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RECEIVED 02 August 2023

ACCEPTED 31 January 2024

PUBLISHED 27 February 2024

CITATION

Baum L and Rau R (2024) Balancing work and private life: when does workplace flexibility really help? New insights into the interaction effect of working from home and job autonomy. *Front. Organ. Psychol.* 2:1271726. doi: 10.3389/forgp.2024.1271726

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Balancing work and private life: when does workplace flexibility really help? New insights into the interaction effect of working from home and job autonomy

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Introduction: Empirical research has reported variable and inconsistent findings regarding the relationship between working from home (WFH) and work-life balance (WLB). We propose that the inconsistency in the relationship between WFH and WLB may be due to unexplored moderators of this relationship. The work characteristic “job autonomy,” defined as the degrees of freedom in terms of time and content, is examined as one such possible moderator. We address the question of whether different types of negative spillover (strain-based and time-based spillover) from work to private life are dependent on an interaction effect between the use of WFH and job autonomy.

Method: Experienced occupational psychologists analyzed heterogeneous workplaces in an organization over a whole shift using a task-related instrument (TAG-MA: Tool for task analyses and job design in jobs with mental work requirements). The degrees of freedom in terms of content and time were assessed within this. Online questionnaires were used to measure WFH use, perceived job demands, and negative spillover from work to private life. Four moderator models were tested in a sample of 110 employees from various occupations.

Results: The results show that WFH is associated with a decrease in negative work-life spillover, especially when people have limited autonomy at work.

Discussion: The results are discussed and differentiated in more detail for the different types of spillover. The implications for health-promoting work design are derived.

KEYWORDS

remote work, working from home (WFH), job autonomy, content-related degrees of freedom, temporal degrees of freedom, work-life balance (WLB), negative spillover

1 Introduction

The shift to remote working during the pandemic has renewed interest in the question of whether increasing work flexibility, in particular working from home (WFH), improves or jeopardizes employees' work-life balance (WLB) and health. After all, WFH leads to a merging of generally separate domains of life and the roles of people within these domains. It is obvious that this can affect work-life balance. Specifically, the demands from different life domains can overlap. This can result in an intra-individual transmission of *time* (e.g., longer working hours can impair recovery processes, more housework can reduce work performance) and a transmission of *strain* (e.g., strenuous work activities reduce the energy for private activities),

as well as a transmission of domain-specific *behaviors* (e.g., incompatible role behavior at work and home) from one life domain to the other. The term *spillover* has been introduced for this purpose (Edwards and Rothbard, 2000; Bakker and Demerouti, 2013). While positive spillover of time, strain, or behavior improves WLB (Hill et al., 2001; Ferguson et al., 2012; Greenhaus et al., 2012), negative spillover impairs WLB and can lead to conflict (Syrek et al., 2013; Brough et al., 2014; Haar et al., 2019). In the literature to date, flexible work arrangements, in general, and working from home, in particular, have mostly been seen as a resource for balancing work and private demands (e.g., Gajendran and Harrison, 2007; Morganson et al., 2010; Nijp et al., 2012; Ter Hoeven and Van Zoonen, 2015). This assumption can initially be explained by the fact that when WFH, the physical distance between work and home (or domestic responsibilities) is eliminated, allowing individuals to save a significant amount of time. The time saved in this way increases temporal autonomy and planning flexibility. This applies equally to working and non-working domains, as well as the coordination of both. Increased temporal autonomy is also seen as a possible explanation for the finding that WFH is associated with increased sleep duration (Hazak et al., 2020; Staller and Randler, 2021). Improved sleep, in turn, is an important resource for coping with daily demands in all areas of life (Staller and Randler, 2021). However, some negative effects of WFH have also been reported. Indeed, there is some evidence that WFH leads to poorer WLB for those who are forced to work remotely but find it difficult to define boundaries between work and non-work (e.g., Allen et al., 2021). Furthermore, work-related satisfaction has been shown to decrease when remote workers do not perceive organizational support (defined as the extent to which the organization values their contributions and cares about their wellbeing; Bentley et al., 2016). Additionally, a lack of structure when WFH can promote an increase in work effort (Rupietta and Beckmann, 2016) and an extension of working hours (Wöhrmann et al., 2020; Backhaus et al., 2021) as well as a general intensification of work, increasing an imbalance in life domains (Shirmohammadi et al., 2022). According to the role scarcity hypothesis (Edwards and Rothbard, 2000; Barnett, 2014), it is assumed that people only have a limited amount of role resources (e.g., energy, time). Spillover can therefore always arise when different roles or life domains rely on the same resources. If there is an increased time overlap between the demands of work and private life when WFH, negative spillover effects can increase (Schuller and Rau, 2013).

The current state of research does not provide a clear answer as to whether WFH improves or worsens WLB. Simplified statements about the general impact of WFH on WLB should therefore be treated with caution. The question arises as to whether the influence of WFH on the occurrence of WLB is dependent on additional moderating influences and circumstances. Beigi et al. (2018) locate sources of moderating influences either within the person (e.g., preference for boundary management), in a situational context (e.g., career or family), or in the work itself (e.g., specific work characteristics). The focus of this study is to investigate possible moderating influences of work characteristics on the relationship between WFH and WLB.

If we first look at the research that deals with negative spillover effects from work to non-work, negative spillovers are mainly

found to occur as a result of poor working conditions. A large body of research shows that high job demands (such as long working hours, high work pressure) and a lack of control in the workplace have a strong association with high levels of negative work–life spillovers (Bakker et al., 2011; Ikeda et al., 2021), even in longitudinal studies (Demerouti et al., 2004; Butler et al., 2005; Oshio et al., 2017). According to the job demands/resources theory (Bakker and Demerouti, 2017), autonomy can act as a buffer against high demands. It facilitates wellbeing, reduces strain, and prevents the spillover of strain into other areas of life (see also the meta-analysis by Matei et al., 2021). However, high job autonomy does not only have a buffering function. Drawing on German action theory, Hacker and Sachse (2013) argue that job autonomy allows employees to choose appropriate strategies to deal with work situations and tasks, resulting in feedback and the learning of new competencies. For example, people with high autonomy at work are able to try out new ways of working and consequently learn new skills for problem-solving and work organization (Rau, 2006; Van Ruysseveldt and van Dijke, 2011). All these skills, in turn, also are prerequisites for the full use of autonomy in the workplace, in general (Hacker and Sachse, 2013), and remote working or WFH, specifically (Charalampous et al., 2019). In line with this, Dettmers and Bredehöft (2020) argue that employees in flexible work arrangements (e.g., WFH) should be equipped with self-organization skills in order to avoid impairments to wellbeing. However, the authors are more likely to envisage human resource development measures, while a high degree of autonomy at work allows these skills to be learned by doing.

Specifically, because of these two functions of job autonomy (buffering of job demands, learning/skill enhancement), the aim of this article is to examine the influence of job autonomy on the relationship between WFH and WLB. Following the German theory of action regulation (Hacker and Sachse, 2013) autonomy is defined as the degree of freedom in terms of content and time available to employees in the accomplishment of their work tasks (see also the next section for a detailed definition of the different degrees of freedom).

Overall, our research question is whether content-related or temporal degrees of freedom at work moderate the relationship between WFH use and perceived negative time-based and strain-based spillover from work to private life.

1.1 Degrees of freedom in terms of time (temporal df) and content (content df) and their relation to WFH and spillover effects from work to private life

Autonomy as a work characteristic can be described as the sum of different degrees of freedom (Hacker and Sachse, 2013). These can be roughly divided into degrees of freedom in terms of time (temporal df) and content (content df). The degree of temporal freedom refers to the discretion of employees to independently determine the temporal sequence of individual activity components or tasks, their duration, to decide on the pace of work and determine the temporal position of work performance within a

working shift (also called “work scheduling autonomy”) (Breugh, 1985; De Jonge et al., 1999; De Spiegelaere et al., 2016). An additional level of temporal degrees of freedom would be the flexibility of working hours (start, end, and timing). This aspect is particularly not included here in the definition of temporal degrees of freedom. The degree of freedom in terms of content refers to the discretion in the choice of work tools and work methods up to the possibility of developing one’s own working methods (also called “method autonomy”; see, e.g., Breugh, 1985; De Jonge et al., 1999; Morgeson and Humphrey, 2006). In its most comprehensive form, degrees of freedom in terms of content allow modifying or determining outcome characteristics or work goals (also called “criteria autonomy”; see, e.g., Breugh, 1985; De Jonge et al., 1999; Kubicek et al., 2014; Hacker, 2016). The range extends from jobs with no or limited degrees of content-related freedom, which provide stricter guidelines for task completion and leave employees less scope for their own mental input and control during work, to jobs that offer individuals to set and pursue their own work goals. In order for people to use their content-related degrees of freedom, they also need to have sufficient temporal degrees of freedom during work (Hacker and Sachse, 2013). The different degrees of freedom allow for a varying degree of self-determined and self-regulated task completion. Therefore, they are a basis for the development of an intrinsic motivation (Hackman and Oldham, 1976). In conjunction with feedback on the success of one’s own actions, a scope for action enables learning and the development of skills (Rau, 2006; Van Ruysseveldt and van Dijke, 2011). Degrees of freedom also allow employees to adapt their own way of working (content df) or at least its temporal process (temporal df) to their current mental and physical state. For example, if an activity is perceived as too strenuous or tiring or if concentration on an activity can no longer be maintained, employees with high job autonomy can cope with different strategies: They could choose an alternative way of working in a self-controlled manner, exchange their current activity for another work-relevant activity, or change their own level of ambition regarding the work performance or outcome. As a result of these changes, the individual’s psychological and physical resources required for work will vary. Consequently, resources that are no longer used can be restored (Meijman and Mulder, 1998; Geurts and Sonnentag, 2006; Zijlstra et al., 2014).

The question arises as to what role job autonomy plays in a possible relationship between WFH and WLB. Relatively little is known about the relationship between the temporal degrees of freedom at work and WLB. This type of temporal autonomy is usually tested as part of the overall autonomy (tested as job autonomy or job control) at work. A lack of job autonomy, including temporal autonomy, has been shown to strongly relate to negative spillover from work to private life (Aryee, 1992; Butler et al., 2005; Grzywacz and Butler, 2005; Schuller et al., 2012). One study that explicitly measures the level of job autonomy regarding work speed indicates that this type of autonomy is negatively correlated work–life conflict (Nordenmark et al., 2012). More common are studies that examine “temporal flexibility”, that is, flexibility in terms of working hours. Regarding temporal flexibility, it can be generally assumed that employees with high temporal degrees of freedom may find it easier to fragment their working hours and thus combine work, private commitments, and leisure time flexibly. Accordingly, there are studies that report greater

temporal flexibility can enhance WLB (e.g., Carnicer et al., 2004; Nijp et al., 2012; Tuttle and Garr, 2012; Wöhrmann, 2016). Allen et al. (2013), as well as Shockley and Allen (2007), even stress that the compatibility of demands in both work and private life depends more on flexibility in time than flexibility in place. Golden et al. (2006) further investigate the role of perceived temporal flexibility when WFH and find that WFH reduces work–family conflict at a slightly faster rate when people experience more temporal flexibility. To summarize the results of all the studies, both the degree of temporal freedom at work (process, pace, and duration of task components) and the flexibility of working hours and shifts are associated with a better WLB. We could expect a similar picture regarding the degrees of freedom in terms of *content*. If the work takes place at home (WFH), content-related degrees of freedom offer the opportunity to use this autonomy across life domains. Both the demands of domestic obligations and the opportunities for recreation in leisure time could be varied with the demands of work to suit one’s current mental and physical state or one’s current prioritization of a life domain. All in all, we assume that the temporal and content-related degrees of freedom at work differ in the way in which they enable the different spheres of life to be combined. When WFH, the temporal degree of freedom at work should allow the coordination and management of time that can be used for work, domestic tasks, or leisure. At best, good timing could create additional leisure time. More than temporal coordination should be possible with sufficient content-related degrees of freedom. The demands of work, domestic tasks, and leisure may be coordinated in terms of content. This could be done by choosing ways of working (for work, domestic tasks, and leisure activities) that require different levels of mental or physical effort and attention. We thus assume to find a direct effect of degrees of freedom on spillover effects, as previous research has reported (Nijp et al., 2012; Ikeda et al., 2021), and additionally a moderating influence of these degrees of freedom on the relation between the use of WFH and spillover effects. We state the following hypotheses:

Hypothesis 1.1: The more *temporal* degrees of freedom at work, the lower (a) the negative *time-based* spillover and (b) the negative *strain-based* spillover from work to private life.

Hypothesis 1.2: The relationship between the use of WFH (days WFH) and (a) the negative *time-based* spillover and (b) the negative *strain-based* spillover from work to private life is moderated by the temporal degrees of freedom at work.

Hypothesis 2.1: The higher *content-related* degrees of freedom at work, the lower (a) the negative *time-based* spillover and (b) the negative *strain-based* spillover from work to private life.

Hypothesis 2.2: The relationship between the use of WFH (days WFH) and (a) the negative *time-based* spillover and (b) the negative *strain-based* spillover from work to private life is moderated by the content-related degrees of freedom at work.

2 Method

2.1 Participants and procedure

The sample was drawn from a German company located in the municipal services sector in the areas of electricity, gas, water,

and transport. In this company, we conducted risk analyses for all workplaces based on German occupational health and safety law (Arbeitsschutzgesetz), which prescribes that every employer has to analyze workplaces for potential health risks/strain according to mental load. In the first step, the company's workplaces were grouped according to their similarity in terms of job content and context. This grouping was based on a document analysis (job descriptions and organizational charts) and then revised and confirmed by the company's human resource department and managers. In the second step, four professional work psychologists visited the participants at their workplaces to conduct a job analysis. Additionally, all job holders were asked to fill out two questionnaires on (1) their perception of work characteristics, WFH use (days WFH) and socio-demographics and (2) their perception of WLB and wellbeing. These questionnaires were administered separately in time to avoid possible common method bias. Participation in the questionnaires was voluntary. All participants were informed about the study (before both the objective work analyses and the questionnaires) and gave their written consent to participate in the research. In addition, a written declaration of consent for the publication of the data was obtained from each person. Data from the objective measure (objective work analyses) and the subjective measures (online questionnaires) could be linked through encrypted coding. After combining data sources, complete data sets were available for a total number of 110 employees. Of these employees, 32.7% stated they were female, 67.3% male, and none diverse. Employees were between 22 and 65 years old ($M = 48.46$, $SD = 9.92$). Within the sample, there was a wide range of hierarchical positions and an equally wide range of job complexity (from simple tasks to highly complex tasks). Of the 110 employees, 40 were in a supervisory position, a category that includes very different management levels. There was a high range regarding the time spent commuting to work, with a minimum of 1 min and a maximum of 60 min per way ($M = 17.12$, $SD = 9.59$). WFH use varied between 0 and 5 days per week. The average use of people working from home was 1.85 days per week.

2.2 Measures

2.2.1 WFH use (days WFH)

WFH use was measured with an online questionnaire, using two items. First, employees were asked whether they have worked remotely (at home) during the last 4 weeks (dichotomous answer: yes/no). If they answered yes, they were additionally asked how many days they worked from home during this time. A continuous variable (WFH days per week) was calculated based on these items. If people answered no to the first question, their answer was coded as "zero days".

2.2.2 Autonomy/degrees of freedom in terms of content and time

In keeping Spector's (1992, 2006) requirement that work characteristics should be rated independently of job incumbents' autonomy was measured by experts of job analysis (work psychologists) by using the Tool for Task Analyses and Job Design

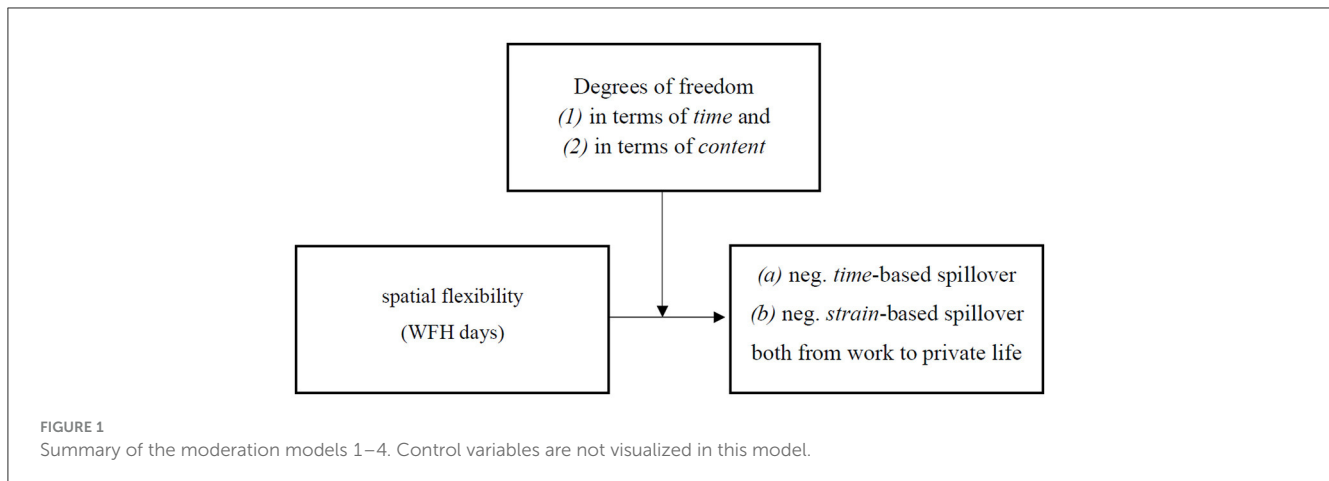
in jobs with Mental Work Requirement (TAG-MA: [Rau et al., 2021](#)). The TAG-MA counts as an objective method because it provides a standard protocol for experts to rate work characteristics independent of employees' perceptions. The analysts observe workplaces and conditions over a whole working day evaluating different work characteristics on anchored rating scales of the TAG-MA instrument. In particular, *degrees of freedom in terms of time* were measured by the TAG-MA scale Temporal Degrees of Freedom (A7.1). This scale contains five verbally anchored levels, describing different types of temporal bindings at work. *Degrees of freedom in terms of content* was measured by the two TAG-MA scales Procedural Degrees of Freedom (A7.2) and Decision-Making (A7.3). Both scales contain five verbally anchored levels. The means of the two scales were added for a total value. The assessment of work characteristics took place at the regular workplace. The raters were trained in advance in the use of the TAG-MA instrument. Admission to the rating in the field was only granted if two raters achieved the same results in four trial counseling sessions during the training. The overall interrater reliability for trained experts of the TAG-MA is Cohen's $\kappa = 0.89$ ($p < 0.000$; [Rau et al., 2021](#)). Hence, for trained experts (applicable to the raters in this study), there is almost complete agreement on the judgement ([Wirtz and Caspar, 2002](#)).

2.2.3 Negative spillover from work to private life

WLB was subjectively assessed (online questionnaire) with two scales of the German "Questionnaire on spillover from work to time for obligatory duties and for leisure" (B-AOF by [Schuller and Rau, 2013](#)), measuring two different facets of negative spillover from work to private life. In particular, one scale measures negative *time*-based spillover with four items (e.g., "Because my work schedule is not predictable, I often have difficulties fulfilling my private obligations") and a second scale measures negative *strain*-based spillover, also with four items (e.g., "After I have done my work and fulfilled my private obligations I do not have the energy to enjoy my leisure time"). Answers are rated on a 5-point Likert scale from 1, (*almost*) *never*, to 5, (*almost*) *always*. According to a previous study, the internal consistency of both scales is high, and reliability, validity and economy are given ([Schuller and Rau, 2013](#)).

2.2.4 Control variables

We decided to include several control variables in the analysis. First, we added *perceived work intensity* (workload) as a control variable because previous findings such as [Schuller et al. \(2012\)](#) showed that work intensity is highly related to both negative time-based and strain-based spillover. *Perceived work intensity* was assessed using five items from the German questionnaire "Perceived work intensity and job control - FIT" by [Richter et al. \(2000\)](#). Similarly, we included *extended work availability for work tasks* as a covariate as there is evidence that employees who have to be available for work demands after regular working hours experience higher work-life conflict ([Dettmers, 2017](#)). Extended work availability was objectively measured by the TAG-MA scale A.9, which contains eight verbally anchored levels (see the earlier description of TAG-MA). Third, *age and gender* (1 = female, 2 = male, 3 = diverse) were added as person-related covariates. There



are mixed findings on the role of gender and age influencing the perception of WLB, respectively, conflict (see, e.g., [Walia, 2015](#); [Richert-Kazmierska and Stankiewicz, 2016](#); [Pace and Sciotto, 2022](#)). However, a relatively high average age in our sample as well as an unbalanced gender ratio raised concerns that potential sampling effects would bias the analysis. Finally, *commuting time* (minutes) was assessed as long commutes (as well as avoiding long commutes when WFH) could have an impact on how much people experience spillover effects or conflict ([Allen et al., 2021](#); [Baek et al., 2023](#)). Age, gender, and commuting time were all self-rated by the employees via the first online questionnaire. Further information on the psychometric quality of the tests and instruments used in this study can be found in the digital appendix ([Supplementary Table 1](#)).

2.3 Statistical analyses

Four separate moderation analyses were conducted with IBM SPSS Statistics 25 using the PROCESS macro by [Hayes \(2018\)](#). The PROCESS macro uses ordinary least squares regression, yielding unstandardized coefficients for all effects. Bootstrapping with 5,000 samples was used together with heteroscedasticity-consistent standard errors, HC3 ([Davidson and MacKinnon, 1993](#)), to calculate the confidence intervals. In all analyses, *WFH use* (days WFH) was added as the independent variable as well as *age*, *gender*, *commuting time*, *perceived job intensity*, and *extended availability* as control variables. When using the PROCESS macro, the covariates are tested in an overall model with the independent variable and the moderator (simultaneous testing of the effects). In the first two analyses, *temporal df* was added as the moderator. The criterion in analysis 1 was *negative time-based spillover*; in analysis 2, it was *negative strain-based spillover*. In the other two moderation analyses, *content df* was added as the moderator. Again, we added *negative time-based spillover* as the dependent variable in model 3 and *negative strain-based spillover* as the criterion in model 4. [Figure 1](#) shows an overview of the four moderation models. We conducted *post-hoc* power analyses for each of these interaction models using G*Power calculator ([Faul et al., 2009](#)). In order to better understand the potential influence of the control variables in the model, all models were also recalculated without covariates.

However, the following results mainly refer to the analyses with control variables.

3 Results

3.1 Descriptive statistics

Means, standard deviations, and correlations of all variables used in the study are shown in [Table 1](#). As assessed by visual inspection of scatterplots after LOESS smoothing, the relationships of all variables involved in the four moderation analyses were approximately linear.

3.2 Influence of temporal degrees of freedom and interaction with WFH

First, two moderation analyses were run to determine whether temporal degrees of freedom (main effect) as well as the interaction between temporal degrees of freedom and WFH use significantly predict negative time-based and negative strain-based spillover from work to private life (in reference to hypotheses 1.1a and 1.1b as well as 1.2a and 1.2b). [Table 2](#) displays the relevant model coefficients of both analyses. The overall model with negative *time-based spillover* as the dependent variable was significant, $F_{(8,101)} = 8.166, p > 0.001$, predicting 34.68% of the variance. As visible in [Table 2](#), we found a significant negative effect of temporal degrees of freedom on negative time-based spillover and found that temporal degrees of freedom moderated the effect between WFH use and negative time-based spillover from work to private life significantly, $\Delta R^2 = 7.48\%$, $F_{(1,101)} = 16.331, p < 0.001$, 95% CI (0.100, 0.327). According to the Johnson–Neyman interval, WFH use reduced negative time-based spillover at the moderator value smaller than 3.618 ($p < 0.05$). At higher moderator values, the conditional effect was insignificant. We found a marginally significant inverse interaction effect with the highest possible value of the moderator variable (temporal $df = 5.000, p < 0.10$). [Figure 2](#) visualizes the conditional effect of WFH use on negative time-based spillover. Also, the covariate *perceived job intensity* occurred as a significant predictor in the model (see [Table 2](#)). The

TABLE 1 Means, standard deviations, and correlations of all variables including control variables (N = 110).

| | M | SD | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|-------|-------|---|----------|--------|----------|----------|---------|----------|---------|----------|----------|----------|
| 1. Neg. time-based spillover | 2.25 | 0.81 | 1 | 0.646*** | -0.102 | -0.244** | -0.023 | -0.219* | 0.359*** | -0.084 | 0.008 | 0.063 | 0.010 |
| 2. Neg. strain-based spillover | 2.32 | 0.86 | | 1 | -0.047 | -0.142 | 0.069 | -0.226* | 0.397*** | 0.047 | -0.042 | 0.054 | 0.102 |
| 3. WFH use | 0.86 | 1.22 | | | 1 | 0.189* | 0.071 | 0.192* | 0.091 | -0.198* | -0.086 | 0.318*** | 0.015 |
| 4. Temporal degrees of freedom | 3.66 | 0.87 | | | | 1 | 0.577*** | 0.244* | 0.134 | 0.035 | 0.107 | 0.053 | 0.188* |
| 5. Content-related degrees of freedom | 3.91 | 0.68 | | | | | 1 | -0.124 | 0.403*** | 0.040 | 0.416*** | -0.007 | 0.574*** |
| 6. Extended availability ^a | 7.25 | 1.69 | | | | | | 1 | -0.038 | 0.118 | -0.219* | 0.045 | -0.079 |
| 7. Perceived job intensity | 2.75 | 0.74 | | | | | | | 1 | 0.098 | 0.276** | 0.098 | 0.463*** |
| 8. Age | 48.46 | 9.92 | | | | | | | | 1 | -0.048 | 0.051 | 0.208* |
| 9. Gender | 1.67 | 0.47 | | | | | | | | | 1 | -0.140 | 0.326*** |
| 10. Commuting time (minutes) | 17.12 | 9.59 | | | | | | | | | | 1 | 0.062 |
| 11. Hierarchical position ^b (supervisor 1 = no; 2 = yes) | 1.364 | 0.483 | | | | | | | | | | | 1 |

Neg., negative; WFH, working from home.

^aCounterintuitive scale polarity: the higher the scale value, the better the work design (less risk for extended availability).

^bHierarchical position was reported to describe the sample but was not included as a control variable in the analyses.

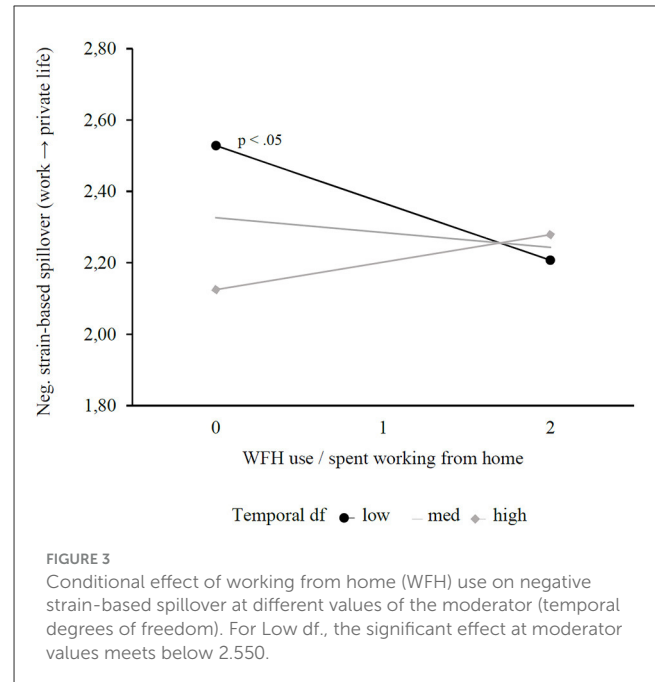
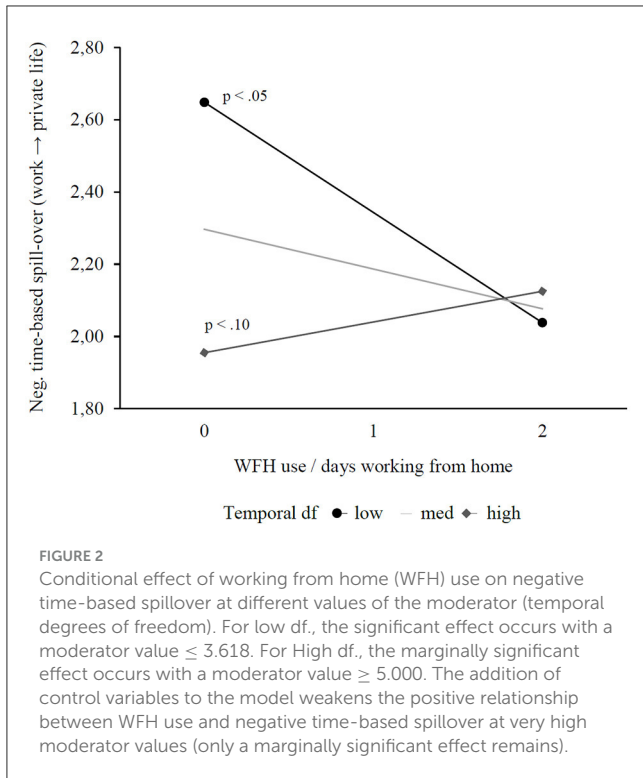
*p < 0.05. **p < 0.01. ***p < 0.001.

TABLE 2 Bootstrap model coefficients (with 95% confidence intervals), model parameters and Johnson-Neyman statistics of moderation analyses 1 and 2 with vs. without covariates (moderator: temporal related df).

| | Moderation Analysis 1 | | Moderation Analysis 2 | |
|--|--------------------------------|------------------------------|----------------------------------|----------------------------|
| | Neg. time-based spillover (Y1) | | Neg. strain-based spillover (Y2) | |
| | Without covariates | With covariates | Without covariates | With covariates |
| WFH use (X) | -0.982*** (-1.425 to -0.343) | -0.881*** (-1.324 to -0.425) | -0.659* (-1.131 to 0.051) | -0.519* (-0.966 to 0.033) |
| Temporal degrees of freedom (W1) | -0.397*** (-0.607 to -0.190) | -0.380*** (-0.592 to -0.181) | -0.254* (-0.469 to -0.037) | -0.223* (-0.431 to -0.019) |
| Interaction | 0.251*** (0.097 to 0.368) | 0.212*** (0.100 to 0.237) | 0.169* (0.001 to 0.289) | 0.131* (0.002 to 0.248) |
| Extended availability ^a | | -0.051 (-0.139 to 0.052) | | -0.102* (-0.187 to -0.010) |
| Perceived job intensity | | 0.456*** (0.278 to 0.630) | | 0.525*** (0.310 to 0.740) |
| Age | | -0.009 (-0.022 to 0.002) | | 0.002 (-0.012 to 0.017) |
| Gender | | -0.204 (-0.473 to 0.054) | | -0.369* (-0.694 to -0.056) |
| Commuting time (minutes) | | 0.003 (-0.012 to 0.016) | | -0.001 (-0.018 to 0.017) |
| F | 6.443*** | 8.166*** | 2.244 | 6.435*** |
| R ² | 0.170 | 0.347 | 0.063 | 0.288 |
| F (X*W2) | 16.190*** | 16.331*** | 5.460* | 4.885* |
| ΔR ² (X*W2) | 0.109 | 0.075 | 0.043 | 0.025 |
| W1-values defining Johnson-Neyman interval | 3.491 4.479 | 3.618 | 2.567 | 2.551 |

^aCounterintuitive scale polarity: The higher the scale value, the less risk for extended availability.

*p < 0.05; ***p < 0.001.



3.3 Influence of content-related degrees of freedom and interaction with WFH

second overall model with negative *strain*-based spillover as the dependent variable was significant as well, $F_{(8,101)} = 6.435, p < 0.001$, predicting 28.76% of the variance. We found a significant negative main effect of temporal degrees of freedom on negative strain-based spillover (see Table 2). The results further show that temporal degrees of freedom moderated the effect between WFH use and negative *strain*-based spillover from work to private life, $\Delta R^2 = 2.52\%$, $F_{(1,101)} = 4.885, p = 0.029$, 95% CI (0.002, 0.248). There was a significant negative influence of WFH use on negative strain-based spillover at moderator values smaller than 2.55 ($p < 0.05$). At all higher moderator values, the influence was insignificant. The conditional effect of WFH use on negative strain-based spillover is visualized in Figure 3. Of all covariates, perceived job intensity, extended availability and gender occurred as additional significant model predictors (see Table 2). The *post-hoc* power analyses showed high statistical power ($1 - \beta = 0.907$) for the first moderation model (prediction of negative time-based spillover) but little power ($1 - \beta = 0.514$) for the second moderation model (prediction of negative strain-based spillover; Faul et al., 2007). There were two notable differences in results between the analyses with vs. without covariates (for further information, see Table 2). First, both simple moderation models (without covariates) naturally predicted less variance than the models with covariates. This led to the fact that the overall model predicting negative strain-based spillover was not significant anymore, although the interaction effect still was ($p < 0.05$). Second, the positive association between WFH use and negative time-based spillover at very high moderator values was still significant ($p < 0.05$; see also W1 value defining the Johnson–Neyman interval in Table 2).

Another two moderation analyses were run to determine whether content-related degrees of freedom (main effect) as well as the interaction between content degrees of freedom and WFH use significantly predict negative time-based and strain-based spillover from work to private life (in reference to hypotheses 2.1a and 2.1b, as well as 2.2a and 2.2b). All relevant model coefficients can be found in Table 3. The overall model with negative time-based spillover as the outcome was significant, $F_{(8,101)} = 8.080, p < 0.001$, predicting 30.91% of the variance. Results show a significant negative influence of content-related degrees of freedom on negative time-based spillover from work to private life (see Table 3). Furthermore, content-related degrees of freedom moderated the effect between WFH use and negative time-based spillover from work to private life, $\Delta R^2 = 5.99\%$, $F_{(1,101)} = 14.535, p < 0.001$, 95% CI (0.118, 0.386). According to the Johnson–Neyman interval, WFH use reduced negative time-based spillover at moderator values smaller than 3.625 ($p < 0.05$). At all higher moderator values, the influence of WFH use on time-based spillover became insignificant. However, we again found a marginally significant reversed effect (positive association between WFH use and negative time-based spillover) at moderator values above 4.863 ($p > 0.10$). A visualization of the conditional effect of WFH use on negative time-based spillover is shown in Figure 4. Furthermore, the covariates *extended availability* and *perceived job intensity* occurred as additional significant predictors in the model (see also Table 3). The overall model of the last moderation analysis with negative *strain*-based spillover as the dependent variable was also significant $F_{(8,101)} = 5.172, p > 0.001$. Yet, neither the direct effect of content-related degrees of freedom nor the interaction effect was significant, showing that content-related degrees of

TABLE 3 Bootstrap model coefficients (with 95% confidence intervals), model parameters and Johnson-Neyman statistics of moderation analyses 3 and 4 with vs. without covariates.

| | Moderation Analysis 3 | | Moderation Analysis 4 | |
|---|--------------------------------|------------------------------|----------------------------------|-----------------------------|
| | Neg. time-based spillover (Y1) | | Neg. strain-based spillover (Y2) | |
| | Without covariates | With covariates | Without covariates | With covariates |
| WFH use (X) | -1.033** (-1.770 to -0.584) | -0.970*** (-1.590 to -0.539) | -0.620 (-1.529 to -0.106) | -0.512 (-1.199 to 0.012) |
| Content-related degrees of freedom (W2) | -0.211 (-0.483 to 0.025) | -0.420** (-0.719 to -0.155) | -0.028 (-0.294 to 0.212) | -0.193 (-0.488 to 0.067) |
| Interaction | 0.257** (0.133 to 0.436) | 0.234*** (0.188 to 0.386) | 0.153* (0.010-0.381) | 0.127 (-0.014 to 0.308) |
| Extended availability ^a | | -0.104 (-0.190 to 0.011) | | -0.132** (-0.206 to -0.041) |
| Perceived job intensity | | 0.494*** (0.300 to 0.685) | | 0.537*** (0.331 to 0.756) |
| Age | | 0.010 (-0.023 to 0.003) | | 0.002 (-0.013 to 0.016) |
| Gender | | -0.153 (-0.462 to 0.150) | | -0.360 (-0.711 to -0.017) |
| Commuting time (minutes) | | 0.002 (-0.012 to 0.017) | | -0.001 (-0.018 to 0.017) |
| F | 3.924* | 8.080*** | 0.983 | 5.172*** |
| R ² | 0.083 | 0.309 | 0.032 | 0.268 |
| F (X*W2) | 10.878** | 14.535*** | 2.301 | 2.802 |
| ΔR ² (X*W2) | 0.075 | 0.060 | 0.023 | 0.016 |
| W2-value defining Johnson-Neyman Interval | 3.595-4.613 | 3.625 | - | - |

^aCounterintuitive scale polarity: The higher the scale value, the less risk for extended availability.
*p < 0.05; **p < 0.01; ***p < 0.001.

freedom did neither directly predict negative strain-based spillover or moderate the effect between WFH use and negative *strain*-based spillover from work to private life, ΔR² = 1.75%, F_(1,101) = 2.802, p = 0.097, 95% CI (-0.014, 0.308). Only the two covariates *extended availability* as well as *perceived job intensity* showed a significant predictive value (Table 3). Again, the *post-hoc* power analyses showed sufficient statistical power (1 - β = 0.839) for the third moderation model (prediction of time-based spillover) but little power (1 - β = 0.372) for the fourth moderation model (prediction of strain-based spillover; Faul et al., 2007). Similar differences were found between the models with vs. without covariates, as in the first two analyses: The analyses without covariates predicted less variance, again leading to the fact that the overall model predicting negative strain-based spillover was not significant anymore. Also, the positive association between WFH use and negative time-based spillover at very high moderator values was still significant (p < 0.05; see also W2 value defining the Johnson-Neyman interval in Table 3).

4 Discussion

4.1 Discussion of results

As predicted, degrees of freedom in terms of both time and content predict negative spillover and moderate the influence of WFH use on negative spillover from work to private life. Negative *time*-based spillover is predicted by both types of autonomy (confirming hypotheses 1.1a and 2.1a), as well as their interaction with WFH use (confirming hypotheses 1.2a and

2.2a). Both models show sufficient to high power. The effect of WFH use on negative *strain*-based spillover, by comparison, is only predicted by temporal degrees of freedom but not content-related degrees of freedom (acceptance of hypothesis 1.1b but rejection of hypothesis 2.1b). We also only find an interaction effect of WFH use with temporal degrees of freedom (acceptance of hypothesis 1.2b) but not with content-related degrees of freedom (rejection of hypothesis 2.2b). However, there is no sufficient power for either of these two moderation models. Several conclusions can be drawn from these results.

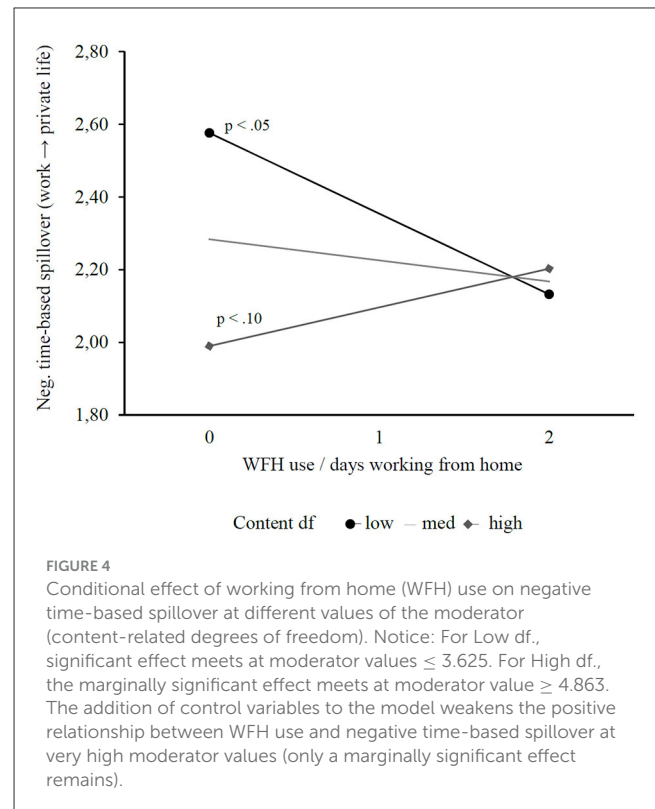
4.1.1 Autonomy and spillover (main effects)

In our study, we find that both temporal and content-related degrees of freedom are directly negatively related to negative time-based spillover. To put it simply, increasing autonomy is associated with a reduction in negative time-based spillover. On an empirical level, these results go in line with a large number of existing findings on the relationship between autonomy and WLB (e.g., Aryee, 1992; Butler et al., 2005; Grzywacz and Butler, 2005; Schuller et al., 2012). Thus, there is repeated confirmation that employees with sufficient or high autonomy at work generally seem to have better opportunities to reconcile life domains. Nevertheless, the differentiated consideration of different degrees of freedom and different types of negative spillover has added value: Contrary to expectations, we find that a negative *strain*-based spillover is only related to degrees of freedom in terms of time but not in terms of content. This finding emphasizes that scheduling options for

tasks within the working day (regarding the temporal sequence of individual activities and tasks, their duration, the pace of work, etc.) is important for balancing work and private life. So far, temporal flexibility as a whole (beginning/ending work hours) has been analyzed and rated as important when it comes to balancing work and private life (Shockley and Allen, 2007; Allen et al., 2013). Our results now provide a more precise understanding of the importance of temporal flexibility by also considering temporal degrees of freedom within the working day. Overall, based on our findings, it could be argued that temporal degrees of freedom may even be more important than content-related degrees of freedom in ensuring that no strain is transferred from work to private life. Also, when looking at the influence of other work characteristics in the model as well as a comparison of effects in the analyses with vs. without covariates, the results suggest that negative strain-based spillover is overall more strongly associated with work intensity and extended availability for work demands than with content-related autonomy (see also Schuller et al., 2012; Dettmers, 2017). However, further confirmation of these findings is needed. On a theoretical level, our findings represent both a confirmation and, to a certain extent, an extension of Bakker and Demerouti (2013) spillover–crossover model. Regarding job autonomy, the authors primarily assume that autonomy promotes positive spillover. The direct influence found in this study now further shows that autonomy is also associated with a direct reduction of negative spillover (especially time-based spillover). All in all, these results support the idea that degrees of freedom in terms of time and content as modifiable work characteristics of job autonomy not only buffer negative aspects of work but also stand for themselves as a central work characteristic that prevent spillover.

4.1.2 WFH and spillover: a question of autonomy (interaction effects)

When closer looking at the moderating effect of temporal degrees of freedom we find a significant negative association between WFH use and negative time-based spillover once people have limited temporal degrees of freedom. Specifically, this is the case when people can only plan their tasks within a few hours or, at most, until the end of the working day (values lower than 3.62). In contrast, at very high degrees of temporal freedom (temporal df = 5) that allow scheduling tasks over several days or even weeks, there is a marginally significant positive association between WFH use and negative time-based spillover. We find a similar picture with content-related degrees of freedom. A negative relationship between WFH use and negative time-based spillover occurs when the content-related degrees of freedom are limited to the discretion of the sequence of processing steps and planning within subtasks (value level below 3.63). We again find a contrary trend (marginally significant positive association between WFH and negative time-based spillover) at very high levels of content-related autonomy (if content df \geq 4.863). Such a high degree of content-related freedom allows employees to choose between existing working methods, develop their own working methods and, at the highest level, even modify or set work goals. In a nutshell, these findings show the following trend: While WFH is associated with a decrease



in negative time-based spillover when people have lower levels of job autonomy, it is associated with an increase in negative time-based spillover when people have very high levels of job autonomy. These results may seem surprising at first glance. Nevertheless, there are reasonable explanations for both of these contrasting effects. We first take a closer look at the finding that WFH only goes in line with a decrease of negative time-based spillover at lower levels of autonomy (significant effect). This association suggests that people who work in jobs with limited autonomy may actually benefit more from WFH than people who already have high or the highest degrees of autonomy in their jobs. Some of the advantages associated with WFH (e.g., the time saved on commuting as well as the reduced physical distance between life domains) may especially make a difference in managing daily demands when people otherwise have little work-related flexibility. In general, it would be conceivable that the reduced distance between work and non-work domains when working from home increases the usability of autonomy in favor of obligatory duties (see also Nijp et al., 2012). This increase in autonomy utility when WFH could be particularly important for individuals who otherwise have few degrees of freedom at work: Having high time commitments and strict guidelines on how to work (little autonomy) does usually not allow people to take care of any private demand within working hours, especially when working in the office/organization. When working at home, however, the coexistence of life domains allows these workers to use the little freedom they have to at least address some of their private obligations (e.g., starting the washing machine during a short break), ideally giving them more time to recover after work. In contrast, adequate levels of autonomy may enable people

to cope with private demands even without workplace flexibility (Baltes et al., 1999). The influence of WFH on the experience of spillover is therefore likely to be less salient for workers who already have sufficient autonomy at work.

The opposite trend (positive relationship between WFH use and negative time-based spillover at very high levels of autonomy) is only marginally significant in both models, which is why this association would generally not be discussed in more detail. However, if the control variables are removed from the prediction models, this positive association becomes significant. We assume that the positive association between WFH use and negative time-based spillover in jobs with high levels of autonomy may be due to a change in the utilization of work-related degrees of freedom when working from home. Very high degrees of freedom in terms of content and time occur in professions with very complex cognitive demands, especially knowledge work (Pyöriä, 2005; Rau and Hoppe, 2020). In the case of knowledge work, it is often difficult for managers and employees themselves to accurately estimate the time required for the work, as the tasks themselves often contain components of uncertainty. This problem is known as the so-called planning fallacy (e.g., Lovallo and Kahneman, 2003). As a result, the time allocated is often too short to complete the tasks within normal working hours. Because an urgent work task is often considered more important than the fulfillment of private life tasks, it is easy to “misuse” existing autonomy in order to finish a work task and work overtime (Mazmanian et al., 2013). This “paradox of autonomy” was reported as a result in different studies according to remote work or work with extended availability for work tasks (Rau and Göllner, 2019; Kost et al., 2023). Such misuse of work autonomy in the sense of extended availability for work demands may consequently be accompanied by higher conflicts between work and family and exhaustion (Golden, 2012; Dettmers, 2017; Beermann et al., 2018). The homes of employees could thereby provide a work context in which an expansion or fragmentation of working hours is more likely to occur (see also Golden, 2012). In addition, remote workers with high levels of autonomy may show greater motivation and commitment (Golden et al., 2006) as well as higher work effort (Chesley, 2010; Rupiëta and Beckmann, 2016), for example, to compensate for the disadvantages of reduced visibility of their work performance (Sewell and Taskin, 2015; Cristea and Leonardi, 2019). Finally, at a very high level of autonomy, employees are responsible for setting their own work goals, going along with the need for well-thought-out work scheduling (Schweden, 2018). When WFH, there are often additional requirements for self-structuring and communication with others, which may lead to increased time expenditure (Kubicek et al., 2014, 2022; Van der Lippe and Lippényi, 2020). The distance to superiors may thereby state a risk that additional requirements are not perceived and consequently not planned for, resulting in an even higher workload and poorer WLB.

Finally, a last interaction effect that needs further discussion is that negative *strain*-based spillover from work to private life is moderated by time-related but not content-related degrees of freedom. Again, we find the tendency that WFH only reduces negative strain-based spillover, if people have very limited temporal degrees of freedom (values lower than 2.6, representing jobs where

the time margin for task planning is rarely more than a few hours). In other words, only people who work in jobs with very tight temporal bindings may benefit from WFH in a way that strain-based spillover decreases. Here again, we found no effect of WFH once people had higher time-related autonomy. An explanation for this finding requires a closer look at the typical characteristics of professions with little planning autonomy. Tight time constraints that ask for an immediate or prompt completion of tasks often arise from a partialized division of labor (Hacker and Sachse, 2013) or from work in direct (face-to-face) or indirect contact (via indirect contact via information and communication technology) with customers (Richter et al., 2014). Many of these occupations (e.g., call center agents) are carried out in shared spaces (e.g., open-plan offices) with unfavorable environmental factors such as high noise levels or poor air conditions (Kaarlela-Tuomaala et al., 2009; Jahncke et al., 2011; Sander et al., 2021). For these people, WFH may reduce strain simply because it is often easier for people to adapt the working environment in their own homes to their individual needs (Xiao et al., 2021).

4.2 Theoretical implication

All in all, we found that job autonomy is not only a predictor of employees' experience of negative spillover but also a specific moderator of how WFH influences negative spillover, respectively, on the WLB experience. We see several theoretical implications. First, our findings indicate that WFH should not *per se* be judged as good or bad for people's WLB. We show that work characteristics, and in particular facets of autonomy, are important factors influencing the relationship between WFH and WLB. In further studies on the influences of WFH on health and wellbeing, it is therefore advisable to take more account of work design/specific work characteristics as potential moderators. Likewise, the moderating influence of autonomy should be considered in theoretical models of the influence of spatial flexibility/WFH on WLB (e.g., extending models such as the Boundary Management Tactics model by Kreiner et al., 2009, by including the influence of central work characteristics). Second, our results imply that autonomy is a central designable work characteristic that entails more than a buffering function for people's wellbeing (as described in the Job Demand-Resource Model by Bakker and Demerouti, 2017). Our results underline that job autonomy is a direct influencing factor that is directly associated with a reduction in spillover effects (main effect). Nevertheless, we discuss that it may be important for future research to focus more on other work characteristics that are often “comorbid” in jobs with a very high degree of autonomy (in particular characteristics such as too little time for tasks with high complexity or high work intensity). Third, our findings suggest that it may be important to consider different facets of autonomy in order to explain differential effects on spillover or other health variables in the WFH context. Based on the considerations of Nijp et al. (2012), it would make sense to take an even closer look at the exact form of autonomy *utilization* (e.g., use of temporal degrees of freedom for work vs. break organization). Differences in access to autonomy (as

objectively assessed in this study) and the desire or utilization of this autonomy by employees could also be examined in more detail (Nijp et al., 2015).

4.3 Practical implication

As far as WLB is concerned, our results indicate that people with little professional autonomy may benefit most from WFH. Consequently, people with little autonomy in particular should be given the opportunity to WFH whenever possible. In this way, companies would support people in their life management and presumably prevent health impairments due to negative spillover effects in the long term. All in all, one could discuss that workplace flexibility compensates for a lack of other autonomy to a certain point and may therefore even be seen as an additional form of autonomy (see also De Spiegelaere et al., 2016). However, because low autonomy (regarding both time and content) still is a potential hazard to mental health (Rau and Buyken, 2015), workplace flexibility should not only be used as a substitute. Rather, the introduction of workplace flexibility should go hand in hand with ensuring sufficient degrees of freedom in terms of content and time as these types of autonomy still generally provide one of the most important resources in occupational health (e.g., Karasek, 1990; Schmidt and Hollmann, 2004; Bergmann et al., 2007; Gajendran and Harrison, 2007; Niebuhr et al., 2022). Nevertheless, our results should also draw attention to the fact that a very high degree of autonomy in combination with spatial flexibility may be accompanied by an increased risk of time-based spillover from work to private life. Still, this does not necessarily mean that people with high autonomy should no longer work remotely or that autonomy itself is harmful. Rather, it would be advisable to create organizational structures that do not restrict people in their autonomy but prevent additional demands. Above all, structures should be created that prevent an extension of working hours and availability. This could include working time regulations that protect against the dissolution of boundaries, for example, avoiding trust-based working time (Janke et al., 2014) or warnings in case of overtime. Individual solutions should be preferred to standard solutions (Roberts, 2007). Most important, however, would be the preventive avoidance of excessive work intensity through good work design (Rau and Göllner, 2019). First, realistic time margins for the completion of tasks should be developed as well as constantly reviewed and adjusted (Rau and Hoppe, 2020). As already explained, this is particularly important, but also equally challenging, in professions with very complex work tasks (knowledge work). Also, it seems important to allow enough time for the additional planning and coordination effort during remote work (Kubicek et al., 2014, 2022). Companies should thereby consider which work tasks are more and which are less suitable for WFH, for example, less cooperative work due to the increased time required (Van der Lippe and Lippényi, 2020). Supervisors should be included in this process. In general, the preservation of autonomy should not be misunderstood as a lack of supervision: Managers should maintain contact with their staff despite the physical distance (Lautsch et al., 2009). In order to reduce spillover effects, this contact should primarily

serve the exchange of information as well as the promotion of work design and border compliance rather than monitoring and control (Lautsch et al., 2009). Additionally, workers in flexible work arrangements need to acquire the ability to plan and structure the demands of their work and private lives (see also Dettmers and Clauß, 2018). For example, it is known that special training on boundary management is likely to prevent health impairments and improve WLB to a certain extent (Peters et al., 2014; Gisin et al., 2016). This seems to be important not only for people with high degrees of freedom but also for people with low degrees of freedom, as they are less able to learn such skills based on their degrees of freedom at work. Above all, however, companies remain responsible for designing work in such a way that negative effects and other work-related impairments are avoided. In this way, as in the regular workplace, high levels of autonomy will remain conducive to wellbeing, health and WLB even when working remotely (see also Wieland, 1999; Kossek et al., 2006; Gajendran and Harrison, 2007; Beermann et al., 2019; Meyer et al., 2021; Becker et al., 2022).

4.4 Strengths, limitations, and future research

By using a multi-method research design and a differentiated objective measurement of autonomy, we contribute to a deeper understanding of the interaction effects of WFH on work-life management. With our approach, we overcome an often mentioned limitation as we rule out the risk of common method bias and self-report bias (Spector, 1992, 2006). We thereby show that using objective measurement methods in occupational health research contributes to a better understanding of the connections between work and strain, which is why it should be practiced more often in future research. In general, this is one of only a few studies to date that consider time planning options *during* the working day (temporal df) as an influencing factor on WLB (other studies often refer more to job autonomy as an overall construct or time flexibility regarding the start and end of working hours). We further show that strain-based spillover need not be influenced by the same work characteristics as time-based spillover. Our results therefore provide a differentiated picture of how work characteristics should be taken into account when designing flexible work arrangements. However, there are also several limitations in our study. A first and central limitation of the study can be found in the cross-sectional design. Specifically, we examine the moderating influence of work characteristics on the connection between WFH use and spillover experience at a fixed point in time. This approach offers information about relevant factors influencing WLB experience in the context of remote working, but no reliable statements can be made as to whether this influence will also be evident in the long term. Also, from a purely statistical point of view, a reverse causation of the effects could have occurred. This mainly concerns the association between WFH and spillover. However, the main effect of autonomy on spillover should not be affected due to the multimethod approach described earlier. A second limitation concerns the sample size. Due to the comparatively high time expenditure of objective analyses, as well as the need for

data linking, the sample is smaller than in most other studies. A smaller sample size deriving from only one company could affect the validity and power of the results. Sampling effects cannot be completely ruled out. We found sufficient statistical power for both models predicting time-based spillover but not for the models predicting strain-based spillover. Regarding the prediction of strain-based spillover, the results and interpretations therefore have to be treated with caution. At this point, it is important to note that *post-hoc* power analyses generally need to be examined critically and do not always reflect the true power of the analysis (Zhang et al., 2019). Furthermore, we decided to include several covariates in our models, as we considered them important in light of the existing literature and some of the particularities of our sample. Nevertheless, the integration of many covariates may involve a risk of overfitting, that is, an overestimation of effects (Zhang, 2014). All in all, further studies could start here and test the effects in a large-scale long-term study. Finally, the interaction effects of WFH with the different degrees of freedom were tested in separate models. Because both facets of autonomy are highly correlated and are likely to mutually dependent (Hacker and Sachse, 2013), it could also be interesting for future studies to test more complex models with variable combinations as moderators or test interaction effects of autonomy facets itself. As we find a significant influence of work intensity and extended availability on negative spillover, further studies should also more closely examine interactions of WFH use with objectively measured work characteristics that are associated with an expansion and intensification of work.

5 Conclusion

Our findings show that there is a differentiated relationship between WFH and negative spillover, which is partly conditional on the degree of job autonomy. Generally, we discuss that employees with little job autonomy may benefit most from WFH. We further debate that employees with very high levels of job autonomy may be at higher risk for negative time-based spillover when WFH as both high autonomy and WFH come along with additional demands. However, we argue that it is still important to promote or maintain job autonomy at work and rather to design work factors that prevent high work intensity and long working hours when working remotely.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

Ethical approval was not required for the studies involving humans because the study was conducted within a single company. The main concern of the study was the analysis of

work characteristics and not of humans wellbeing. The local works council (employee representatives) assessed and approved the study request. The project was also examined by the company's data protection officer. All personal data was collected anonymously. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

LB: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Visualization, Writing – original draft. RR: Conceptualization, Funding acquisition, Project administration, Supervision, Writing – review & editing.

Funding

The author(s) declare financial support was received for the research, authorship, and/or publication of this article. The work was funded through a grant agreement, so the research was knowingly independent of the company's concerns. This study was supported by Stadtwerke Bayreuth Holding GmbH (research project: Can the burdens of digitalization of workplaces be managed prospectively?). Stadtwerke Bayreuth Holding GmbH was not involved in the study design, collection, analysis, interpretation of data, the writing of this article, or the decision to submit it for publication.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/forgp.2024.1271726/full#supplementary-material>

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