker et al. 2020; Rossi et al. 2020; Kalischko and Riedl 2021; Marsh et al. 2022). Our moderation analysis findings showed that DWP use frequency results in cross-over effects. This means that high DWP use frequency differs drastically in its effects from low DWP use

frequency, depending on the type of work-home boundary. In this context, high-level job satisfaction could be achieved with high degrees of work flexibility combined with low DWP use frequency, high-level home permeability combined with high DWP use frequency, and low-level work permeability combined with high DWP use frequency. The substantial drop in satisfaction when information workers use DWP tools frequently and have high-level work permeability could be an indicator of detrimental multi-tasking and excessive task switching at the workplace (Marsh et al. 2022).

In summary, our theoretical contributions suggest that the relationships between satisfaction and flexible as well as permeable boundaries are dependent on how frequently information workers use DWP tools. These cross-over effects are complex to understand because information workers with high levels of DWP use frequency experience satisfaction differently depending on whether their work-home boundaries are flexible and permeable or not. Consequently, an information worker's DWP use frequency should be considered in future investigations into home-work boundaries as IT support seems to play an important role in fostering job satisfaction.

Our findings also have implications for organizational decision-makers and leaders. The moderating role of how frequently employees use DWPs emphasizes the potential benefits that well-integrated DWP tools can have for workers' job satisfaction. Before the pandemic, adoption rates of DWP solutions were slow (Attaran et al. 2019) until the enforced WFH mandates across many countries in the world required organizations to adopt DWPs quickly (Richter 2020). Our findings indicate that organizations can facilitate satisfaction among information workers, no matter whether they can offer flexible or inflexible working schedules (temporal flexibility). However, organizations must see that these workers accept DWP tools and use them frequently, to draw the benefits. Especially for organizations with low-level temporal flexibility, organizations that plan to adopt DWP tools should also work on a meaningful DWP-use strategy for workers as low DWP usage frequencies might leave workers unsatisfied. In general, our findings imply that information workers value spatial and temporal work flexibility. Leaders should consider giving their information workers more flexible work schedules if they recognize reduced job satisfaction. Allowing employees to work from home on one or two days during the week and shifting team meetings to days and times when information workers are co-located in the office could achieve this.

Team leaders should carefully probe their team members' home and work permeabilities. Particularly, when employees work from home, they might feel more stress and anxiety when their home domain interrupts their work.

Leaders could play an important role to help employees feel psychologically safe and facilitate a better organization when working from home and family activities interfere. Moreover, while some employees value the frequent use of DWP tools for work during off-time, other employees are more satisfied when they can separate their work from home and put aside DWP tools. Therefore, leaders may need to decide how to handle work-related communication and collaboration during off-time, especially when their teams consist of information workers having integrator and segregator tendencies. Moreover, leaders should be aware that information workers can be quite unsatisfied when they have high degrees of work permeability and are frequent users of DWPs. The information workers in the underlying sample worked mostly from home, which may have complicated setting strict boundaries between work and family activities. Most likely, the drop in satisfaction emerged from work-related stress and anxiety, which interruptions and communication overload often cause (Marsh et al. 2022). As a leader has little influence over the employee's home-induced interruptions, the leader can change the frequency of communication with the employee and the team. This is not to say that communication should seize or switch to more asynchronous media, as that shift could induce additional detrimental effects on knowledge-sharing and comprehending complex information (Yang et al. 2021). Rather, "wasteful" meetings and frequent check-ins could be (further) minimized (Rigby et al. 2016; Mitchell 2021; O Connor et al. 2021) and employees empowered to shape their boundaries for a better work-life balance.

## 7 Limitations and Future Research

Interpreting the findings of this research should occur in the light of some limitations. The participants of this study were crowdworkers from Amazon MTurk. We applied several remedies to ensure high-level data quality and validity. The effects of the focal variables of the MTurk sample were similar to the sample from our pre-study, in terms of direction of effects and, partly, significance of effects. Yet, both samples were not organization-specific. Therefore, it seems meaningful to repeat the study within an organization, to see if the results hold.

Moreover, the respondents were all from the United States (U.S.), and data was collected in November 2021 and June 2022, when the COVID-19 pandemic still affected the work and life of many Americans. Employees with school-age children were partly confronted with ongoing school disruptions, so their children moved back into remote or hybrid teaching (Burbio 2022). Work in global virtual teams was strongly influenced by the lockdown

status of countries where other team members were located, which led to an everchanging situation of remote work (O Connor et al. 2021). These contextual factors could have further aggravated diminishing work-home boundaries. Therefore, future research could repeat the study during a time not characterized by worldwide uproar and major disruptions in education facilities and system-relevant services, to understand whether results remain stable.

The effects of work flexibility and work-home boundaries on job satisfaction are likely moderated by other factors that future research could uncover. Based on a comment by one of our respondents, we suggest that leadership support and control should be considered in future research. As the MTurker who works full-time in the security industry explains, many of the DWP tools are usually introduced top-down but with no accountability and responsibility to make meaningful use of these technologies on the lower levels of the hierarchy.

> Databases of reports, logs, external clients, etc. have revolutionized what we can do, but most of our management is 60 years old and still thinking like beat cops from the middle of the last century. Nobody is driving implementation of the tools corporate sends us from the middle management level unless they get a memo from above holding them accountable for proving the tools are in use. In the worst cases, a team might have half as many mobile devices as they need, the sim cards have been stolen from them and nobody even noticed for a year because they weren't being used (this is what I found when I was promoted and tried to bring the technology back into use). Although these devices have the apps needed to give us virtual omniscience over our projects, nobody is actually responsible for seeing that these tools are used. It's mind blowing. (MTurker, ID 889)

As the pandemic showed, with a predominant share of the workforce working from home, leaders and supervisors must find new ways to support and monitor their employees through DWP. Thus, future research could investigate how leaders (in collaboration with their employees) tackle the consolidation of DWP tools and manage responsibility and accountability for such tool usage.

## 8 Conclusion

This study is one of the first to empirically show that flexible and permeable work-home boundaries of information workers influence their job satisfaction, but the effects on job satisfaction depend on the frequency of DWP tool use.

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