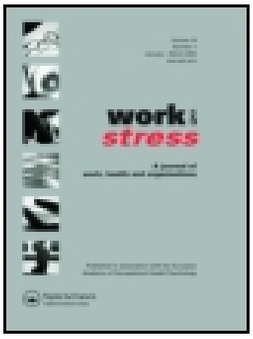

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Please wait until I am done! Longitudinal effects of work interruptions on employee well-being

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ABSTRACT

Work interruptions are contemporary job stressors that occur frequently in the workplace. Theories on work interruptions and the stressor–strain relationship over time suggest that work interruptions should have a lagged negative effect on well-being. However, we argue that continued changes in work interruptions may also be important for employees' well-being. We investigated the mid- and long-term effects of work interruptions on employee job satisfaction and psychosomatic complaints across two studies (Study 1: $N = 415$, four waves over five years; Study 2: $N = 663$, five waves over eight months). Using latent growth modelling, we predicted job satisfaction and psychosomatic complaints with respect to the level of, and changes in, interruptions. Controlling for initial well-being, we found that the mean levels (intercepts) of work interruptions had negative effects on later well-being in Study 1, but not in Study 2. However, increases in interruptions over time (slopes) predicted later well-being consistently. An analysis on reversed effects revealed that only the initial level of psychosomatic complaints positively predicted work interruptions. The studies underscore not only the importance of interruptions for well-being over time in general, but also the particular importance of exposure to increases in interruptions.

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Work interruptions; job satisfaction; psychosomatic complaints; longitudinal studies

Work interruptions come in various forms, such as e-mails, equipment malfunctions, or colleagues seeking a listener. In recent large-scale studies, employees reported work interruptions as the most frequent work stressor (Baethge, Rigotti, & Roe, 2015). Wajcman and Rose (2011) found that, on average, knowledge workers were confronted with 85 work interruptions during their workday. With the rise of new technologies (e.g. smartphones), the prevalence of interruptions seems to have increased even further, becoming more and more relevant to contemporary working life.

The majority of research on interruptions has focused on the relationship between interruptions and performance (Zijlstra, Roe, Leonora, & Krediet, 1999), but less rigorous research has been devoted to the relationship with employee well-being and health.

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Existing studies have suggested that people tend to immediately react to interruptions with negative mood, frustration, and irritation (Zijlstra et al., 1999). However, it is unknown whether such short-term reactions translate into mid- or long-term effects, or whether the effects of work interruptions on employee well-being disappear over time.

Work stress theories assume that the frequency and persistence of work stressors drain resources, impair recovery experiences, and in turn, may translate into well-being and health impairments (e.g. Demerouti, Bakker, Nachreiner, & Schaufeli, 2001; Meijman & Mulder, 1998). In addition, many employees have reported that work interruptions have increased in recent years (Baethge et al., 2015). This notion of changing conditions may reflect difficulties in coping with these changes, which may accentuate possible harmful effects of work interruptions. Therefore, the contribution of the present paper is twofold. First, we seek to gain knowledge of the mid- and long-term effects of work interruptions on employee well-being. Based on the allostatic load model (McEwen, 1998) we argue that work interruptions lead to negative change in well-being over time, a theoretical proposition that can only be tested in longitudinal research designs. Second, we not only investigate whether a certain mean level would affect an outcome, but will also investigate the possible effects of developments in a predictor variable. More specifically, we investigate if levels and changes over time in work interruptions affect well-being and if levels and changes in well-being affect work interruptions. Using the adjustment model as a starting point (Zapf, Dormann, & Frese, 1996), we hypothesise that exposure to changing work conditions is detrimental to well-being over and above the mere mean level. By adopting the perspective that we may not only observe change in outcomes but also their predictors, we aim to expand current theorising on the stressor-strain relationship.

Work interruptions

Work interruptions are described as circumstances or events that impede or delay the achievement of a goal (Jett & George, 2003). In this paper, we focus on interruptions that are involuntary and not controllable from the perspective of the interrupted. Some of the interruptions are initiated by another person (e.g. phone call) and require the individual to engage with others. Other interruptions are "psychological reactions triggered by external stimuli or secondary activities that interrupt focused concentration on a primary task" (Jett & George, 2003, p. 500). In sum, interruptions divert the individual's attention away from the main task and require the individual to deal with the new situation (e.g. new task, conversation with coworker).

From a theoretical perspective, there are several reasons as to why work interruptions may have detrimental effects on employee well-being. First, interruptions tend to trigger emotional strain because they hinder goal achievement (Sonnentag, Reinecke, Mata, & Vorderer, 2018; Zijlstra et al., 1999). Second, if an interruption occurs, employees have to adapt their current behaviour to accommodate the interrupting event, which requires additional effort. Moreover, increased cognitive effort is necessary to resume the initial task at a later time, as the initial task needs to be stored in working memory (Baethge et al., 2015). This increased effort depletes resources, resulting in fatigue and negative mood (Pachler et al., 2018; Segerstrom & Nes, 2007). Third, since the initial task remains active in working memory, employees do not experience closure of tasks. As a result, it is more difficult for employees to focus on the new task, which likely impairs

performance and, in turn, reduce satisfaction with their performance (Leroy, 2009). Fourth, frequent interruptions may make it impossible for employees to finish their tasks. Unfinished tasks increase rumination during leisure time (Smit, 2016; Syrek, Weigelt, Peifer, & Antoni, 2017), which impairs recovery and thus negatively impacts well-being (Geurts & Sonnentag, 2006).

Previous research has shown that work interruptions are negatively related to employee well-being. Cross-sectional studies have reported positive associations between work interruptions and indicators of impaired well-being, such as psychosomatic complaints (Grebner et al., 2003). In addition, work interruptions have been linked to the experience of stress, frustration, and negative emotions in experimental studies (Mark, Gudith, & Klocke, 2008; Zijlstra et al., 1999). Similarly, work interruptions have been related to irritation at work and exhaustion in diary studies (Baethge & Rigotti, 2013; Pachler et al., 2018).

The majority of research on work interruptions has either been cross-sectional or experimental. The problems with cross-sectional studies have been widely discussed in organisational psychology, with one of the most severe issues being the ambiguity of the temporal order of variables (Taris & Kompier, 2014). Experimental studies have many benefits, but their results may not be fully applicable to employees' real-world experiences, which may be far more complex than can be simulated in an experimental setting (Baethge et al., 2015; Jett & George, 2003). In addition, experimental studies – as well as diary studies – focus on short-term effects (i.e. those lasting for minutes or hours), and hence cannot shed light on the more enduring effects of work interruptions on well-being. The lack of longitudinal studies has resulted in a limited understanding of the lasting effects of interruptions and the temporal order of the stressor–strain relationship (Baethge et al., 2015; Jett & George, 2003). Theories and empirical findings demonstrate that prolonged exposure to job stressors increases strain but these effects take time to develop (e.g. Ganster & Rosen, 2013; McEwen, 1998). Relationships between stressors and strain therefore are likely to increase with exposure, at least up to a certain point after which they may level off (Chandola, Brunner, & Marmot, 2006; Ford et al., 2014). This argumentation implies that we may observe stronger relationships between stressors and strains over long observation periods. It is unclear over what time periods effects of work interruptions evolve exactly. We will use studies with differing observations periods (i.e. eight months and five years) and therewith offer some descriptive insights on the developmental trajectories of our study variables as recommended in the literature (Kelloway & Francis, 2013).

Frequency of work interruptions and well-being

Stressors are associated with a large number of potential outcomes (Sonnentag & Frese, 2012). For this study, we focused on job satisfaction and psychosomatic complaints as indicators of well-being. Job satisfaction is described as employees' global positive feelings about their work (Spector, 1997). It is an important component of well-being (e.g. Diener, Suh, Lucas, & Smith, 1999), sensitive to work conditions, and associated with numerous favourable organisational variables such as performance (Judge, Weiss, Kammeyer-Mueller, & Hulin, 2017). Employees who are confronted with job stressors tend to perceive a mismatch between their work environment and their coping abilities, which in turn leads

to lower job satisfaction (Dawis & Lofquist, 1984). Employees may become frustrated, tense, and dissatisfied with their work situation because they are confronted with conditions that prevent them from fulfilling their given tasks (e.g. having to work in a noisy open-plan office).

We therefore hypothesise that higher levels of work interruptions will be longitudinally associated with lower levels of job satisfaction.

Hypothesis 1a. Higher levels of work interruptions predict lower job satisfaction over time.

Our second well-being indicator is psychosomatic complaints. While changes in mood, such as frustration, are short-term reactions to job stressors, psychosomatic complaints can be a long-term consequence of stress experiences (Frese, 1985). Examples of psychosomatic complaints are headaches, back pain, or sleep problems (Nixon, Mazzola, Bauer, Krueger, & Spector, 2011). As outlined above, work interruptions are likely to trigger feelings of frustration and tension. Tension created by the stress experience manifests itself as muscle tension, as low threshold motor units are kept active (e.g. Lundberg et al., 2002). Such prolonged activation may cause muscular pain (Lundberg & Melin, 2002). In general, prolonged psychological and physiological activation inhibits recovery processes and may lead to psychosomatic complaints (e.g. McEwen, 1998; Meurs & Perrewé, 2011). For instance, high levels of psychological and physiological arousal have been linked to sleep problems (Åkerstedt, 2006). We therefore hypothesise that higher levels of work interruptions will be longitudinally associated with higher psychosomatic complaints.

Hypothesis 1b. Higher levels of work interruptions predict more psychosomatic complaints over time.

Changing frequency of work interruptions

Frese and Zapf (1988) proposed varying models to describe the stressor–strain relationship over time. Typically, theoretical models and empirical research in occupational health psychology have assumed that exposure to a stressor results in a lagged effect on strain (Demerouti et al., 2001; Frese & Zapf, 1988). However, these theories are based on the, often implicit, assumption that job stressors remain stable over time. Such an approach does not take into account the fact that job stressors may change over time. In recent years, individuals have perceived a general acceleration of their lives and an intensification of their work (e.g. Sonnentag, Pundt, & Albrecht, 2014). Despite such a general trend of intensification, the majority of longitudinal studies in occupational health psychology have either used the level of a job stressor in the first wave of data collection or used exposure time to a certain level to predict later well-being (cf. Taris & Kompier, 2014). Notably, some studies have looked at deteriorating or improving work conditions and categorised employees as being exposed to stable or changing conditions, respectively (e.g. de Lange, Taris, Kompier, Houtman, & Bongers, 2002; Schnall, Schwartz, Landsbergis, Warren, & Pickering, 1998). For example, in a study over three years, 31 percent of employees were categorised as being exposed to either improving or deteriorating work conditions (de Lange et al., 2002).

Although these studies revealed some valuable insights, their treatment of change has limited our understanding of changing conditions. Typically, participants have been

categorised as having either high or low stressors in relation to the rest of the sample (e.g. median split). In such a classification, change is represented by employees changing their position relative to others in the sample and to their previous position. This view of change, however, provides a rather rough classification because some important changes may not be observed (e.g. change from the 10th to the 45th percentile), while other small changes (e.g. from the 48th to the 52nd percentile) would be. For individuals, all changes may have relevance. These changes can be modelled in a graded fashion by using statistical procedures such as latent growth models that reflect intra-individual changes.

One of the models proposed by Frese and Zapf (1988), the adjustment model, suggests that people may adapt to certain levels of job stressors and learn to cope with them. In terms of work interruptions, lab studies have shown that individuals tend to develop strategies to compensate for the interruption immediately (Zijlstra et al., 1999). These strategies may support employees in coping with the usual amount of work interruptions (i.e. stable mean level). However, it has been suggested that coping with stressors may become unsuccessful if employees are exposed to the stressor over longer time periods (Zapf et al., 1996). In addition, having to face continuously increasing work interruptions requires employees to constantly come up with new coping strategies. Finding these new strategies may be additionally exhausting and employees may be confronted with the boundaries of their behavioural and cognitive repertoire. Lastly, being able to anticipate the interruption may facilitate successful coping and selection of adequate strategies, however, anticipation is not possible if work interruptions continue to change (Andrews, Ratwani, & Trafton, 2009; Eldor et al., 2017). Therefore, being confronted with increasing work interruptions may prevent adaptive processes and may have an incremental effect on well-being above the mere presence of the stressor (i.e. mean level).

In sum, we hypothesise that increases in work interruptions will negatively affect job satisfaction and positively affect psychosomatic complaints over time.

Hypothesis 2. Increases in work interruptions predict (a) lower job satisfaction and (b) more psychosomatic complaints over time.

Well-being as a predictor of work interruptions

While there is a considerable body of research focusing on the stressor-to-strain relationship, some scholars have also investigated the reversed relationship from well-being to job stressors and found empirical support for these effects (Ford et al., 2014). Two main arguments for why well-being affects job stressors can be made. First, employees' impaired well-being limits their job performance which in turn may initiate downward spirals resulting in employees being in less desirable positions (cf. drift hypothesis; Frese, 1982). These less desirable positions may be characterised by increased stressors (e.g. more work interruptions because of office relocation to open floor plan). Second, employees with poor well-being may perceive job stressors as more stressful because they lack the resources (e.g. energy) to deal with the stressors (Hobfoll, 1989; Hockey, 1997). Theoretically, we may argue that employees with lower levels of job satisfaction and more psychosomatic complaints perceive more work interruptions as their overall work quality is lower and they lack personal resources to cope with the interruptions. Similar to the mechanisms

explained above, we also investigate if changes in well-being have additional effects on the development of work interruptions.

Hypothesis 3. (a) Lower levels of job satisfaction and (b) higher levels of psychosomatic complaints predict more work interruptions over time.

Hypothesis 4. (a) Decreases in job satisfaction and (b) increases in psychosomatic complaints predict more work interruptions over time.

Method

Participants and procedures

We used two longitudinal archival studies to investigate our hypotheses. Study 1 (Transition to Education and Employment; TREE, 2016) consisted of four waves over five years ($N = 415$), and Study 2 (Meier & Spector, 2013) consisted of five waves over 8 months ($N = 663$).

Study 1 was a cohort study investigating young employees and their educational and occupational trajectories in Switzerland. The first data collection took place in 2000 at the end of participants' compulsory school, and 6,343 young adults participated in the study. In 2001, participants enrolled in vocational education training or academically oriented high school. Individuals who complete vocational education training tend to go on the labour market after graduation, whereas individuals who complete high school usually enrol in university studies. Response rates of this panel study ranged from 54% to 71% between 2005 and 2010. In 2005 4,506 (71%), in 2006 4,133 (65%), in 2007 3,979 (63%), and in 2010 3,424 (54%) individuals participated in the study. For this paper, we were only interested in employed individuals and therefore only included participants who were fully employed in 2005 (1,677, 37%), 2006 (1,835, 44%), 2007 (2,026, 51%), and 2010 (1,532, 45%). Employment status was determined through a question on status in the questionnaire (e.g. in education, employed, unemployed) and through a reconstructed status variable for participants who did not participate in some of the waves (these participants were asked to give their status for the period since last participation). Of those participants, status of 415 individuals was employed over the four waves. We chose this procedure to avoid having individuals in the dataset who went back to full-time education. However, we also computed the models with employees who at least participated in the first and last wave ($N = 626$) and obtained the same results as reported below. We compared whether individuals whose status was known in the first wave and continued to participate differed from participants who dropped out before 2010 in terms of study variables and sociodemographic variables. Dropouts reported lower values in work interruptions (t1: $d = 0.14$, $p < .05$, t4: $d = 0.23$, $p < .01$) and job satisfaction (t1: $d = 0.19$, $p < .01$), and higher values in psychosomatic complaints (t4: $d = 0.14$, $p < .05$) in some waves. None of the sociodemographic variables differed between responders and non-responders. The mean age was 20.6 years ($SD = 0.78$) at t1, and 65% were female. At Time 1, the majority of participants had a vocational education degree (94%) and 5% had a high-school degree (11 participants did not disclose their educational degree). Participants reported mean working hours ranging from 39.6 ($SD = 8.80$) to 40.2 ($SD = 9.84$) over the four waves and had a broad spectrum of occupations.

Study 2 was a longitudinal study investigating the relationship between work conditions and well-being. The study employed time lags of two months and ran for eight months. The sample consisted of 663 employees of different organisations. Data on study variables were available for 663 individuals at t1, 535 individuals at t2 (81%), 472 individuals at t3 (71%), 407 individuals at t4 (61%), and 385 individuals at t5 (58%). The mean age was 32.4 years ($SD = 10.5$) at t1, and 51% were female. In t1, 9% had completed the mandatory nine school years or less, 52% had completed secondary education (vocational education training or high school), 14% had a bachelor's degree, 23% had a master's degree, and 2% had a doctoral degree. Participants reported mean working hours ranging from 38.5 ($SD = 6.92$) to 39.0 ($SD = 6.03$) over the five waves. As in Study 1, participants had a broad spectrum of occupations. To investigate the potential impact of attrition, differences in demographic and study variables were tested between participants who completed the Time 5 assessment and participants who dropped out of the study before Time 5. Results indicated that younger participants were more likely to drop out than older participants. For only one study variable (work interruptions at Time 4), participants who dropped out reported lower values than did participants who completed the full study ($d = 0.30$, $p < .05$).

Measures

Work interruptions

In both studies, the measure for work interruptions asked participants about the frequency of work interruptions they experienced. In Study 1, two items from the Short Questionnaire for Job Analysis by Prümper, Hartmannsgruber, and Frese (1995) asked participants about the frequency of being interrupted. The items were "I keep getting interrupted while working on my main tasks (e.g. through telephone calls)" and "I cannot focus on one task because I am getting interrupted all the time". Participants answered the items on a five-point scale ranging from 1 (*never*) to 5 (*always*). In Study 2, employees indicated how often they were interrupted by others ("How often do you find it difficult or impossible to do your job because of interruptions by other people?"). This item was taken from the Organizational Constraints scale by Spector and Jex (1998). Participants answered the item on a five-point scale ranging from 1 (*never*) to 5 (*always*).

Job satisfaction

Both studies used a general job satisfaction measure (e.g. "In general, how satisfied are you with your work?") developed by Baillod and Semmer (1994). Participants answered three items in Study 1 and four items in Study 2 on a seven-point scale ranging from 1 (*extremely unsatisfied/never*) to 7 (*extremely satisfied/always*).

Psychosomatic complaints

Study 1 asked participants to rate the frequency with which they experienced six psychosomatic symptoms (e.g. headache, back pain) on a five-point scale ranging from 1 (*never*) to 5 (*daily*) (Grob et al., 1991). Study 2 used a questionnaire by Jenkins, Stanton, Niemcryk, and Rose (1988) to ask about sleep problems (e.g. "I had troubles falling asleep"). Participants were asked to rate the four items on a seven-point scale ranging from 1 (*not at all*) to 7 (*completely*).

Analytical procedure

We analyzed the data using latent growth modelling in Mplus 8.1 (Muthén & Muthén, 1998–2017). In the first step, we tested we tested the measurement models and their invariance over time. In both studies, measurement models revealed good fit and a factor solution in which well-being variables were separated from each other was superior (results can be obtained from first author). Second, we fitted linear latent growth models for the study variables to the data and compared them to nonlinear solutions. Third, we estimated a trivariate growth model to investigate the correlations between intercepts and slopes of the study variables. These preliminary findings will inform the field on developmental trajectories of work interruptions and well-being (Kelloway & Francis, 2013). Fourth, we tested our hypotheses by estimating the effect of the initial level (intercept) and the estimated growth (slope) on outcome variables in the last wave, controlling for the baseline of the outcome variables.

Previous research has shown that older employees may have higher coping resources to deal with work stressors (Shirom, Gilboa, Fried, & Cooper, 2008); therefore, they may be less affected by work interruptions. Because Study 1 was a cohort study (all participants were of the same age), we controlled for age in Study 2 only. The inclusion or exclusion of age did not affect the patterns reported here. However, in order to ensure comparability between the two studies, we included age in our analyses.

We applied the robust full information maximum likelihood (MLR) estimation to deal with missing values. To report model fit, we relied on Hu and Bentler's (1999) recommendations to report the Comparative Fit Index (CFI), the Root Mean Square Error of Approximation (RMSEA), and the Standardized Root-Mean-Square Residual (SRMR). They suggest that appropriate fit is indicated by values greater than or equal to .90 for CFI, less than or equal to .08 for RMSEA and SRMR. As we are using MLR estimator, we report Satorra and Bentler (SB) corrected Chi-square. The Chi-square has only limited usefulness in itself but can be used to compare models. A significant Chi-square difference test implies superiority of one model over the other (Satorra & Bentler, 2010).

Results

Table 1 shows descriptive statistics and Cronbach's alphas for all study variables across both studies.

Measurement invariance

In both studies, models applying partial scalar invariance (i.e. equality of factor loadings and intercepts over time) showed a non-significant difference compared to an unconstrained model (see Table 2). Although the other model fit indicators did not change significantly (cut-off values for CFI (ΔCFI < .01) and RMSEA (ΔRMSEA < .015) were not exceeded; Meade, Johnson, & Braddy, 2008), we released constraints on intercepts for the first (Study 2) or last (Study 1) measurement wave to confirm partial scalar invariance using the SB-Chi-square difference test.

Table 1. Means, standard deviations, correlations, and cronbach alpha for study variables.

	M	*SD*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Study 1																	
1 t1 interruptions	2.62	1.05	*.82*														
2 t2 interruptions	2.78	1.02	.66***	*.83*													
3 t3 interruptions	2.93	1.05	.59***	.65***	*.81*												
4 t4 interruptions	3.00	0.97	.40***	.47***	.52***	*.81*											
5 t1 satisfaction	4.73	1.25	−.17**	−.01	−.03	−.05	*.78*										
6 t2 satisfaction	4.83	1.14	−.05	−.20***	−.08	−.05	.37***	*.78*									
7 t3 satisfaction	4.71	1.22	−.10	−.20***	−.27***	−.04	.38***	.44***	*.82*								
8 t4 satisfaction	4.75	1.13	−.14*	−.16**	−.10	−.18***	.30***	.28***	.27***	*.74*							
9 t1 psysom	1.80	0.59	.17**	.18**	.19**	.17**	−.09	.01	−.11*	−.14**	*.76*						
10 t2 psysom	1.80	0.62	.11	.25***	.20***	.12*	−.04	−.12*	−.11*	−.06	.67***	*.80*					
11 t3 psysom	1.82	0.65	.06	.14**	.15**	.10*	−.06	−.05	−.23***	−.11*	.63***	.66***	*.83*				
12 t4 psysom	1.80	0.59	.06	.16**	.19***	.17***	−.03	−.07	−.09	−.22***	.54***	.61***	.59***	*.79*			
Study 2																	
1 t1 interruptions	2.89	1.15	–														
2 t2 interruptions	2.88	1.09	.55***	–													
3 t3 interruptions	2.80	1.12	.53***	.55***	–												
4 t4 interruptions	2.71	1.09	.52***	.53***	.63***	–											
5 t5 interruptions	2.81	1.12	.49***	.49***	.56***	.61***	–										
6 t1 satisfaction	4.63	1.28	−.15***	−.17***	−.13**	−.17**	−.04	*.78*									
7 t2 satisfaction	4.50	1.27	−.15***	−.18***	−.15**	−.17**	−.10	.67***	*.77*								
8 t3 satisfaction	4.54	1.33	−.08	−.14**	−.13**	−.12*	−.07	.63***	.75***	*.81*							
9 t4 satisfaction	4.53	1.34	−.05	−.12*	−.15**	−.19***	−.14*	*.50***	.58***	.69***	*.82*						
10 t5 satisfaction	4.50	1.34	−.05	−.10	−.08	−.15**	−.15**	.44***	.46***	.55***	.71***	*.79*					
11 t1 psysom	2.79	1.43	.14***	.22***	.13**	.12*	.14**	−.30***	−.25**	−.24***	−.19***	−.17**	*.85*				
12 t2 psysom	2.76	1.32	.15**	.24***	.18***	.16**	.21***	−.24***	−.26***	−.25***	−.25***	−.20***	.68***	*.83*			
13 t3 psysom	2.70	1.33	.15**	.17***	.23***	.20***	.19***	−.26***	−.24***	−.30***	−.29***	−.18**	.60***	.67***	*.83*		
14 t4 psysom	2.63	1.35	.17**	.18**	.25***	.24***	.21***	−.25***	−.21***	−.20***	−.31***	−.24***	.59***	.68***	.72***	*.85*	
15 t5 psysom	2.66	1.37	.09	.14**	.16**	.14*	.20***	−.21***	−.20***	.14*	−.27***	−.30***	.54***	.53***	.61***	.69***	*.86*

Note: Cronbach alpha in diagonal printed in italics. Psysom = psychosomatic complaints.
*$p < .05$. **$p < .01$. ***$p < .001$.

Table 2. Fit statistics for confirmatory factor analyses and measurement invariance of study variables across the two studies.

	SB-Chi-Square	df	CFI	RMSEA	SRMR	Model comparison	*p*-value SB-Chi square difference test
Study 1 (*N* = 415)							
1 Configural invariance	965.2	770	.97	.03	.05		
2 Metric invariance	990.5	786	.97	.03	.05	1 vs 2	.08
3 Partial scalar invariance	1021.3	807	.97	.03	.05	2 vs 3	.07
Study 2 (*N* = 663)							
1 Configural invariance	1019.0	615	.97	.03	.08		
2 Metric invariance	1048.2	639	.97	.03	.08	1 vs 2	.16
3 Partial scalar invariance	1075.6	657	.97	.03	.08	2 vs 3	.08

Note: SB-Chi-Square = Satorra Bentler scaled chi-square, CFI = comparative fit index, RMSEA = root-mean-square error of approximation, SRMR = standardized root mean square residual.

Preliminary analyses: Trivariate latent growth curve models

We computed the average of the respective items of each subscale to estimate the latent growth models (partial aggregation model; Bagozzi & Edwards, 1998). To reflect linear growth, the loadings for the slope were set to 0, 1, 2, and 5 in Study 1 and to 0, 1, 2, 3, and 4 in Study 2. We compared the linear solution to models including a quadratic slope. As shown in Table 3, the linear solution fitted the data well for all variables in both studies, however, the non-linear solution showed better model fit for work interruptions in Study 1 and for job satisfaction and psychosomatic complaints in Study 2. Inspection of the trajectories for work interruptions in Study 1 and job satisfaction and psychosomatic complaints in Study 2 revealed that growth levels off after the first three

Table 3. Model fit for linear, quadratic, and trivariate latent growth models.

	SB-Chi-Square	*df*	CFI	RMSEA	SRMR	Model comparison	*p*-value SB-Chi square difference test
Study 1 (*N* = 415)							
1 Work interruptions linear	17.3	5	.97	.08	.03		
2 Work interruptions quadratic	0.8	1	1.00	.01	.01	1 vs 2	<.01
3 Job satisfaction linear	6.4	5	.99	.03	.05		
4 Job satisfaction quadratic	4.4	1	.97	.09	.02	3 vs 4	.65
5 Psychosomatic complaints linear	7.5	5	.99	.03	.05		
6 Psychosomatic complaints quadratic	0.8	1	1.00	.01	.01	5 vs 6	.14
7 Trivariate growth model	149.6	51	.92	.07	.05		
Study 2 (*N* = 663)							
1 Work interruptions linear	13.2	10	1.00	.02	.04		
2 Work interruptions quadratic	10.4	6	.99	.03	.04	1 vs 2	.54
3 Job satisfaction linear	54.3	10	.94	.08	.08		
4 Job satisfaction quadratic	10.7	6	.99	.04	.02	3 vs 4	<.001
5 Psychosomatic complaints linear	21.0	10	.99	.04	.05		
6 Psychosomatic complaints quadratic	10.1	6	.99	.03	.04	5 vs 6	<.05
7 Trivariate growth model	184.4	91	.97	.04	.04		

Note: SB-Chi-Square = Satorra Bentler scaled chi-square, CFI = comparative fit index, RMSEA = root-mean-square error of approximation, SRMR = standardized root mean square residual.

or four measurement waves. Because addition of a quadratic slope makes model estimation and interpretation more difficult and the shape of development is not at the core of the paper, we decided to account for the levelling off by not fixing the last slope (Meredith & Tisak, 1990). Hence, the nonlinear trends were accounted for by estimating the loadings of the slope for the last wave freely, reflecting a less steep development in all subsequent models.

Next, we estimated a model which included intercepts and slopes of all variables. Model fit for both studies was good (cf. Table 3). Table 4 shows estimated means and variances of intercepts and slopes as well as intercorrelations for Study 1 and 2. Estimated growth rates for work interruptions differed significantly from zero in both studies. In Study 1, the mean growth rate was positive ($M = 0.14$, $SE = 0.03$, $p < .001$), whereas in Study 2, the mean growth rate was negative ($M = -0.05$, $SE = 0.01$, $p < .01$; see Table 3). In both studies, the variance around the mean level and slope was significant, indicating variability between individuals. The initial level of work interruptions was related to the initial levels of job satisfaction (Study 1: $r = -.24$, $p < .01$; Study 2: $r = -.27$, $p < .001$) and psychosomatic complaints (Study 1: $r = .21$, $p < .01$; Study 2: $r = .26$, $p < .001$). In addition, the slope of work interruptions was related to the slope of job satisfaction (Study 1: $r = -.49$, $p < .05$; Study 2: $r = -.46$, $p < .01$) and psychosomatic complaints (Study 1: $r = .33$, $p < .05$; Study 2: $r = .39$, $p < .05$). Our findings show that as work interruptions increase, participants report less steep increases in job satisfaction and steeper increases in psychosomatic complaints. The initial level of work interruptions was not associated with the slope of job satisfaction (Study 1: $r = .02$, $p = .93$; Study 2: $r = .15$, $p = .05$) and psychosomatic complaints (Study 1: $r = -.19$, $p = .06$; Study 2: $r = -.04$, $p = .68$). Similarly, the initial levels of job satisfaction (Study 1: $r = .22$, $p = .09$; Study 2: $r = .14$, $p = .22$) and psychosomatic complaints (Study 1: $r = .01$, $p = .99$; Study 2: $r = -.04$, $p = .73$) were not associated with development in work interruptions. In sum, these findings support the assumption that mid- and long-term changes in work interruptions correspond to changes in well-being (stressor-strain trend model; Garst, Frese, & Molenaar, 2000), but they also imply that mean levels do not drive development over time.

Table 4. Means, variances, and correlations for intercepts and slopes of study variables.

	M	Var	1	2	3	4	5
Study 1							
1 I interruptions	2.61***	.84***					
2 S interruptions	.14***	.04**	−.61***				
3 I job satisfaction	4.76***	.68***	−.24**	.22			
4 S job satisfaction	−.01	.01*	.02	−.49*	−.73***		
5 I psychosomatic complaints	1.81***	.27***	.21**	.01	−.13	−.05	
6 S psychosomatic complaints	.01	.01*	−.19*	.33*	.10	−.63*	−.34***
Study 2							
1 I interruptions	2.90***	.72***					
2 S interruptions	−.05***	.02**	−.27*				
3 I job satisfaction	4.59***	1.21***	−.27***	.14			
4 S job satisfaction	−.03	.08***	.15	−.46**	−.34***		
5 I psychosomatic complaints	2.81***	1.37***	.26***	−.04	−.40***	.19*	
6 S psychosomatic complaints	−.05**	.06**	−.04	.39*	.23*	−.55***	−.33**

Note: I = intercept (level at time 1); S = slope (change across time); *M* = estimated mean; Var = estimated variance.
*$p < .05$. **$p < .01$. ***$p < .001$.

Hypotheses testing: Latent growth curve models and prediction of outcomes

To test our hypotheses, we ran two models. The first model predicted well-being in the last wave using the intercept and slope of work interruptions, controlling for well-being in the first wave. The second model predicted work interruptions in the last wave using the intercepts and slopes of the well-being indicators, controlling for work interruptions in the first wave.

Testing the common stressor-strain effect, the models predicting job satisfaction and psychosomatic complaints using the intercept and slope of work interruptions fitted the data well (Study 1: SB-scaled $\chi^2(14) = 31.0$, CFI = .97, RMSEA = .06, SRMR = .04; Study 2: SB-scaled $\chi^2(30) = 59.2$, CFI = .97, RMSEA = .04, SRMR = .04). The patterns of relationships between the level of work interruptions (i.e. intercept) and employee well-being were similar across the studies: Higher levels of work interruptions predicted job satisfaction negatively; however, the coefficient was significant in Study 1 only ($\beta = -.26$). These findings only partially confirmed Hypothesis 1a. Similarly, there was a positive lagged effect from work interruptions on psychosomatic complaints in Study 1 ($\beta = .17$), but not in Study 2. Again, these findings were only partially in line with Hypothesis 1b. Regarding the effect of change in work conditions (i.e. slopes), increases in work interruptions were negatively related to job satisfaction (Study 1: $\beta = -.24$; Study 2: $\beta = -.23$) and positively related to psychosomatic complaints (Study 1: $\beta = .30$; Study 2: $\beta = .20$). These findings were in line with Hypotheses 2a and 2b. Notably, predictions from growth rates on outcomes were mostly stronger compared to the mean levels across the two studies (see Table 5).

Testing the reversed effects, the models predicting work interruptions using the intercept and slopes of well-being (Study 1: SB-scaled $\chi^2(34) = 77.6$, CFI = .94, RMSEA = .06, SRMR = .06; Study 2: SB-scaled $\chi^2(63) = 200.8$, CFI = .94, RMSEA = .06, SRMR = .07) did not reveal any significant associations between intercept or slope of job satisfaction and work interruptions. The intercept of psychosomatic complaints, however, was positively related to work interruptions (Study 1: $\beta = .30$; Study 2: $\beta = .16$) while the slope was not. These findings support only Hypotheses 3b, but are not in line with Hypotheses 3a, 4a, and 4b (see Table 5).

To illustrate our findings, we predicted mean values of well-being for different intercepts and developmental patterns of work interruptions using the following regression equation: $Y' = A + b1 \times (\text{intercept interruptions}) + b2 \times (\text{slope interruptions}) + b3 \times$

Table 5. Results of latent growth model parameters predicting outcomes.

Predictor	Outcome	Study 1	Study 2
Stressor to strain			
I work interruptions	Job satisfaction	−.26**	−.09
I work interruptions	Psychosomatic complaints	.17*	.09
S work interruptions	Job satisfaction	−.24*	−.23*
S work interruptions	Psychosomatic complaints	.30**	.20*
Strain to stressor			
I job satisfaction	Work interruptions	.13	−.03
S job satisfaction	Work interruptions	−.01	−.14
I psychosomatic complaints	Work interruptions	.30*	.16**
S psychosomatic complaints	Work interruptions	.19	.07

Note: I = intercept (level at time 1); S = slope (change across time).
*$p < .05$. **$p < .01$. *** $p < .001$.

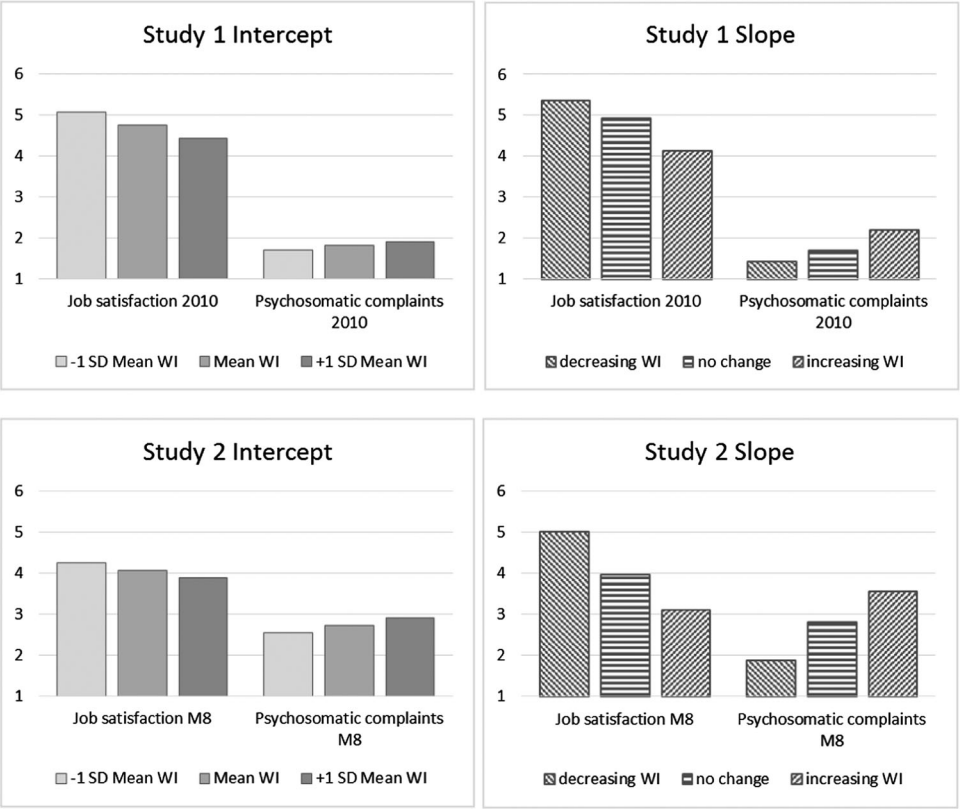

Figure 1. Mean values for job satisfaction and psychosomatic complaints for different values of intercept of work interruptions and decreasing, stable, and increasing work interruptions. Scale for job satisfaction ranged from 1 to 7 in both studies; scale for psychosomatic complaints from 1 to 5 in Study 1 and from 1 to 7 in Study 2. WI = work interruptions.

(baseline well-being). Figure 1 shows mean values of well-being in the last wave for different values of the intercept and the slope of work interruptions. In the first panel (study × intercept), the effect on well-being is portrayed for the mean intercept as well as ±1 *SD* around the intercept. In these figures, we used the estimated mean slope of work interruptions. In the second panel (study × slope), the effect on well-being is shown for the three different developmental patterns of decreasing work interruptions (−1 *SD* mean slope), stable work interruptions (slope = 0), and increasing work interruptions (+1 *SD* mean slope). For the effects of the slope, we used the model-estimated intercepts of work interruptions. Figure 1 shows that higher or lower levels of work interruptions have less of an effect on outcomes than increases or decreases in work interruptions. If work interruptions increase over the course of the study, well-being outcomes are worse compared to stable or decreasing interruptions.

Discussion

Work interruptions are a common job stressor in today's workplace. However, surprisingly little research has focused on the mid- and long-term effects on employee well-

being. Our goal was to investigate these effects in two longitudinal studies and thus to provide a greater understanding of their association with employee well-being. Our findings showed that work interruptions have mid- and long-term effects on employee well-being. While mean levels of work interruptions tended to predict job satisfaction and psychosomatic complaints in the first study, they were not significantly associated with employee outcomes in the second study. However, increases in work interruptions over time predicted job satisfaction and psychosomatic complaints in both studies over and above mean levels. In addition, increases in work interruptions tended to have stronger effects than initial levels.

Interestingly, employees reported increases in work interruptions over time in Study 1, but decreases in Study 2. These results may be related to the participants or to the time lags. The first study included young employees who had just entered the labour market and spanned a longer time period (i.e. five years). The second study covered all age groups and followed them for eight months. It is possible that increases in work interruptions are related to career stages, indicating that work interruptions increase as one gains expertise (e.g. colleagues only ask for advice if they think their coworker can offer insight). Note, however, that increases in work interruptions were detrimental for job satisfaction and psychosomatic complaints in the second study as well.

Continued increases in work interruptions may have detrimental effects because employees constantly need to learn new coping strategies. Moreover, strategies that had previously proven successful may become ineffective as complexity increases. Previous research has shown that a higher level of work interruptions is associated with higher levels of time pressure and workload (Weigl, Müller, Vincent, Angerer, & Sevdalis, 2012; Zohar, 1999). This might indicate that the overall quality of one's job decreases with increases in interruptions, because employees no longer gain, or may even lose, resources. For example, the more interruptions employees experience, the more they may feel that they have little control over their work (e.g. time control). Such a perceived loss of resources may make it even more difficult for employees to cope with the demands of their job.

We also investigated effects from well-being on work interruptions. The only significant relationship we found was between the initial levels of psychosomatic complaints and work interruptions in the last wave, indicating that health complaints such as sleep problems may translate faster into lower job quality than motivational well-being indicators such as job satisfaction. However, effects from well-being to work interruptions may need more time to evolve as a recent meta-analysis showed that reversed causation effects tend to increase with longer observation periods (Ford et al., 2014).

Theoretical implications

Our results showed that changes in work conditions had a longitudinal effect on well-being. These results imply that it is the actual development of perceived interruptions that is associated with well-being and not only an individual's recollection of improvements or deteriorations (cf. the notion of intensification). The majority of theories in occupational health psychology assume that a certain level of work conditions drives the association with employee outcomes. Our findings extend these theories in the sense that changes in themselves, regardless of levels, seem to be relevant for well-being. A

theoretical explanation for this finding may be related to the adjustment model (Frese & Zapf, 1988). Employees may develop strategies to cope with a certain level of interruptions, for example work longer hours until the initially planned tasks are finished. A consistent level of interruptions may also mean that there is a certain regularity to the interruptions that makes them more foreseeable and thus controllable. If the interruptions continue to increase or become less predictable, however, coping strategies that had previously been successful may become ineffective.

In this paper, we focused on the possible negative effects of work interruptions. However, work interruptions may also have positive effects. For example, they may be an acceptable relief from boring tasks; they may function as breaks; and interactions with colleagues may lighten the mood or provide information that otherwise would have required additional effort (Baethge et al., 2015; Fisher, 1998; Jett & George, 2003). Under certain conditions, interruptions may also have positive effects on performance (Zijlstra et al., 1999). In our study, however, we found that work interruptions had consistent negative long-term effects on two well-being indicators. These findings may reflect the primary implications of interruptions. Work is a goal-related activity (Frese & Zapf, 1994); reaching goals is associated with positive affect, whereas failing to reach them is associated with negative affect (Plemmons & Weiss, 2013). As interruptions tend to make goal achievement more difficult, it seems justified to see them primarily as a stressor.

Limitations and future research

This paper overcomes some of the recently identified gaps in research on work interruptions by investigating the effects of work interruptions longitudinally and cross-validating the results in two studies with different time lags. We were primarily interested in investigating how changes (as opposed to the initial level) in job stressors affect well-being variables. Although we offer some insight in how work interruptions and well-being affect each other over time, a more rigorous test of the direction of effects would be beneficial for the field. While we used the estimated change to predict outcome variables, future research may also investigate if different developmental patterns exist for subgroups and what person and environmental factors affect different developmental trajectories in job stressors and well-being. In addition, we focused on job satisfaction and psychosomatic complaints as outcome variables of work interruptions in our studies. In Study 2, we used sleep problems as an indicator for psychosomatic complains. Although meta-analytic research demonstrated very similar effects between sleep problems and psychosomatic complaints (Nixon et al., 2011), future research may investigate the two separately.

Other limitations of this study relate to the sole use of self-report data and the measurement of work interruptions. Future research may use other-report data, workplace observations, and physiological measures. Both studies only assessed the frequency of work interruptions. Besides quantity, the quality (e.g. complexity, interruption length) and type (e.g. intrusion, distraction) of interruptions may have relevant differential implications for well-being. Multi-item measures that cover different dimensions and types of work interruptions may support researchers in capturing more nuanced effects of interruptions.

As mentioned above, we focused on possible negative effects of work interruptions in this paper. Although possible, positive effects of work interruptions (e.g. serving as a break) may be confined to special circumstances and have predominantly short-term effects, they may nevertheless buffer some of the negative effects of work interruptions. Future research may investigate the circumstances under which interruptions are perceived as positive and how these relate to employee well-being and health.

Implications for practice

Work interruptions come in various forms, and therefore various options for redesign are available. It is likely that many work interruptions occur in open-space and open-plan offices. In these environments, separate spaces for meetings, phone calls, and chats between coworkers may be beneficial for employees. Independent of the office design, certain rules may reduce work interruptions. For example, employees may establish fixed hours during which they do not check their e-mails or answer their phone, which would allow them to work on a task for an extended period of time without being interrupted. Also, there may be rules to the effect that others may enter a person's office only if the office door is open. The possibility of taking home office days may also be valuable in enabling employees to allocate tasks that are complex and require undivided attention to those days.

Interruptions during certain tasks, especially tasks that may have severe consequences in the case of errors, may be especially stressful for employees (e.g. counting medication for drug administration in a hospital). Therefore, work design should not only establish interruption-free zones, but also create interruption-free time periods to carry out these tasks. Lastly, offering resources may alleviate the effects of interruptions (Bakker, Hakanen, Demerouti, & Xanthopoulou, 2007). Specifically, job control increases the range of possible reactions to interruptions, which may allow employees to decide on their own if they must shift their focus to the interruption or if they can first finish the task at hand.

Conclusion

Our results extend previous findings by showing the detrimental effects of work interruptions on employee well-being over longer time periods across two samples. Most importantly, changes in work interruptions were stronger and more consistent predictors of job satisfaction and psychosomatic complaints than mean levels. Participants in both of our studies were from a variety of occupations which highlights that interruptions are not only a bothersome phenomenon among knowledge workers. It seems that work interruptions are an underestimated work stressor in practice and thus deserve more attention when designing workplaces.

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