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Activity-based flexible offices: effects on work-related outcomes in a longitudinal study

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ABSTRACT

A recent popular trend in office re-design is the activity-based flexible office (A-FO). Initially, assumptions about the effects of A-FOs were drawn from research into open-plan offices where lack of privacy, concentration opportunities, and an increase in distractions are identified as main downsides. These aspects have not been explored sufficiently in the context of A-FOs. Using a longitudinal within-subjects design with three measurement times, we focussed on analysing the change in distraction after moving to an A-FO, how distraction-affected important work-related outcomes, and what factors moderated these relationships. Results showed that moving to the A-FO had negative effects on distraction, work engagement, job satisfaction, and fatigue. The negative effects of distraction were more pronounced in situations of increased time pressure and unpredictability. The obtained results highlight the harmful effects of the interaction of work stressors for employees' motivation and well-being.

Practitioner summary: The results of our research provide important insight into how moving to an activity-based flexible office impacts the employees. Besides having quiet zones for concentrated work to avoid distractions managers and leaders should also focus on taking care of work stressors to avoid fatigue and loss of motivation.

Abbreviations: A: FO: activity-based flexible office; ANOVA: analysis of variance; CFA: confirmatory factor analysis; ISTA: instrument zur stressbezogenen tigkeiten analyse [Instrument for stress-oriented job analysis]; POMS: profile of mood states questionnaire; UWES: utrecht work engagement scale

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Activity-based flexible office; office type; distraction; time pressure; unpredictability

Introduction

Spatial and temporal flexible work practices were developed and introduced in the United States and European companies on an increasingly significant level since the 1990s (Brunia, De Been, and van der Voordt 2016; Kingma 2019). The idea of working flexibly was not new at the time, and examples of flexible and innovative work arrangements can be found even in the 1970s and 1980s¹. But it took some time for it to become a more mainstream practice, mainly thanks to the technological developments and to the change of management (Human Resources) paradigm (van Meel 2011). Initially, the central focus of the pioneers in flexible work was on office or workspace design and re-design, as part of the global trend of work 'flexibilization' in general (Kingma 2019). A recent

popular trend in office re-design is the activity-based flexible office concept (A-FO). Defined as a new type of office configuration with openness, desk sharing, and flexibility in the use of office space based on the activity requirements as its main features (Wohlers and Hertel 2017), this concept is rapidly emerging as the focus of attention of researchers in organisational behaviour and related fields (for a more detailed summary of the studies that explored the effects of A-FOs please see Appendix A).

Many of the ideas and assumptions about the effects of A-FOs in the literature initially come from research on open-plan office designs. Ashkanasy, Ayoko, and Jehn (2014) argue that the impact of the physical environment on employee behaviour is especially highlighted in open-plan office types. We argue that this impact is even more prominent in the A-FOs because these types

of offices usually do not include personal workstations (Bodin Danielsson and Bodin 2008). Previous studies on the implementation of open-plan offices mostly agree that the openwork arrangements decrease acoustic and visual privacy and concentration opportunities and increase work interruption and distractions (Ashkanasy, Ayoko, and Jehn 2014; van der Voordt and van der Klooster 2008; Volker and van der Voordt 2005). The most recent systematic review about the effects of A-FOs shows that A-FOs tend to be associated with reduced privacy and fewer concentration opportunities (Engelen et al. 2019), yet results varied considerably among studies. Moreover, studies that explored interruptions and distractions before and after relocating to new flexible offices revealed either an increase, no change, or even a decrease in interruptions and distractions (Brennan, Chugh, and Kline 2002; Berthelsen, Muhonen, and Toivanen 2018; Gerdenitsch, Korunka, and Hertel 2018; Rolfö 2018). Therefore, more research is needed to clarify these inconsistent findings, especially considering the growing evidence about the negative effects of work interruptions on workers' well-being and performance (Baethge, Rigotti, and Roe 2015; Keller et al. 2020).

In addition, there are at least two downsides regarding the studies on A-FOs conducted thus far. First, not many studies investigating the effects of A-FOs have used a longitudinal within-subject design (for exceptions see: Gerdenitsch, Korunka, and Hertel 2018 and Meijer, Frings-Dresen, and Sluiter 2009; for the summary of other studies please see Appendix A), which restricts the conclusions we can make about the effects of A-FOs on a variety of work-related outcomes. In the present study, we used a within-subject design to assess the impact of A-FO by comparing work-related outcomes before and after the implementation of the new office design. We focus on relatively short time reactions (i.e. 2 months after relocation) following Gerdenitsch, Korunka, and Hertel (2018) recommendations because the effects of A-FO can best be captured and better understood shortly after the change. We also assess long term reactions (i.e. 12 months after relocation) to check if the changes after the relocation are maintained over time, because previous findings on the long-term effects of office re-design have been inconsistent (Gerdenitsch, Korunka, and Hertel 2018; Meijer, Frings-Dresen, and Sluiter 2009)

Secondly, previous research does not employ sound theoretical explanations of the associations found, which hinders the progress of this research area. Therefore, in the present study, we attempted to overcome this limitation by combining Wohlers and

Hertel's (2017) A-FO theoretical model and action-regulation theory (Frese and Zapf 1994; Hacker 2003; Zacher and Frese 2018). Wohlers and Hertel's (2017) A-FO theoretical model 'explains why and under which conditions working in an A-FO evokes benefits and risks at the individual, the team and the organizational level' (480). The model suggests that the specific features of A-FOs affect important working conditions, which in turn, affect individual, team, and organisational work-related consequences². According to the model, employees in A-FOs experience a lack of privacy as one of the specific working conditions, and this is accompanied by additional distractions and audio and visual disturbances. The potentially harmful effects of distractions that come from an A-FO design can be explained and understood through action-regulation theory. According to action-regulation theory (Hacker 2003; Zacher and Frese 2018), stressors, such as distractions, require that employees engage more cognitive resources to regulate actions and this might lead to an increased cognitive effort and consequently to negative work-related outcomes. Based on this, we analysed more comprehensively the effects of distractions on some work-related consequences included in the A-FO model, namely motivation, satisfaction, and well-being.

Moreover, the A-FO model assumes that certain task-, person-, or organisation-related factors could limit or enhance the effects of A-FO features on working conditions and the effects of working conditions on work-related consequences. Following these assumptions, we included time pressure and unpredictability as task-related moderators, because they may strengthen the negative effects of distractions on work-related outcomes in an A-FO context. In this way, we aimed to address calls for more research on the proposed relationships of the A-FO model and to investigate these relationships before and after switching to an A-FO (Wohlers and Hertel 2017). The hypothesised relationships are presented in Figure 1. Specific parts will be described in more detail in the following sections.

In summary, the three main contributions of the present study are: first, a *methodological design* that includes within-subject assessments of working conditions and outcomes before and after switching to an A-FO including both short term and long term reactions, with fairly large sample size; second, a clear *theoretical* underpinning for justifying the research questions and explaining the obtained results; and third, the focus on *distraction* and potential *moderators*

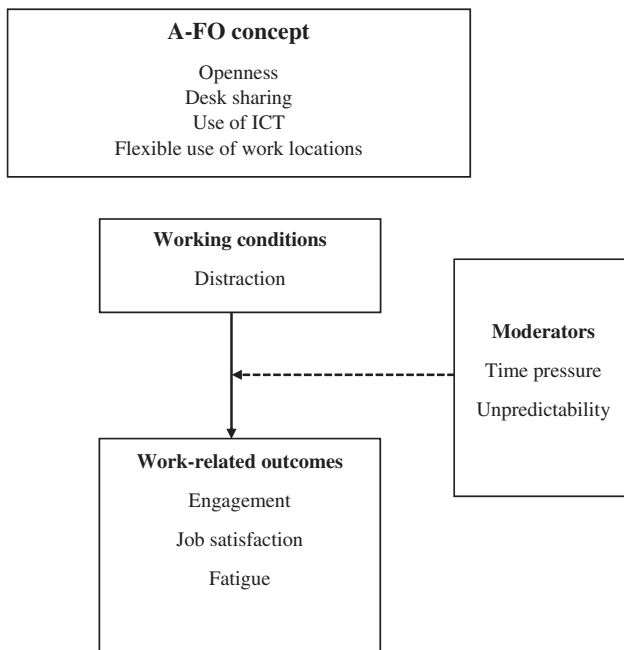


Figure 1. Hypothesised model with proposed effects of working conditions in A-FO on work-related outcomes in office workers and moderating effects (dashed line) (Based on the Model of Wohlers and Hertel 2017).

to better comprehend the effects of A-FOs on employees' well-being, satisfaction, and motivation.

A-FO concept

Different definitions of A-FOs can be found in the literature. Bodin Danielsson and Bodin (2008) define *flex office* as an open plan arrangement with no individual work stations and with spaces for concentrated work. Appel-Meulenbroek, Groenen, and Janssen (2011) define activity-based office as models where 'people, whilst in the office, can choose an activity-based workstation that best suits the activity at hand from a functional perspective and also matches with the employees' preferences' (123). Boutellier et al. (2008) describe the multi-space office concept as an open space office but offering a diversity of workplaces depending on the activity. Summarising previous definitions, Wohlers and Hertel (2017) highlight four main features of A-FOs – openness, desk sharing, use of ICT and flexible use of activity-related work locations. In the present study, we adopted Wohlers and Hertel's (2017) definition of A-FO and A-FO's effects on employees at work will be analysed through the lenses of their A-FO model.

The A-FO model postulates that the specific features of A-FOs affect important working conditions such as privacy and territoriality, and that these, in

turn, affect the individual, team, and organisational level work-related consequences. The model proposes that, in comparison to the cellular or open-plan offices, the A-FOs' specific features will affect these working conditions differently. Thus, employees in A-FOs will experience more autonomy but less privacy than employees in cellular offices. Additionally, the model proposes that A-FOs' specific features can have both positive and negative consequences for employees depending on different task-, person- or organisation-related factors (Wohlers and Hertel 2017).

Working conditions and work-related outcomes in an A-FO

From a careful examination of the literature on the effects of the workspace (i.e. physical environment) on employee's reactions and behaviour (see Appendix A), we derive three key characteristics of previous studies. First, the majority of the studies focussed either on comparing the effects of different office types (e.g. closed, shared offices, open-plan offices, combi offices) on different outcomes (e.g. health, satisfaction, stress, exhaustion), or on exploring the conditions and work-related outcomes after introducing new flexible work arrangements, such as open offices or A-FOs. Second, most of the studies used less rigorous methodological designs, such as case studies, observations, descriptive, and cross-sectional data analysis to study these effects. In addition, sample sizes were usually rather small. Third, the results of these studies so far have been contradictory, reporting both positive, negative, and zero effects of physical environment on a variety of outcomes. In Appendix A, we summarise the findings of the studies that investigated the effects of office types (including A-FOs) on different outcomes.

As can be seen in this summary, research *comparing the effects of different office types* on employees' attitudes and behaviour showed that, in comparison with the classical cell offices, workers in open or flexible offices mainly complain about (or report dissatisfaction with) lack of privacy, interruptions from co-workers, distractions, difficulties with concentrating, and excessive ambient noise levels. Similarly, research analysing *employees' behaviour and attitudes after implementing A-FOs* shows that one of the commonly mentioned downsides of implementing flexible office designs (such as A-FOs) is a decrease in acoustic and visual privacy and an increase in distractions. These studies identify greater freedom/autonomy (e.g. choosing a place to work) and better communication with colleagues or team members as main positive effects,

and loss of privacy, territorialism, concentration problems, excessive noise levels, and distractions as the main downsides of flexible office designs. Finally, studies comparing *employees' attitudes and behaviour before and after relocating to new flexible offices* showed contradictory findings regarding distractions and disturbances as an effect of A-FOs (see Gerdenitsch, Korunka, and Hertel 2018 and Rolfö 2018 as examples of decreased distraction).

Our assumption is that the A-FO design implemented in our study would increase both acoustic and visual distractions (e.g. phone call conversations or colleagues passing by) and task-related distractions (e.g. colleagues' questions about a task or requests for information). Moreover, lack of space for concentrated work (i.e. no zones for concentrated work were provided) would also negatively affect what Wohlers and Hertel (2017) call psychological privacy. Since the implemented A-FO is expected to decrease the psychological privacy of employees and that this, in turn, is expected to cause distractions and acoustic disturbances, we expected that relocating to the A-FO would increase distraction in our employee sample and that this increase in distraction would be maintained over time.

Hypothesis 1a and 1b: Implementing A-FOs will increase employees' level of distraction in the short and long term. Employees will report higher levels of distraction immediately after (1a) and 12 months after (1b) moving to A-FOs.

Wohlers and Hertel's (2017) A-FO model, although very detailed and comprehensive, assumes that office features would affect work-related consequences indirectly, through particular working conditions (e.g. territoriality, autonomy). Based on our literature review, we assume it is also reasonable to expect that moving to an A-FO would have direct effects on well-being. De Croon et al. (2005) found strong evidence that open workplaces decrease job satisfaction and found empirical proof for the link between office design and work-related outcomes such as fatigue, stress, and job satisfaction. Based on De Croon et al. (2005) review, we expected that moving to a new office design would not only affect employees' distractions but also negatively impact employees' work-related outcomes.

Hypotheses 1c–1e: Implementing A-FOs will increase fatigue (1c) and reduce work engagement (1d) and work satisfaction (1e). Employees will report higher fatigue levels and lower levels of work engagement and job satisfaction after moving to A-FOs.

Hypotheses 1f–1h: Increase in fatigue (1f) and decrease in work engagement (1g) and job satisfaction (1h) will be maintained 12 months after relocation.

Effects of distractions on work-related outcomes in an A-FO

Distractions are a form of work interruptions defined as 'psychological reactions triggered by external stimuli or secondary activities that interrupt focused concentration on a primary task' (Jett and George 2003, 500). They are usually considered dysfunctional for employees (Jett and George 2003) and an important stressor that negatively affects performance and increases work-related strain (Baethge and Rigotti 2013; Baethge, Rigotti, and Roe 2015).

Research so far has shown that distractions negatively affect performance as indicated by more forgetting intentions (Baethge and Rigotti 2013; Einstein et al. 2003), lengthening task times (Bailey and Konstan 2006; Eyrolle and Cellier 2000), increasing errors (Bailey and Konstan 2006; Oulasvirta and Saariluoma (Oulasvirta and Saariluoma, 2004) and decreasing performance satisfaction in general (Baethge and Rigotti 2013; Pachler et al. 2018). Moreover, there is evidence that distractions negatively affect concentration and satisfaction with the work environment (Banbury and Berry 2005; Lee and Brand 2005); are linked with greater irritation (Baethge and Rigotti 2013; Grebner et al. 2003), negative emotions (Zijlstra et al. 1999), somatic complaints (Grebner et al. 2003; Lin, Kain, and Fritz 2013; Keller et al. 2020), emotional exhaustion (Lin, Kain, and Fritz 2013; Pachler et al. 2018; Rogers and Barber 2019), disengagement and work tension (Rogers and Barber 2019), anxiety (Lin, Kain, and Fritz 2013), and lower job satisfaction (Keller et al. 2020).

Apparent from this summary is that most studies about distraction and well-being focus on the affective aspect of well-being. Aside from Rogers and Barber (2019) who focussed on disengagement and Keller et al. (2020) who looked at work satisfaction, studies that explored whether distractions affect motivation or job satisfaction are scarce. Moreover, as Keller et al. (2020) argue, most of the research on work interruptions has been either cross-sectional or experimental. Apart from Keller et al. (2020), no other study has focussed on longitudinally studying how changes in distractions affect employees' well-being. The results of their study showed that not only are interruptions per se harmful for well-being over time but that increases in interruptions also deteriorate health and well-being – even to a greater extent than constantly high levels of interruptions (Keller et al. 2020). Therefore, if we assume that switching from a regular office to an A-FO will cause a negative change (increase) in one of the working

conditions (e.g. distraction), we might assume that this change will be detrimental to workers' well-being and motivation. Moreover, according to action regulation theory, we might expect that coping with these increased distractions in a new office would require additional cognitive effort from employees that can lead to a decline in well-being or motivation, which can be especially pronounced if the stressors are maintained over time (Zacher and Frese 2018).

Based on previously described research and arguments, we proposed that:

Hypothesis 2a: Distractions immediately after the move to A-FO will be positively related to fatigue and negatively related to work engagement and work satisfaction.

Hypothesis 2b: Distractions 12 months after the move to A-FO will be positively related to fatigue and negatively related to work engagement and work satisfaction.

Time pressure and unpredictability as moderators of the relationship between distraction and work-related outcomes

Following the idea that the effects of distractions at work can depend on task-, person-, and organisation-related factors (Jett and George 2003; Wohlers and Hertel 2017), we wanted to detect factors that might determine the scope of the assumed negative effects of distraction on employees' outcomes in A-FO. More precisely, we focus on two specific task-related moderators – time pressure and unpredictability.

Time pressure was initially defined as a stressor caused by a lack of time to perform job tasks (Kinicki and Vecchio 1994). In the context of flexible work, Wohlers and Hertel (2017) argue that frequently changing workstations in A-FOs can be time-intensive and exhausting for the employees. Besides, previous research showed that work interruptions (including distractions) could lead to greater time pressure (Baethge, Rigotti, and Roe 2015; Baethge and Rigotti 2013; Mark, Gudith, and Klocke 2008).

From an action-regulation perspective, both time pressure and distractions are seen as stressors that disturb the action regulation process and affect goal attainment. Both stressors require additional effort and resources to attain goals and overcome the problems that arise (Frese and Zapf 1994; Hacker 2003; Zacher and Frese 2018). Since distractions and time pressure both drain employees' resources, time pressure is likely to strengthen the negative association between distractions and work-related

outcomes. Although no previous studies have assessed the interactive effects of time pressure and distractions, some research supports the unfavourable effects of combinations of stressors. For instance, Pearsall, Ellis, and Stein (2009) showed that combined time pressure and role ambiguity had the most damaging effect on performance, transactive memory, and psychological withdrawal among teams in a decision-making simulation. The combination of these two stressors was more harmful for the team members than the independent effects of the stressors and no stressors at all. Therefore, we expected that time pressure enhances the negative effects of distraction on employees' outcomes:

Hypothesis 3a: Distraction immediately after the move will be more strongly related to work engagement, job satisfaction, and fatigue under conditions of high time pressure.

Hypothesis 3b: Distraction 12 months after the move will be more strongly related to work engagement, job satisfaction, and fatigue under conditions of high time pressure.

On the other hand, unpredictability is also likely to strengthen the relationship between distraction and work-related outcomes. Due to desk sharing and flexible use of workstations in A-FOs, employees may experience a lack of availability of needed co-workers and an increased number of unplanned encounters with non-team members and other co-workers. In turn, these employees may experience feelings of unpredictability in their daily work tasks. Unpredictable tasks are those that cannot be accomplished with known and established methods and procedures of performance (Chudoba et al. 2005). They require more information processing (Mohr and Wolfram 2010) and more intense communication with co-workers (Chudoba et al. 2005). As there are often no established methods available to accomplish unpredictable tasks, this disturbs the action regulation (Frese and Zapf 1994), requiring more cognitive resources to regulate actions and hence, leading to an increased cognitive effort (Mohr and Wolfram 2010). In work environments where distractions already burden employees' cognitive resources, unpredictability may even increase the negative effects of distractions on work-related outcomes. Mohr and Wolfram (2010) showed that lower predictability (i.e. higher unpredictability) was associated with more irritation in situations with more dynamic tasks. Chudoba et al. (2005) showed that predictability reduced the negative effects of working in discontinuous environments (such as virtual teams). In addition, research on new

ways of working showed that other flexible work arrangements (e.g. teleworking) are also linked with aspects of uncertainty (e.g. role ambiguity and role conflicts) and that these are associated with work exhaustion (Sardeshmukh, Sharma, and Golden 2012). We expected that unpredictability is an additional factor that might enhance the negative effects of distractions in A-FOs:

Hypothesis 3c: Distraction immediately after the move will be more strongly related to work engagement, job satisfaction, and fatigue under conditions of high unpredictability.

Hypothesis 3d: Distraction 12 months after the move will be more strongly related to work engagement, job satisfaction, and fatigue under conditions of high unpredictability.

As previously mentioned, action regulation theory assumes that, in order to overcome obstacles, such as distractions, one has to invest additional effort, use additional resources, or take additional actions. In the context of A-FOs, this might already be done under time pressure (i.e. frequently changing workstations in A-FOs can be time-intensive and exhausting; Wohlers and Hertel 2017) and unpredictability (i.e. not knowing when, where, and with whom one will be working; Wohlers and Hertel 2017). This can lead to a vicious cycle, as described in the action regulation theory, meaning that new actions and additional effort can produce even more stress (Frese and Zapf 1994). As already mentioned, combinations of stressors can have even worse effects on behavioural, cognitive, and affective outcomes compared to isolated stressors on their own (Pearsall, Ellis, and Stein 2009). In line with this, we assumed that the combination of high time pressure and high unpredictability would enhance the detrimental effects of distraction on well-being and motivation. Therefore, based on the arguments mentioned above, we assumed that:

Hypothesis 4a: Distraction immediately after the move will be more strongly related to work engagement, job satisfaction and fatigue under conditions of high time pressure and high job unpredictability.

Hypothesis 4b: Distraction 12 months after the move will be more strongly related to work engagement, job satisfaction and fatigue under conditions of high time pressure and high job unpredictability.

Method

Procedure and sample

The study was conducted at the headquarters of a large company, which moved to a new office in

December 2017. The employees located at the headquarters worked in a large variety of departments covering the core functions of the organisation, such as strategy, communications, innovation management and human resources. Accordingly, the employees worked on very diverse tasks, including strategic management, market research, product development or recruiting.

The data collection took place before the move – at the end of September/beginning of October 2017 (Time 1; T1), – in February 2018 – 2 months after the move (Time 2; T2) and in December 2018 – 12 months after the move (Time 3; T3). The data were collected online and the data collection period lasted three weeks for each wave, with reminders sent out twice. Respondents were matched across different waves by using a personal code, which the participants generated themselves. The total number of employees working at the headquarters was around 1000 employees³. However, the total number of respondents who completed T1 and T2 was 335. The total number of respondents who completed T1, T2 and T3 was 181. Participation in the study was voluntary.

The employees moved from the old office to a new flexible 'activity-based' office with desk sharing. In the new 'activity-based' office the employees had meeting rooms and telephone booths but no special zones for concentrated work were provided. The old office was a mix between the small open office and small to medium conventional offices where employees shared the office with 2–3 people. In the old office, some employees (mostly leaders) had their own room, and some of them kept their own offices even after this transition. Therefore, we focussed solely on employees without leadership positions. Hence, the following analysis only focussed on changes in distraction (and subsequent changes in work-related outcomes) among employees (non-leaders).

The final sample consisted of 247 employees without a leadership position who were matched for T1 and T2. The sample included slightly more men (54.3%). The average age was 42.6 years ($SD = 10.15$) and the average tenure 14.64 years ($SD = 14.04$). Average working hours per week were 40.65 ($SD = 6.88$), and 42.9% of the sample held a university degree and 34.4% held a high school diploma.

For analysing the long-term effects of office relocation (12 months after the move), we used a sub-sample that participated in all three measurement times. This sample consisted of 127 employees without leadership positions who were matched for T1, T2 and T3.

Control variables

Previous research showed that age and gender are important to control for because there might be differences in reactions to change in working conditions between men and women and younger vs. older employees (Wohlers and Hertel 2017). Therefore, we controlled for age and gender. We also included tenure, education, and total working hours per week as control variables.

Measures

All the questions at T1 referred to the period over the last three months, all the questions asked at T2 referred to the period after relocating to the new office and all the questions asked at T3 referred to the period over the last 7 months⁴.

Work Engagement was assessed using three items from the Utrecht Work Engagement Scale (UWES-9), one for each dimension of work engagement (Schaufeli, Bakker, and Salanova 2006): 'At my work I felt full of energy'; 'I was enthusiastic about my job' and 'Time flew when I was working'. The selected items correspond to the items used in the 6th European Working Conditions Survey (Eurofound 2017). Internal consistency of the scale as indicated by Cronbach's alpha was .75 (T1), .80 (T2) and .75 (T3).

Fatigue was measured with four items from Profile of Mood States questionnaire (POMS; McNair, Lorr, and Droppelman 1971) adapted by Sonnentag, Binnewies, and Mojza (2008). POMS includes a list of mood-descriptive adjectives that are included in a number of measures of mood states. Respondents were asked to indicate how often they felt 'fatigued', 'tired', 'exhausted', and 'spent' after a workday using response choices ranging from 1 (*never*) to 5 (*always*). Internal consistencies were .88 (T1), .89 (T2) and .93 (T3).

Job satisfaction was measured with a single item adapted from Dolbier et al. (2005). Participants were asked, 'How satisfied were you with your work in general. Answers ranged from 1 (*not at all satisfied*) to 7 (*extremely satisfied*).

Distraction at the workplace was measured using three items from Lee and Brand (2005) distraction scale (translated and adapted to German by Gerdenitsch, Korunka, and Hertel 2018): 'I found it difficult to concentrate on my work', 'In my workspace, I experienced distractions (auditory and/or visual)', and 'I experienced the opportunity for privacy in my workspace' (reverse coded). The three items were rated from 1 (*not at all true*) to 5 (*exactly true*). Internal consistencies were satisfactory ($\alpha_{T1} = .82$, $\alpha_{T2} = .75$, $\alpha_{T3} = .72$).

Time pressure was measured using three items from Semmer, Zapf, and Dunckel (1999) stress-related work analysis tool (ISTA). Participants were asked to rate how often they had been pressured by time at their work on a scale from 1 (*never*) to 5 (*very often*). A sample item reads, 'How often have you been under time pressure?' Internal consistencies were .82 (T1), .79 (T2) and .81 (T3).

Unpredictability was assessed using four items developed for the present study, based on the predictability scale used in Mohr and Wolfram's study (2010). Items were: 'In my work, I was often confronted with unexpected requirements'; 'In my work, it was often unpredictable when I would work'; 'In my work, it was often unpredictable where I would work' and 'In my work, I often did not know who I would work with'. The four items were rated from 1 (*completely disagree*) to 5 (*completely agree*). Internal consistencies were .68 (T1), .74 (T2) and .69 (T3).

Preparatory analyses

We conducted a confirmatory factor analysis (CFA) with maximum likelihood estimation in MPlus 8.2 (Muthén and Muthén 2017) to assess the factor structure of the self-devised unpredictability scale in a model that included only predictor variables (distraction, unpredictability, and time pressure). We compared the proposed three-factor structure (M1) with a one-factor model (M2) (all items loading on one common factor) and three two-factor models (M3, M4, and M5). As can be seen in Table 1, the three-factor model fits the data better than any of the other models. For

Table 1. Fit indices for measurement model and comparison models.

Tested models	χ^2	CFI (CFI \geq .90)	TLI (NNFI \geq .95)	RMSEA (RMSEA $<$.08)	SRMR (SRMR $<$.08)	AIC
M1: measurement model (3 factors ^a)	72.967 (32)	.950	.929	.071	.054	6372.040
M2: one factor	530.922 (35)	.393	.219	.237	.194	6823.995
M3: Two-factor model ^b	326.544 (34)	.642	.526	.185	.151	6621.618
M4: Two-factor model ^c	232.703 (34)	.757	.678	.152	.107	6527.777
M5: Two-factor model ^d	296.430 (34)	.679	.575	.175	.154	6591.503

^aMeasurement model M1 includes the predictor variables unpredictability, distraction and time pressure; ^bsame as M1 but with distraction and time pressure items loading on one latent variable; ^csame as M1 but with unpredictability and time pressure items loading on one latent variable; ^dsame as M1 but with distraction and unpredictability items loading on one latent variable.

the three-factor model, all factor loadings were statistically significant ($p < .001$) and greater than .50 (except for one item on time pressure which had a standardised loading of .39). Hence, the four-item unpredictability scale had an appropriate factorial validity and was used for hypotheses testing.

Results

Because two different matched samples were used for short- and long-term effects the results will be presented in two separate sections. First, we will describe the short-term effects obtained on a T1–T2 matched sample, and then the results with the follow-up measurement (long-term effects) with the T1–T2–T3 matched sample.

Short-term effects

Descriptive analysis

Means, standard deviations and zero-order correlations between the study variables at T1 and T2 are presented in Table 2. As can be seen from the table, distraction correlated significantly and positively with time pressure and fatigue and negatively with work engagement and job satisfaction at both measurement times.

Change in distraction and work-related outcomes in A-FO

To test hypothesis 1, stating that levels of distraction (1a) and fatigue, work engagement, and job satisfaction (1c–1e) would change after moving to the A-FO, we employed paired t -tests in IBM SPSS Statistics (Version 25). The results showed that, of all variables measured, there was a significant increase in distraction ($t = -3.21$, $p = .002$), fatigue ($t = -4.87$, $p = .000$) and a significant decrease in work engagement ($t = 3.76$, $p = .000$) after the move to the new offices.

Job satisfaction did not change from before to after the move. Therefore, hypotheses 1a, 1c and 1d were supported, and hypothesis 1e was not.

Effects of distractions on work-related outcomes

To test hypothesis 2a, we conducted hierarchical regression analyses for each outcome separately. We entered control variables at T1 in step 1, distraction and the respective outcome at T1 in step 2, and finally distraction at T2 in step 3 in the regression model. All independent variables were standardised. The results show that, of all control variables included in step 1, only gender was a significant predictor and only so for work engagement. Further independent sample t -test revealed that women showed slightly higher work engagement than men at T2 (mean difference = 0.29; $t = -3.4$; $p < .001$). None of the other control variables were significant and therefore were not included in the table (although they were considered in the analyses). As shown in Table 3, distraction at T2 was a significant predictor of work engagement, fatigue, and job satisfaction at T2 controlling for distraction and the respective outcome at T1. Thus, hypothesis 2a was supported.

Time pressure and unpredictability as moderators

To test hypotheses 3a and 3c, we conducted a hierarchical moderation analysis separately for each outcome using Hayes's PROCESS 3.0 Macro in SPSS (Hayes 2013). For each model, we introduced control variables at T1 (age, gender, education, tenure, and working hours) together with distraction at T1 and the respective outcome variable at T1 as covariates, distraction at T2 as the independent variable and time pressure and unpredictability as moderators. In testing hypotheses 3a and 3c, we did not find any significant interactions between distraction and either of the moderators in predicting either of the outcomes. Therefore, hypotheses 3a and 3c were not supported.

Table 2. Means (standard deviations) and correlations between the study variables at before (T1) and after (T2) moving to an A-FO.

Variables	<i>M</i> (<i>SD</i>)	<i>n</i>	1	2	3	4	5	6	7	8	9	10	11	12
1. Distraction T1	3.15 (1.02)	247												
2. Distraction T2	3.41 (0.88)	247	.16**											
3. Time pressure T1	3.00 (0.88)	247	.22**	.14*										
4. Time pressure T2	3.07 (0.81)	246	.12	.10	.62**									
5. Unpredictability T1	2.10 (0.65)	247	.12	-.01	.37**	.25**								
6. Unpredictability T2	2.28 (0.69)	247	.03	.04	.20**	.28**	.43**							
7. Engagement T1	3.74 (0.64)	247	-.21**	-.18**	.09	.09	.03	-.10						
8. Engagement T2	3.59 (0.69)	247	-.10	-.44**	.12	.18**	.03	-.07	.60**					
9. Fatigue T1	2.85 (0.78)	247	.29**	.21**	.30**	.32**	.19**	.22**	-.34**	-.22**				
10. Fatigue T2	3.07 (0.78)	246	.17**	.53**	.20**	.32**	.04	.19**	-.20**	-.36**	.58**			
11. Job satisfaction T1	5.40 (1.15)	247	-.32**	-.19**	-.12	-.07	-.04	-.15*	.55**	.37**	-.50**	-.33**		
12. Job satisfaction T2	5.43 (1.2)	247	-.10	-.41**	.02	.07	.00	-.19**	.38**	.59**	-.23**	-.42**	.46**	

Note. * $p < .05$; ** $p < .01$.

Table 3. Hierarchical regression results for work engagement, fatigue and job satisfaction at T2.

Variable	Outcomes					
	Work engagement T2		Fatigue T2		Job satisfaction T2	
	<i>B</i>	ΔR^2	<i>B</i>	ΔR^2	<i>B</i>	ΔR^2
Step 1		.09*		.05		.06
Control variables	0.30**					
Step 2		.34**		.32**		.23**
Outcome T1	0.41**		0.46**		0.59**	
Distraction T1	0.02		-0.02		0.05	
Step 3		.11**		.17**		.10**
Distraction T2	-0.23**		0.33**		-0.39**	

Note. $n = 247$; control variables included: age, gender, education, tenure and working hours; *B* is unstandardised regression coefficient; * $p < .05$; ** $p < .01$.

To test hypothesis 4a, we were interested in the three-way interaction effect (distraction \times time pressure \times unpredictability) for each outcome in order to determine whether distraction would be more strongly related to the outcomes under conditions of high time pressure and high job unpredictability introduced together. From the model summary results, we observed significant three-way interaction effects for work engagement and fatigue.

For work engagement as the dependent variable, the three-way interaction was significant ($B = -0.16$, $t(228) = -2.35$, $p = .02$, 95% CI $(-.29, -.03)$), explaining 1.1% of additional variance ($\Delta R^2 = .011$, $F(1, 228) = 5.53$, $p < .05$) of the overall model ($R^2 = .55$, $F(14, 228) = 19.65$, $p < .001$). The interaction is presented in Figure 2. In situations of high time pressure, increases in distraction negatively affected work engagement in general, but more strongly among those employees with higher unpredictability ($B = -0.36$, $p = .00$) than those with lower unpredictability ($B = -0.16$, $p = .03$). In addition, a significant slope difference was found ($t = 2.02$, $p = .004$). No such difference was found in situations of low time pressure ($t = 1.39$, $p = .17$).

The three-way interaction was significant for fatigue as well ($B = 0.26$, $t(227) = 3.46$, $p = .001$, 95% CI $(.11, .40)$), explaining 2.2% of additional variance ($\Delta R^2 = .022$, $F(1, 227) = 11.95$, $p < .05$) of the overall model ($R^2 = .58$, $F(14, 227) = 22.11$, $p < .001$). The negative effect of distraction was moderated by unpredictability in the high time pressure group. In situations of high time pressure, it was those who reported high unpredictability that suffered the most from distraction in terms of fatigue ($B = 0.51$, $p = .00$) in comparison to those with low unpredictability ($B = 0.16$, $p = .05$). As with work engagement, these two slopes differed significantly, $t = 3.17$, $p = .002$ (see Figure 3). Again, no such difference was found in case of low time pressure ($t = 1.8$, $p = .07$).

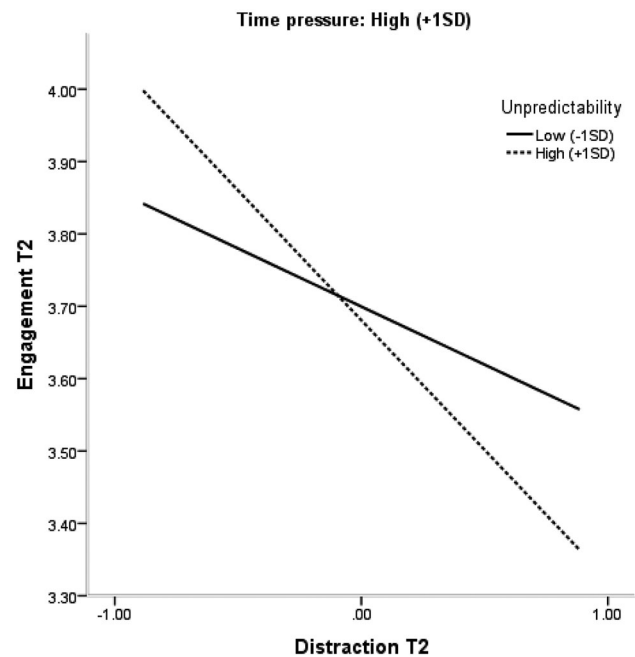


Figure 2. Interaction between distraction and unpredictability predicting engagement at T2 in situations with high time pressure.

Finally, no significant three-way interaction was found for job satisfaction.

In sum, the expected effects of distraction were found for work engagement and fatigue and they were the strongest under conditions of high time pressure and higher unpredictability. Therefore, hypothesis 4a was partially supported.

Long-term effects

Change in distraction and work-related outcomes in A-FO

To check whether the change in distraction (1b), fatigue, work engagement, and job satisfaction (1f–1h) would be maintained in the long-term, we employed repeated measures ANOVA. The results showed that, even with the smaller sample, there was a significant

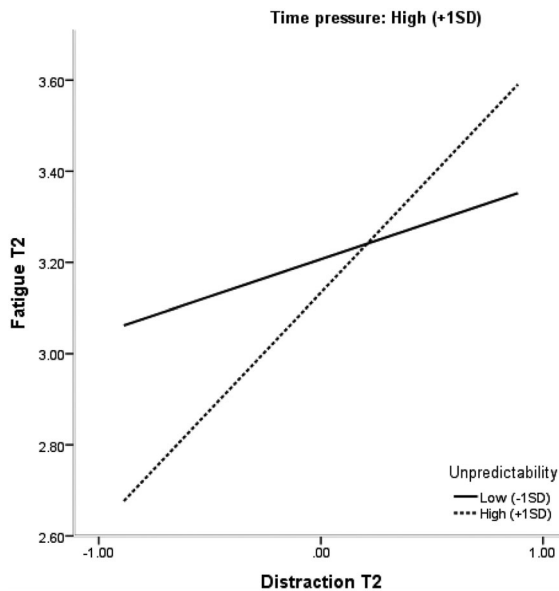


Figure 3. Interaction between distraction and unpredictability predicting fatigue at T2 in situations with high time pressure.

increase in distraction and fatigue, and a significant decrease in work engagement immediately after the move to the new offices (2 months after). Job satisfaction did not change from before to after the move. In addition, distraction decreased slightly between T2 and T3, but this decrease was not significant. As can be seen in Table 4, in the longer term, 12 months after the introduction of the A-FO, the distraction change compared to baseline remained high and this difference was significant. Contrary to distraction, there was a small but significant increase in work engagement at T3 in comparison with T2. As can be seen in Table 4, in the longer term, 12 months after the introduction of the A-FO, there was a small but non-significant improvement in fatigue and job satisfaction compared to T2. Therefore, hypothesis 1b was supported and 1f–1h were not.

Effects of distractions on work-related outcomes

To test the effects of distraction on the outcomes in long term, we conducted hierarchical regression analyses for each outcome separately. We entered control variables at T1 in step 1, distraction, and the respective outcome at T1 and T2 in step 2, and finally distraction at T3 in step 3 in the regression model. All independent variables were standardised. As shown in Table 5, distraction at T3 was a significant predictor of work engagement, fatigue, and job satisfaction at T3 controlling for distraction and the respective outcome at T1 and T2. Thus, hypothesis 2b was supported.

Table 4. Mean scores (SD) on all study variables on short- and long-term effects of the implementation of the A-FO ($n = 127$).

Variable	T1	T2	T3
Distraction	3.12 (0.10)	3.47 (0.89) ^a	3.40 (0.89) ^b
Engagement	3.70 (0.61)	3.55 (0.65) ^a	3.65 (0.61) ^c
Fatigue	2.86 (0.82)	3.05 (0.86) ^a	2.96 (0.86)
Job satisfaction	5.45 (1.12)	5.41 (1.18)	5.54 (1.02)

^aSignificant difference between T1 and T2; ^bsignificant difference between T1 and T3; ^csignificant difference between T2 and T3.

Time pressure and unpredictability as moderators

To test interaction with moderators at the long-term, we conducted a hierarchical moderation analysis separately for each outcome using Hayes's PROCESS 3.0 Macro in SPSS (Hayes 2013). For each model, we introduced control variables at T1 (age, gender, education, tenure, and working hours) together with distraction at T1 and T2 and the respective outcome variable at T1 and T2 as covariates, distraction at T3 as the independent variable and time pressure and unpredictability at T3 as moderators.

For work engagement we found significant interactions between distraction and unpredictability ($B = -0.16$, $p = .01$, 95% CI $(-.28, -.03)$) explaining 1.9% of additional variance ($\Delta R^2 = .019$, $F(1, 111) = 6.21$, $p < .05$) of the overall model ($R^2 = .65$, $F(12, 111) = 17.42$, $p < .001$), and between distraction and time pressure ($B = -0.16$, $p = .004$, 95% CI $(-.27, -.05)$) explaining 2.6% of additional variance ($\Delta R^2 = .026$, $F(1, 113) = 8.57$, $p < .01$) of the overall model ($R^2 = .65$, $F(12, 113) = 17.71$, $p < .001$).

We also found significant interactions between distraction and time pressure in predicting fatigue ($B = 0.16$, $p = .05$, 95% CI $(-.0004, .32)$) explaining 1.2% of additional variance ($\Delta R^2 = .012$, $F(1, 112) = 3.91$, $p = .0505$) of the overall model ($R^2 = .65$, $F(12, 112) = 17.23$, $p < .001$) and in predicting job satisfaction ($B = -0.38$, $p = .001$, 95% CI $(-.61, -.15)$) explaining 5% of additional variance ($\Delta R^2 = .05$, $F(1, 113) = 10.94$, $p = .0013$) of the overall model ($R^2 = .48$, $F(12, 113) = 8.54$, $p < .001$). Hypotheses 3b and 3d were partially supported. These interactions are presented in Figures 4 to 7.

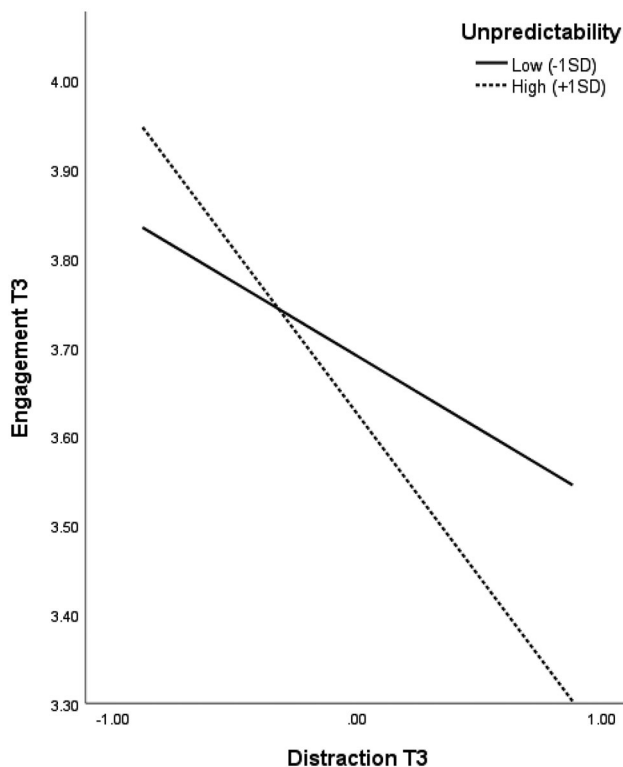
When distraction increases, work engagement decreases, but more so among those employees with higher unpredictability ($B = -0.37$, $p = .00$) than those with lower unpredictability ($B = -0.16$, $p = .012$) and for those with high time pressure ($B = -0.40$, $p = .00$) than those with lower time pressure ($B = -0.15$, $p = .03$).

The same effect is obtained for fatigue and job satisfaction. When distraction increases, fatigue increases and job satisfaction decreases, but more so among

Table 5. Hierarchical regression results for work engagement, fatigue and job satisfaction at T3.

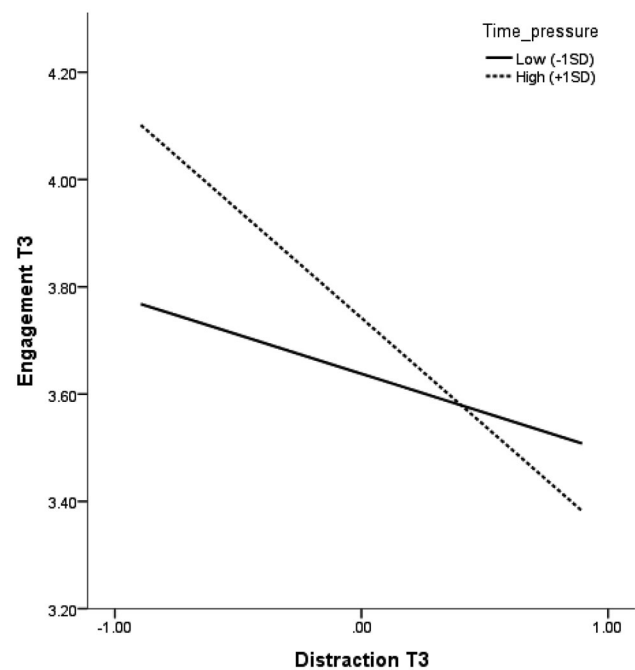
Variable	Outcomes					
	Work engagement T3		Fatigue T3		Job satisfaction T3	
	<i>B</i>	ΔR^2	<i>B</i>	ΔR^2	<i>B</i>	ΔR^2
Step 1		.12		.07		.09
Control variables						
Step 2		.47***		.51***		.27***
Outcome T1	0.16**		0.30***		0.23*	
Distraction T1	0.03		0.04		-0.03	
Outcome T2	0.32***		0.30**		0.39**	
Distraction T2	-0.03		0.16*		-0.04	
Step 3		.06***		.04**		.06**
Distraction T3	-0.21***		0.24**		-0.35**	

Note. $n = 126$; control variables included: age, gender, education, tenure and working hours; *B* is unstandardised regression coefficient. * $p < .05$; ** $p < .01$; *** $p < .001$.


Figure 4. Interaction between distraction and unpredictability predicting engagement at T3.

those employees with higher time pressure ($B = 0.38$, $p = .00$; $B = -0.73$, $p = .00$) than those with lower time pressure ($B = 0.13$, $p = .15$; $B = -0.12$, $p = .38$).

As for the three-way interaction effect (distraction \times time pressure \times unpredictability) for each outcome, from the model summary results, we observed significant three-way interaction effect only for fatigue. ($B = 0.30$, $p = .03$, 95% CI (.02, .57)) explaining 1.5% of additional variance ($\Delta R^2 = .015$, $F(1, 106) = 4.65$, $p = .03$) of the overall model ($R^2 = .66$, $F(16, 106) = 12.79$, $p < .001$). The negative effect of distraction was moderated by unpredictability in the high time pressure group. In situations of high time pressure, it was those


Figure 5. Interaction between distraction and time pressure predicting engagement at T3.

who reported high unpredictability that suffered the most from distraction in terms of fatigue ($B = 0.53$, $p = .00$) in comparison to those with low unpredictability ($B = 0.25$, $p = .09$). However, these two slopes did not differ significantly, $t = 1.36$, $p = .17$ (see Figure 8). No difference in slopes was found in case of low time pressure either ($t = 1.65$, $p = .10$).

Discussion

The purpose of this study was to analyse the effects of A-FOs by comparing different outcomes before, shortly after (2 months) and 12 months after the relocation, thereby following the studies by Meijer, Frings-Dresen, and Sluiter (2009) and Gerdenitsch, Korunka, and Hertel (2018), who also employed a

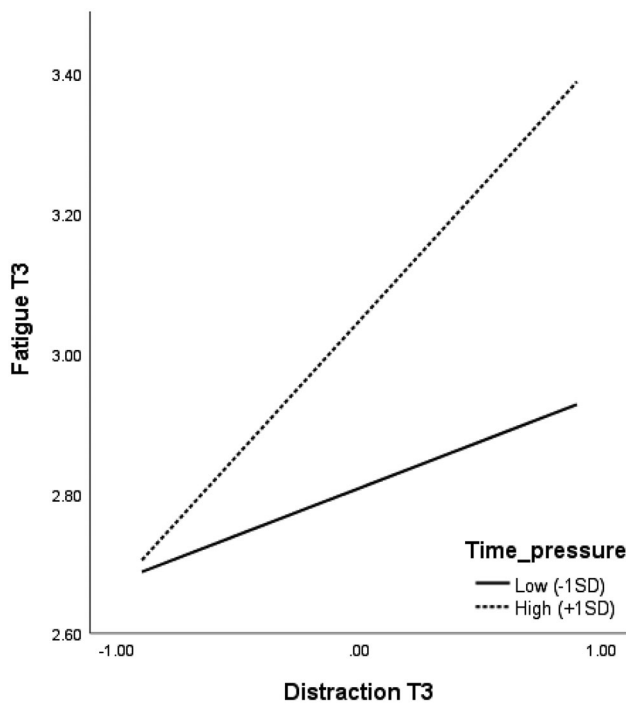


Figure 6. Interaction between distraction and time pressure predicting fatigue at T3.

three-wave design. More precisely, we focussed on analysing the change in distractions after the move, how distractions affected fatigue, work engagement, and job satisfaction, and what factors moderated these relationships. Leaning on the A-FO model (Wohlers and Hertel 2017) and action regulation theory (Frese and Zapf 1994; Hacker 2003), we assumed that A-FOs' specific features would increase distractions and negatively influence work-related outcomes. Moreover, we assumed that these changes and effects would be maintained in the long-term.

First, we found that moving to the A-FO had negative consequences. The level of distraction and fatigue increased while work engagement decreased immediately after the move to new offices. Furthermore, distractions after the move was significantly and negatively related to work engagement and job satisfaction, and significantly and positively related to fatigue. Finally, significant three-way interactions showed that the negative relationships between distraction and work engagement and fatigue were more pronounced in situations of increased time pressure and unpredictability. On the other hand, no change in job satisfaction was found immediately after the relocation. One possible explanation for these short-term results obtained might have been the demand characteristics or resentments at perceived inconveniences of the movement to the new office and this could have influenced employees' responses.

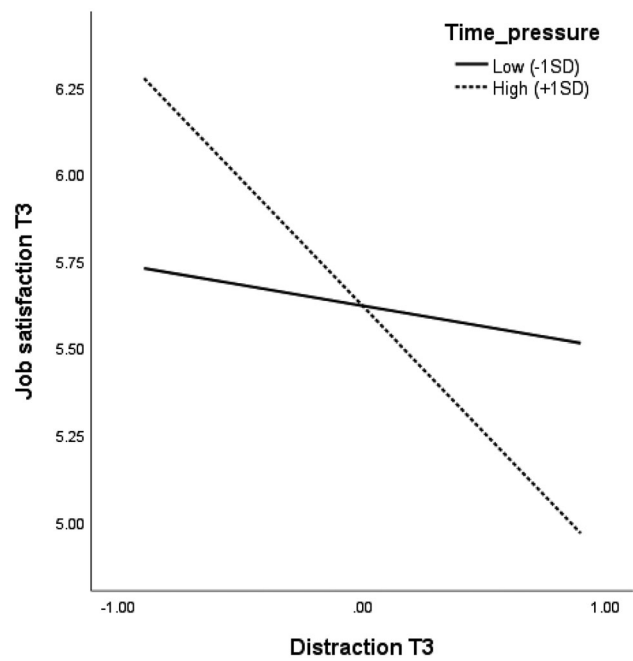


Figure 7. Interaction between distraction and time pressure predicting job satisfaction at T3.

However, we believe the results did not solely relate to resentment towards the movement itself because the new location was close and there were no big changes in commuting demands, the tasks and organisational structure did not change, but above all, the obtained effects in the first two months are partially present at long-term as well. We found that the increase in distraction was maintained even 12 months after the move and that distractions were still significantly related to work engagement, fatigue, and job satisfaction at the follow-up measurement. We also found that time pressure acted as an important moderator, accentuating the negative effects of distraction on all study variables at follow-up. Therefore, we believe that the obtained effects were not solely because of the movement itself or resentments at perceived inconveniences of the new office design, but actually because of the new office design and increased level of distractions.

Theoretical implications

Our results give empirical support to some of the proposed relationships in the A-FO model. According to the model, employees use their cognitive capabilities to cope with the lack of privacy caused by A-FOs and with related distractions and interruptions (Wohlers and Hertel 2017). This specific cognitive effort, in turn, affects their work-related outcomes. Our results support this idea. We identified distractions as an important working condition of A-FOs that is associated with

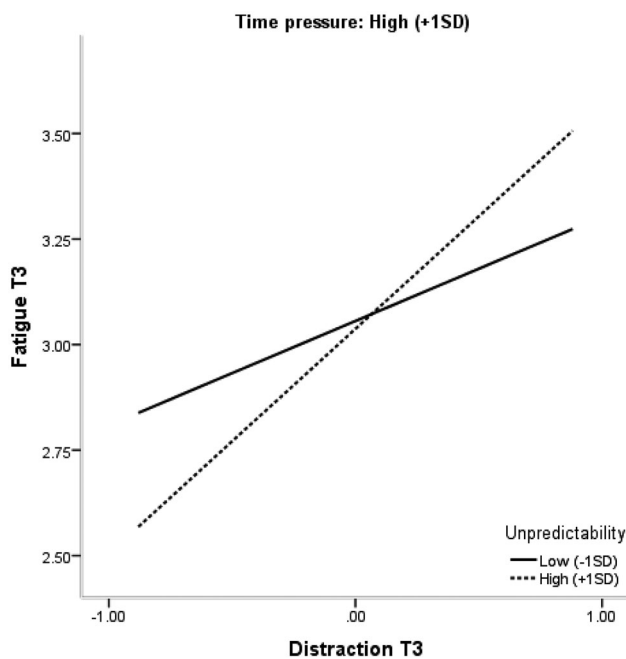


Figure 8. Interaction between distraction and unpredictability predicting fatigue at T3 in situations with high time pressure.

negative employees' reactions. This could be due to the fact that zones for concentrated work were not provided. Unlike in Gerdenitsch, Korunka, and Hertel's (2018) study, where the company provided quiet zones and a decrease in distractions was found, most of the previous studies on the effects of A-FOs identified work interruptions, lack of privacy, difficulties concentrating, and audiovisual distractions as products of the new flexible office environments (Ashkanasy, Ayoko, and Jehn 2014; Brennan, Chugh, and Kline 2002; Elsbach and Pratt 2007; Engelen et al. 2019; Gorgievski et al. 2010; van der Voordt and van der Klooster 2008; Wohlers and Hertel 2017). In addition, distraction was associated with important work-related outcomes in the present study – work engagement, fatigue, and job satisfaction – in both short-and long-term, confirming previous claims about the negative effects of distraction on well-being (Lin, Kain, and Fritz 2013; Pachler et al. 2018; Rogers and Barber 2019) and adding to the scarce evidence about the negative effects of distraction on motivation and work attitudes (Keller et al. 2020; Rogers and Barber 2019). Besides, according to Baethge and Rigotti (2013), the majority of research on work interruptions is done in hospital settings. Therefore, the present study expands research on the effects of interruptions (focusing on distraction) on well-being in a different work setting.

Moreover, our results also showed that moving to an A-FO had negative consequences for two important outcomes – work engagement and fatigue.

Work engagement significantly decreased and fatigue increased after the relocation. This result provides evidence for the direct link between office design and work-related outcomes, as claimed by De Croon et al. (2005). Therefore, we believe that the A-FO model should assume a direct link between office features and work-related outcomes, in addition to an indirect link through working conditions.

In contrast, job satisfaction did not change after the relocation, nor at the follow-up. It seems that job satisfaction is a more stable construct and is influenced by other job-related characteristics, rather than changes in the environment. Work engagement and fatigue, on the other hand, seem to fluctuate more and are more affected by these changes. Even though previous studies found changes in employee satisfaction after relocating to A-FOs (Brennan, Chugh, and Kline 2002; Gerdenitsch, Korunka, and Hertel 2018; Rolfö 2018; Rolfö, Eklund, and Jahncke 2018), these studies assessed satisfaction with the psycho-social work environment or satisfaction with the office design and not job satisfaction. Our results highlight the difference between job satisfaction and satisfaction with the environment and imply a more stable nature of job satisfaction construct.

Finally, in an attempt to answer calls for investigating potential moderators of the effects of A-FOs, we identified an interplay between time pressure and unpredictability in determining the effects of distraction on work-related outcomes. The negative effects of distraction were emphasised in situations when employees perceived high time pressure and unpredictability. These results align with action regulation theory (Frese and Zapf 1994) that assumes that engaging more cognitive resources to regulate actions when obstacles (stressors) occur leads to an increased cognitive effort. If cognitive effort associated with coping with distractions in A-FOs is combined with high time pressure and high unpredictability, this combination might be quite harmful for the employees in new flexible office arrangements. Our results also support the idea that the combined effects of multiple stressors can be very harmful not only for teams (Pearsall, Ellis, and Stein 2009) but for individual employees as well.

Practical implications

Our results provide important insight for managers and HR professionals dealing with A-FOs and their impact on employees. First, considering the office features of the A-FO we investigated, the results highlight the importance of having quiet zones for concentrated

work to avoid distractions. Our results support De Croon's (2005) argument that 'innovative offices should provide sufficient shelter from unwanted acoustic and visual stimuli' (130) but under the condition that employees adequately use these spaces in order to attain the desired benefits (Appel-Meulenbroek, Groenen, and Janssen 2011; Brunia, De Been, and van der Voordt 2016).

However, aside from the quiet zones and the adequate and suitable implementation of A-FOs, our results highlight another very important practical implication. The significant two-way and three-way interactions imply that not only office design is important for employees' reactions, but general working conditions as well. A detrimental interplay between distractions caused by the office design, time pressure, and unpredictability show that the focus of managers and leaders should not only be on office re-design, but also on job re-design, taking care of work stressors and ways to reduce them.

Limitations and suggestions for future studies

The first limitation is the lack of a control group that limits conclusions we can make about the causal effects of the new office environment. We cannot know for sure if the obtained effects are due to some other characteristic of this sample or other characteristics of the office environment that were not controlled for. Including a control group in a pre-post assessment of the office features would overcome this limitation and provide more robust conclusions about the consequences of implementing A-FOs. However, since the whole organisation moved within a specific time, we were not able to include a control group, nor was it possible to do that for a practical reason in this kind of study.

A second limitation was the use of self-report measures for all the studied work-related outcomes. Because of the type of work performed by the employees (mostly project work), objective work outcomes were very difficult to obtain. It would be useful to assess more objective work quality outcomes if they are possible to obtain from the companies.

Another limitation is that the data was collected from only one organisation, which limits the generalisation of the results to other organisations and work contexts. A-FO's configuration and their implementation can differ from one organisation to another (Wohlers and Hertel 2018), and this should be accounted for in future studies.

Furthermore, some previous studies called for exploring the mechanisms behind the effects of the work environment in general. For instance, Ashkanasy, Ayoko, and Jehn (2014) called for more research on mechanisms that could explain why physical environments sometimes succeed and sometimes fail to positively impact employees' behaviour. Similarly, Bodin Danielsson and Bodin (2008) called for investigating the mechanisms through which the office type has an influence on employees' perceived health and job satisfaction. The results of our study indicate that distraction is one of those mechanisms, but there are other mechanisms suggested in the A-FO model (Wohlers and Hertel 2017), such as perceived autonomy or territoriality, that might affect employees' reactions to office design. We call for future studies to focus more on mediation in order to provide more empirical support for the underlying mechanisms linking physical environments and work-related outcomes.

Finally, future studies should aim at finding those job resources that could diminish the negative effects of distraction, even beyond the added negative effects of unpredictability and time pressure. Some of the potential buffering factors to be explored in the future might be task/workflow interdependence and its interaction with the office configurations (Ashkanasy, Ayoko, and Jehn 2014), time-spatial job crafting (Wessels et al. 2019), or employee participation and empowerment (Rolfö 2018) as a means to ensure a better fit between flexible office arrangements and their adequate use.

Conclusion

In summary, comparing data before and after moving to flexible, open space, desk-sharing offices showed unfavourable effects on employees in terms of levels of distraction but also regarding worsened work engagement and increased levels of fatigue. One plausible explanation for these deteriorated work-related outcomes was the increase in distraction. Besides, a combination of high time pressure and high job unpredictability added to an already detrimental effect of distractions on these outcomes for the employees in A-FOs. Hence, the results put the focus on the importance of quiet zones for concentrated work but also on the importance of job re-design in the context of flexible office arrangements in general. Moreover, the obtained results provide empirical support for the Wohlers and Hertel's (2017) A-FO model and corroborate its usefulness in guiding A-FO research theoretically. Yet the results also suggest

adding the direct links between A-FO features and important work-related outcomes, which have not yet been included in the model. Doing so will provide a more holistic assessment of how AFOs affect the modern work environment.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Notes

1. Appel-Meulenbroek, Groenen, and Janssen (2011) mention the "CoCon-office type" (COmmunication and CONcentration) as the antecedent of NWW in the 1980's. Van Meel (2011) describes what seems to be an innovative activity based flexible office in a 1970 IBM office project.
2. In their A-FO model, Wohlers and Hertel (2017) use the term "work related consequences" to refer to the outcomes of the working conditions caused by A-FO features. Whenever Wohlers and Hertel's model is cited in the present article, the term "work related consequences" will be used. In the rest of the text the term "work-related outcomes" will be used to refer to fatigue, engagement and job satisfaction.
3. Because of the permanent fluctuation of workforce, the HR department was not able to provide an exact number of employees.
4. Between T2 and T3 (approx. 7 months prior to T3) there was a survey unrelated to our study, and therefore we used 7-month time focal instructions for answering the questions.
5. Office type where employees have an assigned workstation, usually in an open or half-open office area

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Appendix A. Summary of the studies investigating the effects of office types on work-related outcomes

Authors	Focus of the study	Main findings	Limitations
<i>Studies comparing different office types</i>			
Bodin Danielsson and Bodin (2008)	Compared cell office, shared room office, small open plan office, medium-sized open plan office, large open plan office, flex office, and combi office	Flex offices and the usual single room offices were the most beneficial for employees' health and job satisfaction	Small sample size for some office types; observational cross-sectional study
McElroy and Morrow (2010)	Compared traditional cubicle office arrangement with redesigned open office space	Employees in open space office report higher level of distraction than those in cellular offices	A quasi-field experimental design with non-randomly assigned subjects to experimental and control group; survey methodology (causal relation not possible)
Kim and de Dear (2013)	Compared enclosed private and shared office, cubicle offices and open office with no partitions or limited partitions	Sound and visual privacy were the main downside in open-plan office configuration	The classification of office layouts is based on the self-report by occupants; focus only on satisfaction with environmental indicators.
Seddigh et al. (2014)	Compared cell offices, shared-room offices, open plan, and flexi offices	Employees in flex offices reported less distraction than employees in open plan offices but more distraction than those in cell offices; employees in flex offices report more cognitive stress compared to employees in open plan offices.	Cross-sectional study; no pre and post measurements.
De Been and Beijer (2014)	Compared individual and shared room offices, combi offices and flex offices	Employees in flex offices were least satisfied with the lack of concentration and privacy when compared to cellular and combi ⁵ office workers	Cross-sectional study; focus on subjective appraisal of office environment
Bäcklander et al. (2019)	Compared cell offices, A-FOs and landscape offices	No relationship between office type and cognitive stress and performance	Cross-sectional study; comparison groups of different sizes
<i>Studies assessing outcomes after the implementation of A-FOs</i>			
van der Voordt (2004); Volker and van der Voordt (2005); van der Voordt and van der Klooster (2008)	Post occupancy evaluations of the new flexible offices	Positive: more opportunities for communication and social interaction, greater freedom/autonomy (to choose the place to work for instance); Negative: loss of privacy, concentration problems, excessive noise levels and visual and acoustic distractions	Case studies; no pre-post data
Gorgievski et al. (2010)	Post occupancy evaluation of satisfaction with the new office design (AFO offices)	Positive: social interaction and communication; Negative: lack of privacy and concentration, and no possibility to personalise the workspace	Survey data; no comparison before and after relocation
Appel-Meulenbroek, Groenen, and Janssen (2011)	Evaluation of the effectiveness of the activity-based office concept	Majority of users of flexible offices tend to work at the same place and personalise the workstation; employees are distracted by others' conversations, and other sounds (doors, copiers, air conditioning, etc.).	Case study; descriptive data; no comparison before and after relocation
Brunia, De Been, and van der Voordt (2016)	Assessed satisfaction with the new office types	Positive aspects: the accessibility of the building, the architecture and appearance of the building and the opportunities to communicate; Negative aspects: indoor climate, privacy, archive facilities, opportunities to concentrate and share own ideas about the work environment	Mainly descriptive and explorative case study; no comparison before and after relocation
Wohlers, Hartner-Tiefenthaler, and Hertel (2019)	Evaluation of the effects of work environment on office workers' job attitudes and vitality	Provision of A-FOs resulted in increased vitality and positive job attitudes	Cross-sectional study; results are not restricted to A-FOs, but are based on a variety of office designs with varying degrees of activity-based work environments
Haapakangas et al. (2018)	Measured the perceived impact of the environment (A-FO) on the perceived level of productivity and well-being	The privacy was the strongest predictor of perceived productivity among the employees in the A-FO	No comparison before and after switching
Göçer et al. (2018)	Post-occupancy evaluation of the factors affecting workplace choice, level of mobility occupants' satisfaction in A-FO	When given the opportunity to choose where to work (in a flexible clean desk policy office plan), more than half of the respondents reported they would rather work at the same desk; employees who preferred to change workstations reported higher satisfaction levels	Case study; descriptive data; no pre/post data

(continued)

Appendix A. Continued.

Authors	Focus of the study	Main findings	Limitations
Wohlens and Hertel (2018)	Evaluation of the effects of A-FO design on intra and inter team processes	Moving to new offices improved communication and collaboration possibilities between teams but worsened intra team communication and collaboration	No pre-post assessment; qualitative data analysis; interviews; small sample; focus only on team work
<i>Studies assessing outcomes before and after switching to A-FOs</i>			
Brennan, Chugh, and Kline (2002)	Compared employees' perceptions of physical environment and productivity before and after the relocation to an open office building.	Satisfaction with physical environment and perceived job performance significantly decreased and this was maintained over time; lack of privacy and confidentiality and increased noise were the main complaints reported	Very small sample; the effects refer only to an open plan office type
Meijer, Frings-Dresen, and Sluiter (2009)	Evaluating the effects of the innovative office concept on work-related health and productivity	No effect on work related fatigue, perceived health or productivity after relocating from classical cellular offices to A-FOs	Small sample; no control group
Blok et al. (2012)	Evaluating the effects of a flexible office on work behaviour, collaboration, employee satisfaction and knowledge sharing after moving from classical offices	No improvement in business objectives except a significant decrease in knowledge sharing	Case study; T1 collected while already changing to new offices
Berthelsen, Muhonen, and Toivanen (2018)	Analysing the experience of the working environment of university employees before and after moving from cell offices to activity-based offices	Deteriorated job satisfaction, commitment to work and social support, less concentration opportunity and more disturbance by others	Descriptive analysis only
Gerdenitsch, Korunka, and Hertel (2018)	A longitudinal study assessing the effects after relocating from a cellular office to an A-FO configuration	Decreased distraction and increased satisfaction after A-FO redesign.	No control group; data collected from a single organisation with a small number of workers
Rolfö (2018)	Assessing employee satisfaction with the A-FO and exploring the effects of A-FO on perceived performance and employee satisfaction	Perceived performance and employee satisfaction with the physical work environment increased after the relocation and distraction decreased	Case study
Rolfö, Eklund, and Jahncke (2018)	Exploring office features, work conditions and overall satisfaction and performance change after relocation from an open space office to an A-FO	No change in performance after relocating	Explorative case study; small sample in some groups
Haapakangas et al. (2019)	Measured satisfaction with communication, social relations and work demands 3 and 12 months after the relocation	All measured outcomes deteriorated 3 months after relocation; satisfaction with communication and emotional demands remained impaired 12 months after	Data collected from a single organisation; small sample in some groups; no moderators investigated