

Working from home: Cognitive irritation as mediator of the link between perceived privacy and sleep problems

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Abstract: Since the COVID-19 pandemic began, many employees have been required to work full- or part-time at home. This paper investigates the impact of perceived privacy on cognitive irritation and sleep problems among employees who worked from home during the pandemic. Additionally, we analyzed the role of cognitive irritation as a mediator between privacy and sleep problems. We created a cross-sectional questionnaire, which was completed by 293 employees who performed home-based telework in German-speaking Switzerland. A mediation analysis was then conducted using a multiple regression analysis. A test of the indirect effect showed a significant mediation path from perceived privacy via cognitive irritation to sleep problems. Hence, the negative indirect effect indicates that perceived privacy is an important job resource that may prevent sleep problems. Further research is needed regarding home-based telework and recovery strategies to prevent sleep problems.

Key words: Telework, Perceived privacy, Cognitive irritation, Sleep problems, Working from home

Introduction

During the COVID-19 pandemic, many employees and employers needed to react rapidly to the developing situation. One of the extensive restrictions that has resulted from the pandemic is the government's recommendation that employees work part- or full-time at home. In 2020, the teleworking rate of the Swiss labor market was 34.1%. This percentage of teleworkers increased by 9.5% compared to the previous year¹. Working from locations other than

one's main office is defined as telework. Therefore, telework requires the increased use of information and communications technologies (ICTs). Before the pandemic, telework was an alternative to working remotely from one's regular workplace².

Although telework can be performed anywhere and at any time, this paper examines working from home (WFH) during the COVID-19 pandemic. In a permanent state of WFH, perceived privacy is assumed to be a crucial working condition. Until now, a gap in knowledge existed concerning the role of perceived privacy regarding to WFH, and little was known about the levels and differences in perceived privacy between home-based teleworkers. Before the COVID-19 pandemic, telework was recognized as an attractive addition to workplaces^{3, 4}.

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Much of the literature that examined part-time telework focused on job-related outcomes, such as job performance and job satisfaction⁴⁻⁶, absenteeism and work-life balance^{6, 7}, and family-work or work-family conflict⁸. However, little research exists regarding working conditions in home-based offices⁹. Wütschert *et al.*¹⁰ study examined the effect of perceived privacy and musculoskeletal complaints, and Vieira and Meirinhos¹¹ study provided additional evidence that perceived privacy among home-based teleworkers may play a supporting role in mental health. This paper aims to investigate this research gap in more detail by examining the impact of perceived privacy on sleep and cognitive irritation as an experienced perceived lack of psychological detachment.

The literature has made a distinction between visual privacy and acoustic privacy¹².

Achieving both types of privacy can help individuals control visual exposure and accessibility, which limits external distractions and controls acoustic distribution¹²⁻¹⁴. This idea explains the close relationship between perceived privacy and job control. High perceived control over the workplace was reported to decrease work stress¹⁵ and increase levels of general job satisfaction and well-being. While there is a knowledge gap concerning the role of privacy in WFH, some research has been conducted on privacy at work in open-plan offices. In open workplace design, significant stress factors are noise, distractions, and perceived lack of privacy^{16, 17}. Distractions result from the presence, behaviors^{18, 19}, and movements of others²⁰. The perceived lack of privacy can facilitate acute stress reactions and can be related to mental and physical health issues^{14, 21, 22}.

Privacy's function as an environmental factor can be explained by the job demands-resources (JD-R) model of work stress from Demerouti *et al.*^{23, 24}. The JD-R model postulates that every working environment has its own risks and protective factors regarding health and motivation. These factors can be categorized into job demands (e.g., distractions) and job resources (e.g., privacy)²³. Job demands are not primarily negative, but they can turn into job stressors when the achievement of the demands involves high effort and employees are not able to recover sufficiently from that effort^{24, 25}.

Recovery can be seen as a process that is opposite to the strain process. Demerouti *et al.*^{24, 26} defines recovery as the sense of urgency that people feel to take a break from their demands when fatigue increases (p.2). For recovery, the ability to mentally detach from work during non-work time plays an important role²⁶. Etzion *et al.*²⁷ defines psycho-

logical detachment from work as the sense of being disconnected from one's work situation (p.579). In addition, Sonnentag²⁶ emphasized that psychological detachment is not only the refraining from performing work-related tasks but also the mental disconnection from work during non-work time. Sonnentag²⁶ defined psychological detachment as an important recovery process.

Mohr *et al.*²⁸ described the inability to detach as an experienced irritation. Irritation includes the subjectively perceived emotional and cognitive strain that results from an experienced imbalance between personal resources and everyday work strain²⁸.

There is empirical evidence that has demonstrated that recovery processes are important to individual well-being^{26, 29}. Moreover, evidence (e.g., diary studies³⁰ and meta-analysis³¹) has suggested that psychological detachment is related to recovery from work stress. Therefore, Kinnunen *et al.*³² and Sonnentag *et al.*³³ consider recovery experiences during non-work time to be mediators between work characteristics (e.g., demands and resources) and well-being outcomes. Psychological detachment is based on Meijman and Mulder²⁵ effort-recovery (E-R) model, the main premise of which is that effort expenditure at work is associated with stress responses. In optimal conditions, stress responses return to pre-stressor levels during off hours, and employees completely recover before the start of the next day²⁹. If employees psychologically detach themselves from work during non-work time, the likelihood that the employees will be able to recover from the demands of work increases²⁹.

The effects of the COVID-19 pandemic regarding sleep impairments cannot yet be sufficiently recorded. A small number of studies exist about the effect of the COVID-19 pandemic on sleep³⁴⁻³⁶. Beck *et al.*³⁵ cross-sectional study found evidence that people in the general population of France aged 18 to 34 reported the highest rate of sleeping disorders.

Additionally, 16% of the participants reported that they began taking sleeping pills during the lockdown. Sleep plays a main role in recovery. Longitudinal research has shown that sleep is considered to be a link between reactions to job demands and the development of long-term health issues²⁶. These long-term consequences can be explained with the E-R model²⁵. If workers do not completely recover, short-term workloads may lead to adverse and chronic problems, such as fatigue, chronic tension, and sleep problems (e.g., meta-analysis³⁷).

Additionally, sleep problems lead to decreased perceptions of stress in response to job demands³⁸. Empirical

studies have shown that work stress is related to sleep problems, whereas restful sleep increases people's ability to self-regulate and prevents performance deficiencies²⁶⁾. Therefore, the aim of our study is to investigate the effect of perceived privacy on sleep since the COVID-19 pandemic began.

To summarize, both perceived privacy and the ability to mentally detach from work during non-work time may lower the occurrence of sleep problems. The mediating role of cognitive irritation in our study underlines the assumption that teleworkers, especially permanent home-based teleworkers, continue to think about work-related tasks and responsibilities during non-work times²⁶⁾ (i.e., perceived lack of psychological detachment). We also assumed that a perceived lack of privacy in the can predict cognitive irritation^{26, 39)}. As previously mentioned, psychological detachment has been indicated as a main mediator in the prediction of recovery²⁶⁾; therefore, we expected that the perceived lack of privacy increases cognitive irritation, and in turn, cognitive irritation increases the likelihood of sleep problems.

Purpose of This Study

According to our current knowledge, there is a gap in literature concerning how privacy in home-based telework and cognitive irritation are related to sleep problems. This study is intended to explore this research gap. Thus, we hypothesized that the level of perceived privacy can be a determinant for whether sleep problems increase or decrease among home-based teleworkers (H1; level of perceived privacy → sleep problems) and whether cognitive irritation increases or decreases (H2; level of perceived privacy → cognitive irritation).

Furthermore, we expected that cognitive irritation is positively related to sleep problems (H3; cognitive irritation → sleep problems). Finally, we assumed that cognitive irritation mediates the association between privacy and sleep problems (H4; level of perceived privacy → cognitive irritation → sleep problems).

Subjects and Methods

Sample

We recruited participants for this study's survey via social media networks, and we provided the survey in German. All study participants were informed of the study's content and its voluntary participation. The study was approved by the ethics committee of the University of Bern, Switzerland (12.01.21, Ethics No. 2021-01-00001). We

collected data between January and March 2021 during the COVID-19 lockdown when Switzerland's government recommended that people work from home. The study's inclusion criteria were as follows: (1) adult participants possess age-appropriate health, (2) participants are between the ages of 18 and 65, and (3) participants telework a minimum of one to two days per week from home.

A total of 310 participants completed the survey, and the survey's participation rate was 90%. On average, participants were 44.5 years old, with an age range of 18 to 65 ($SD=0.99$). Of the total number of participants, 193 (65%) were female, and 103 (35%) were male. Regarding relationship status, 115 (39%) of the participants were married, 110 (37%) reported they were in a committed relationship, 50 (17%) were single, and 18 (7%) were separated or divorced. One hundred forty-five participants were fully employed (49%), 231 (78%) participants attended higher education, such as university, and 65 (22%) had participated in an apprenticeship. Of the participants, 172 (58%) had no children, and 124 (42%) had children. Of the total number of participants, 184 (63.5%) had a separate office room in their home while 112 (36.5%) did not. The demographic characteristics are reported in Table 1.

Instruments

The perceived level of privacy

Participants' satisfaction about the perceived privacy regarding to WFH was measured with four items. One item was "How satisfied are you with the acoustic separation of your home office, i.e., hearing others or being heard?" These items were answered on a five-point Likert scale ranging from 1 (not satisfied at all) to 5 (totally satisfied). The privacy subscale has been used in different studies and shows validity^{14, 40)}. The Cronbach's alpha in this study was $\alpha=0.88$.

The perceived lack of psychological detachment.

We used a single item in the cognitive irritation subscale of the irritation scale by Mohr *et al.*²⁸⁾ The single item was "I find it hard to turn off after work." The item was answered on a seven-point Likert scale ranging from 1 (does not apply at all) to 7 (applies very much). The irritation scale is an instrument that has proven to be reliable in a large number of studies and can therefore be used across multiple disciplines²⁸⁾. This study evaluated recovery in non-work time as an underlying process with cognitive irritation. The item showed in the scale manual from Mohr *et*

Table 1. Demographic characteristics (n=296)

Characteristics	Number of participants	Percentage
Gender		
Male	103	35%
Female	193	65%
Age Group		
20–29 years	73	28%
30–39 years	86	29%
40–59 years	106	36%
60–69 years	22	7%
Marital Status		
Single without a partnership	50	17%
Single with a partnership	110	37%
Married	115	39%
Separated, divorced	18	7%
Offspring		
Children	124	42%
No children	172	58%
Part or full-time work		
Full-time work (100 %)	145	49%
Part-time work (80 %)	65	22%
Part-time work (60–40 %)	86	29%
Education		
University	231	78%
Apprenticeship	65	22%
Workplace at home		
Own working room	184	62%
Living room	71	24%
Kitchen room	41	14%

*al.*²⁸) the second highest load on the factor (p.45), therefore it can be assumed that this is a valid item. The use of single item of rumination as perceived lack of psychological detachment has been confirmed by the cross-sectional study from Elfering *et al.*⁴¹) and showed validity.

Sleep problems. Sleep problems were measured with a single item from Buysse *et al.*⁴²) The item was “How would you evaluate your sleep-related problems over the past two weeks?” The item had to be answered on a four-point Likert scale ranging from 1 (not at all) to 4 (very hard). The cross-sectional study from Elfering *et al.*⁴¹) used successfully single items of sleeping problems.

Control variables. Because sleep problems have been suggested to differ depending on age (1=< 20 years; 2=20–29 years; 3=30–39 years; 4=40–59 years, 5=60–65 years) and gender (0=male; 1=female), we controlled these variables^{43, 44}). Individual requirements were also controlled with the variable full- or part-time employment, as suggested by the studies from Galliker *et al.*⁴⁵)

Procedure and Analysis

We conducted all analyses using R software 4.0.2 (R Core Team, 2020). Linear and logistic regression was analyzed to estimate the association between cognitive irritation and perceived privacy as predictor variables and sleep problems as an outcome variable. The tests were two-tailed. For direct and indirect effects, we conducted a single mediation analysis with the bootstrapping procedure rec-

ommended by Preacher and Hayes⁴⁶). In this study, we estimated a 95% bias-corrected confidence interval (CI) using 5,000 bootstrapped samples. When using the bootstrapped CI procedure (lower limit of the CI [LL]; upper limit of the CI [UL]), the exclusion of zero from the CI for the indirect effect indicates mediation. If the bootstrapped CI does not include zero, then the mediating effect differs from zero⁴⁶).

Results

Mean and standard deviations for this study’s variables and bivariate correlations are reported in Table 2. The level of perceived privacy was negatively related to sleep problems [$r(293)=-0.214, p<0.01$] and cognitive irritation ($r=-0.188, p<0.01$). Cognitive irritation was positively associated with sleep problems ($r=0.350, p<0.01$). Part-time work was positively related to perceived privacy ($r=0.163, p<0.01$). Age was positively associated with perceived privacy ($r=0.246, p<0.01$). Finally, sex was positively related to perceived privacy ($r=0.142, p<0.05$).

The test of direct path c showed that the level of perceived privacy was negatively related to sleep problems ($\beta=-0.17, SE=0.06, p<0.003$). Path a showed that the relationship of perceived privacy to cognitive irritation was significant and negative ($\beta=-0.36, SE=0.10, p<0.000$). Path b showed that the relationship of cognitive irritation to sleep problems was significant and positive ($\beta=0.16, SE=0.03, p<0.000$). The indirect effect of perceived priva-

Table 2. Descriptive statistics and pearson correlations of variables

	Mean	SD	1	2	3	4	5	6
1. Privacy	3.927	1.032	1					
2. Sleep problems	1.95	0.980	-0.214 **	1				
3. COGIRR	3.32	1.775	-0.188 **	0.350 **	1			
4. Part-time work	8.49	1.857	0.163 **	0.103	0.094	1		
5. Age	3.20	0.994	0.246 **	-0.070	-0.064	-0.025	1	
6. Sex	0.35	0.477	0.142 *	-0.107	-0.112	0.291 **	0.168 **	1

Notes: N=293.

COGIRR=Cognitive Irritation

Included control variables: age, sex, and part-time work of 42 week-schedule.

* $p<0.05$, ** $p<0.01$, *** $p<0.001$, two-tailed.

Table 3. Regression results for simple mediation

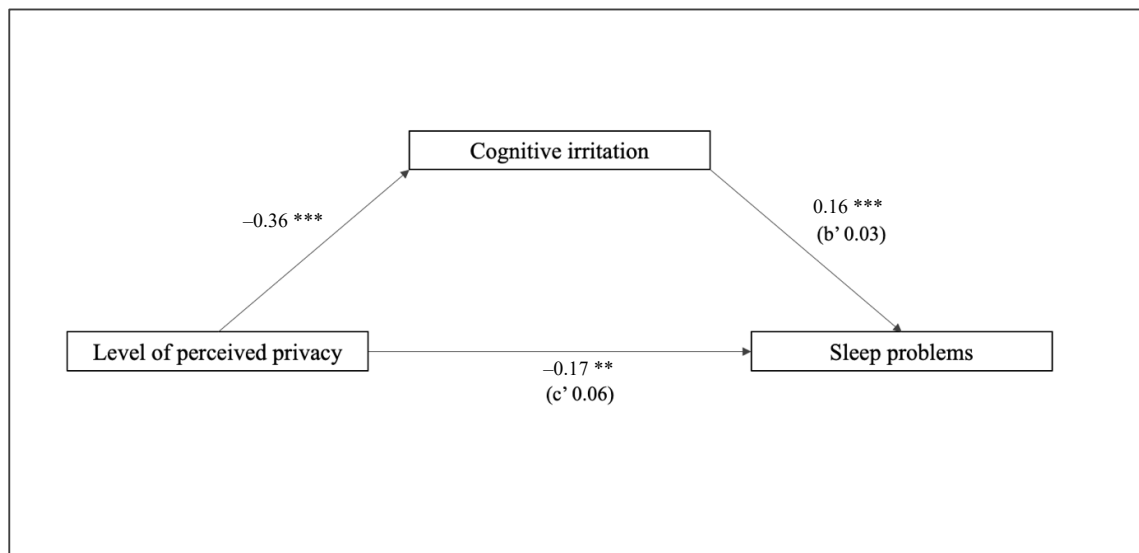
Direct and total effects				
	β	<i>SE</i>	<i>t</i>	<i>p</i>
Privacy → Sleep problems	-0.17 **	0.06	-2.99	0.003
Privacy → COGIRR	-0.36 ***	0.10	-3.49	0.000
COGIRR → Sleep problems	0.16 ***	0.03	5.18	0.000
Age	0.01	0.06	0.20	0.844
Sex	-0.17	0.12	-1.43	0.155
Part-time work	0.07 *	0.03	2.22	0.027
Bootstraps results for indirect effect				
	Effect	<i>SE</i>	95% CI LL	95% CI UL
Indirect Effect of Privacy and Sleep problems	-0.06 **	0.02	-0.105	-0.021

Note: N=293.

β =unstandardized regression coefficient; *SE*=standard error; 95% CI LL=confidence interval lower limit; 95% CI UL=confidence interval upper limit. Bootstrap size=5,000. Included control variables: age, sex, and part-time work of 42 week-schedule.

COGIRR=Cognitive Irritation

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, two-tailed.



Note. unstandardized Coefficients are reported.

Included control variables: Age, sex, and part-time work of 42 week-schedule.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, two-tailed.

Fig. 1 Mediation model: cognitive irritation mediating the effects of the level of perceived privacy on sleep problems.

cy on sleep problems was -0.06 and differed significantly from zero (CI95=-0.11 to -0.02). Hence, a complete mediation was found. Table 3 lists the complete results of our mediation analysis. Fig. 1 provides an overview of the hypothesized mediation model and the unstandardized coefficient for all paths.

Discussion

This study tested perceived privacy to predict sleep problems among home-based teleworkers during the COVID-19 pandemic. Our aim was to understand the role

of the perceived lack of psychological detachment experienced through cognitive irritation as a mediator between perceived privacy and sleep problems. All hypotheses were supported. The mediation analysis revealed that perceived privacy had a negative effect on the likelihood of a home-based teleworker experiencing sleep problems and that this association was negatively mediated by cognitive irritation (the perceived lack of psychological detachment).

According to current knowledge, this study makes an important contribution to the field of work and organizational psychology. It fills the research gap with respect to employers' views of changes in work life, and the findings contribute to employers' increasing interest in contextual factors of mobile work⁴⁷⁾. To the best of our knowledge, the impact of the level of perceived privacy on home-based teleworkers has not yet been investigated in relation to sleep problems and cognitive irritation.

We found that the level of perceived privacy has a negative relationship with the likelihood of experiencing sleep problems and cognitive irritation, which was consistent with our expectations. These results reflect the theoretical framework of the JD-R model^{20, 21)}.

The JD-R model underlines the importance of job demands and job resources²³⁾. The model also postulates that not every job's demands are experienced as negative, but demands can turn into negative job stressors when high effort is involved and employees are not able to recover completely^{24, 25)}. When perceived privacy is satisfactory, it contributes to recovery because privacy functions as a workplace resource for home-based teleworkers, whereas the perceived lack of privacy acts as a work stressor, which in turn increases the likelihood of sleep problems.

Studies about the influence of workplace resources and health outcomes support these findings^{26, 39, 48)}. Furthermore, in workplace design, the perceived lack of privacy is known to lead to acute stress reactions and could be related to mental and physical health issues^{14, 21, 22, 49)}. Research has shown evidence that, when a worker initiates the recovery process, one's ability to mentally detach from work during non-work time plays an important role^{26, 39)}. The inability to mentally detach can cause irritation²⁸⁾. The results are also supported by the fact that cognitive irritation or the perceived lack of psychological detachment is known as a stressor and impacts workers' health^{26, 39)}. Therefore, our results show the significant positive relationship between cognitive irritation and the likelihood of experiencing sleep problems.

Our results were also supported by cross-sectional and longitudinal studies from other disciplines, which found that a lack of perceived psychological detachment was pos-

itively linked to sleep problems and underlined psychological detachment's mediating role^{37, 39)}.

Furthermore, these results were also supported by the cross-sectional study from Beck *et al.*³⁵⁾ Beck *et al.*³⁵⁾ found evidence that the prevalence of sleep problems decreased significantly during the final weeks of the pandemic lockdown. Furthermore, a quarter of Beck's³⁶⁾ study population reported that their sleep improved one month after the end of the lockdown. This improvement was less among those who were still exposed to news of the pandemic after the end of the lockdown. The results from Beck *et al.*³⁶⁾ underline the importance of psychological detachment not only from work but also from stress-related events.

The study from Bakker and van Wingerden³⁴⁾ supported these assumptions when they found a significant negative relationship between thinking about COVID-19 and well-being, the results of which were increased depressive symptoms, exhaustion, and decreased vigor.

Bakker and van Wingerden³⁴⁾ made a significant contribution by examining the role of playful work design on contemplating stress-related events. Employees who used their imagination, fantasy, and humor to proactively reshape work tasks reported fewer depressive symptoms and fatigue, and their vitality increased. Bakker and van Wingerden³⁴⁾ emphasized that self-determined behavior can be used to buffer the impact of thoughts about COVID-19 and improve psychological and social resources. Therefore, it can be assumed that playful work design can actively support psychological detachment.

Sonnentag²⁶⁾ also believed that initiating processes which stimulate recovery is a powerful approach to counteracting the negative effects of job stressors. Sonnentag²⁶⁾ emphasized the importance of prioritizing recovery, especially because people who experience high levels of job stressors tend to detach less during non-work time (e.g., less physical activity and poorer sleep quality; see also the meta-analysis from Litwiller *et al.*³⁷⁾). Sonnentag²⁶⁾ referred to the experience of high job stressors, high need for recovery, and low propensity to rest as the recovery paradox. The recovery paradox can be explained as the following: (1) high state regarding to negative effect, which in turn has a strong effect on sleep and psychological detachment; (2) depletion of energy resources that are relevant for physical exercise, psychological detachment, and sleep; and (3) constant connection to technology and work. Employees in stressful jobs are more likely to work during non-work time and turn to their mobile devices^{26, 50)}. Thus, using mobile devices during non-work time provides a behavioral pathway that links high job stressors with low psychological

detachment from work and sleep impairments^{26, 37}). In addition to these three factors, Sonnentag²⁶) also emphasized the importance of work climate, which Bakker and van Wingen³⁴) have supported.

Study Limitations

First, this study used self-reported measures and a cross-sectional design, which are its main limitations because self-reported measures and cross-sectional studies are susceptible to common method bias⁵¹). Second, our mediations should be tested in longitudinal studies to compare the mediation model with the reversed causation model⁵²). Third, we measured cognitive irritation and as well as sleep problems with a single-item. The use of single items can be criticized for lack of reliability of measurement⁴¹). However, Wanous *et al.*⁵³) showed in their meta-analysis of single-items that address rather global constructs like job satisfaction, health status, sleep quality and ruminating thoughts have been successfully tested to meet good psychometric reliability and validity^{53, 54}). Single-items on sleep quality and lack of detachment have been used successfully before⁴¹).

Conclusion

This study's results underline the importance of perceived privacy. The results demonstrate that privacy can act as a job demand or job resource and affect cognitive irritation (the perceived lack of psychological detachment) and influence one's likelihood to experience sleep problems. Studies such as ours will assist in increasing scientific understanding of perceived privacy and perceived privacy's effect on health among home-based teleworkers. It can be assumed that people now recognize that WFH is a proven and accepted extended workplace in the market economy, and future research should increasingly address the effects of WFH and their design⁵⁵⁻⁵⁷). Future research should also address the recovery paradox in regarding to WFH, especially when work stressors are high. Therefore, further research is needed regarding home-based telework and recovery strategies, such as playful work design,³⁴) mindful exercises, and short breaks^{26, 37}) to prevent sleep problems among home-based teleworkers.

Declaration

Funding

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Conflicts of interests

On behalf of all authors, the corresponding author states that there is no conflict of interest.

Availability of data and material

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Authors' contributions

All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by [MSW]. The first draft of the manuscript was written by [MSW] and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Ethic approval

The Ethical approval (12.01.21, Ethics No. 2021-01-00001) was obtained from the Ethics Commission of the University of Bern, Switzerland prior to data collection.

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