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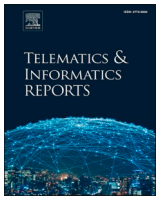

An expanded view on electronic monitoring: Testing moderating effects of participation and perceived purposes of electronic monitoring

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ABSTRACT

Electronic monitoring has become a widespread method to record and analyze the behavior of employees. The current study investigated how developmental and controlling purposes of electronic monitoring, as well as participation, moderate the effects of electronic monitoring on employees' well-being. Based on social information processing theory, developmental and controlling purposes were assumed to buffer or strengthen the relationship of monitoring with work satisfaction, engagement, and stress. In addition, participative decision making by team-leaders and works councils were expected to weaken this relationship. To examine our hypotheses, we surveyed 365 blue-collar workers from 29 organizations in Germany. To provide the best fit to the data, a Bayesian multivariate and multilevel approach was applied. We found detrimental effects of electronic monitoring on worker stress. However, we could not find the proposed moderator effects. We discuss several theoretical and methodological aspects that may have led to these findings. Future research on electronic monitoring should consider additional explaining factors rather than solely focusing on electronic monitoring.

1. Introduction

The last decades have witnessed significant advances in new technologies, leading to their rapid adoption in organizations [11,54,65]. The increased connectivity between people, processes, and electronic systems has the potential to drive improvements in efficiency, customization, and maintenance. On the one hand, this enhanced connectivity enables the collection of vast amounts of information, which can be leveraged for process optimization. On the other hand, it also facilitates the monitoring of employees, as exemplified by warehouse pickers who must follow a predetermined algorithmic route, their performance and individual work steps being closely tracked (cf., [47]).

The evolution of employee monitoring has been rapid in recent years (cf., [35,58,70]). While direct observation was once the primary means of monitoring, technological advancements have expanded to include a range of electronic methods. Research showed detrimental influence of electronic monitoring on employees, but the effects of electronic monitoring seem context-dependent and many questions remain unanswered [33,58]. For instance, studies have highlighted the significance of perceived purpose and participation in shaping outcomes under electronic monitoring [2,16,20,76]. However, evidence for the influence of these variables in an organizational setting is scarce. In light of this knowledge gap, this study aims to investigate the perceived purposes of a monitoring system and employee participation in an organizational context. Drawing on social information processing theory (SIP theory, [62,80]), we examine how employees perceive monitoring systems and their effects on well-being and stress perception, as well as explore potential differences between individuals and organizations.

2. Theoretical background

2.1. Electronic monitoring

Electronic monitoring refers to workplace practices where data is electronically collected to observe, record, and analyze employee performance and behavior (cf., [9,50]). Over the years, advances in technology have made it easier and cheaper to gather, store, and analyze data, leading to a higher prevalence of electronic monitoring [3,58].

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These new technologies reduced also the use of subjective and labor-intensive monitoring methods inherent in traditional monitoring methods (e.g., direct observation, managing by wandering around, [79]). Electronic monitoring can take various forms, including keystroke logs, telephone call observations, video surveillance, and others [3]. In fact, present-day electronic monitoring of employees may not even be a deliberate managerial decision but rather an built-in function within machines or software products (cf., [32]). Moreover, in some areas, leadership has transitioned to "algorithmic management", where algorithms distribute tasks, regulate work processes, evaluate performance, and make hiring or lay-off decisions [21,48]. As such, the collection of electronic data about employees is an inherent aspect of this management style, rendering it unavoidable for informed decision-making.

Electronic monitoring at work is often discussed in terms of its nature as a stressor and its negative effects on employees' work attitudes and physiological or psychological well-being [3,7,8,58]. For instance, there are findings that electronic monitoring decreases job satisfaction, increases employee turnover, reduces organizational citizenship behavior, and increases stress [7,58,59,67,78]. On the other hand, electronic monitoring is often justified on the grounds that it maintains organizational and individual performance, prevents theft, and fulfills legal liability [8]. To explain how electronic monitoring affects employees, SIP theory seems especially useful (cf., [39,71,72]).

2.2. Social information processing theory

Fundamental to SIP theory [62,80] is the premise that individuals "adapt attitudes, behavior, and beliefs to their social context and to the reality of their own past and present behavior and situation" ([62], p. 227). On a more specific level, this implies that one's attitudes are built on (social) information. The theory assumes that a broad range of information is social in nature [62], including not only coworkers' or supervisors' behavior and attitudes but also past experience. In an organization, employees seek cues or signals to understand the environment and regulate their attitudes, behavior, and beliefs to adapt to the environment [80]. These cues can be very subtle and implicit.

Several aspects make SIP theory especially useful in the context of electronic monitoring: The emphasis on social interaction and information helps to explain how employees perceive electronic monitoring and react to it. For example, monitoring systems can send information to employees which behavior is desirable - more specifically which tasks are more important than others (e.g., [39,71,72]). For the purposes of this study, it is more pertinent to note that SIP theory posits that the salience of social information (e.g., job characteristics) and the strength of its association with job attitudes are the determining factors in the formation of these attitudes (see [80], for an extension to cognitive processes; and see [60], for a recent application of SIP theory). Thus, SIP theory is well able to explain direct and moderating effects of job characteristics on job attitudes and stress. In accordance, electronic monitoring can be seen as a specific job characteristic whose salience may be altered by social information. For example, a question like "Do you know how our employer uses the information from the door access system?" from a coworker may direct an employee's attention to the electronic access control system.

Beyond this, electronic monitoring may also give employees the impression that their organization distrusts them, and that maintaining performance or theft prevention are necessary from the management's perspective [29]. This can be particularly pronounced when employees are subject to increased levels of monitoring (or multiple monitoring techniques), which in turn amplifies the salience of the monitoring system and captures the employee's attention [29]. The resulting sense of distrust is expected to negatively impact work satisfaction and engagement, as well as increase stress due to the heightened emphasis on performance measures [29]. Consistent with this, research has demonstrated that the intensity and invasiveness of electronic monitoring are associated with work satisfaction, engagement, and stress perception [30,78]. Therefore, we propose the following hypothesis:

Hypothesis 1. The extent of electronic monitoring is negatively associated with work satisfaction and engagement, and positively associated with stress.

2.3. Purposes of employee monitoring

The salience of job characteristics and their influence on employee attitudes and behavior may be altered by other social information [62,80]. Although the extent of monitoring probably impacts employees' attitudes and behavior, there are further variables that might shape the perception of electronic monitoring procedures. One such variable is the purpose of electronic monitoring; more specifically, the reasons that are communicated to employees why they are monitored. Ravid et al. [58] identified four key purposes of electronic monitoring: performance appraisal, development, administrative, and no clear purpose. These purposes may provide employees with an indication of what an organization expects and values [58], and according to SIP theory, they can shape the perception of the monitoring system and of which behavior is expected. In the current study, we will focus on the purposes of performance appraisal and development, as they are the most relevant in the present context.

Performance appraisal, or controlling purposes, promote organizational interests and are aimed at maintaining performance and preventing loafing, theft, and other undesired behavior that may have a negative outcome for the organization [16,44,58,76]. If an organization communicates a controlling purpose (via representatives, official documents, etc.), employees will probably perceive monitoring procedures to be especially distrustful [46,59,68,76]. For example, a time clock to monitor employees' working time might indicate to employees that the organization does not trust them to comply with the mandatory working hours. Thus, this attribution may strengthen the negative impression of the monitoring system. We therefore propose that the overall effect of electronic monitoring on employees' attitudes and stress perception is moderated by a perceived controlling purpose:

Hypothesis 2. A perceived controlling purpose of electronic monitoring moderates the relationship of the extent of electronic monitoring with work satisfaction, stress, and work engagement, insofar as the relationship is stronger in situations where the controlling purpose of electronic monitoring is high.

By contrast, a developmental purpose (also known as informative or supportive purpose, [16,46]) promotes employees' interests. This kind of electronic monitoring may provide employees with feedback about their performance and help to foster their individual development. Any additional information from an electronic monitoring system that facilitates task-processing or is in the interest of the employee is also subsumed under the supportive purpose. In contrast to the example provided above, employees may see a time clock as beneficial if it makes it easier for extra work to be credited, even though this is still a kind of monitoring. From the perspective of SIP theory, developmental purposes portray a beneficial character of monitoring technology to employees. In the above example, credited extra work shows employees that their effort to go beyond the mandatory working hours is appreciated and may thus reduce the perception of a monitoring system as invasive and threatening. Therefore, we propose a buffering effect of a developmental purpose on the relationship between electronic monitoring and employees' attitudes and stress perception:

Hypothesis 3. A developmental purpose of electronic monitoring moderates the relationship of the extent of electronic monitoring with work satisfaction, stress, and work engagement, insofar as the relationship is weaker in situations where the developmental purpose of electronic monitoring is high.

2.4. Participation

Previous research has investigated the role of participation in the framework of SIP theory (e.g., [42,66]) and in lab-based electronic monitoring studies (e.g., [2,20]). According to SIP theory, participation is a characteristic of the work environment (comparable to monitoring). In this respect, participation signals to employees that they are trusted, that their input is valued and that they can shape decisions in their own way. In turn, this fosters a trustful environment in which employees do not expect threatening actions from their organization without prior notice and interaction. Beyond this, Alge [2] and Douthitt and Aiello [20] demonstrated the relevance of participation in the implementation of (and the control over) electronic monitoring in terms of reducing negative impacts on employees. However, it is most likely that employees in an organization have only a minor influence on decisions, which may be made two or three managerial levels above them (cf., [61]). Moreover, new employees in an organization that already has monitoring procedures in place may be unable to change them. Thus, the two aforementioned laboratory studies are barely transferable to real-world situations. In the current study, we decided to focus on participation that is closer to real-world employment situations: participative leadership and works councils.

Participative decision making or participative leadership refers to leadership behavior that promotes the use of employees' knowledge and input in decision making (e.g., [5,61]) and fosters trust in one's supervisor [19]. Whereas decisions to implement electronic monitoring may occur at the level of top management, its actual use in everyday work contexts may be associated more with the behavior of employees' direct supervisors. Therefore, the direct supervisor might be particularly relevant for communicating and explaining the collection and use of data (cf., [70]). If participative leadership is high, the supervisor might be open to discussing the results of electronic monitoring and their implications with an employee instead of exerting control. From an SIP perspective, participative leadership signals to employees that they will be consulted before implications are enforced. Due to this process, which probably fosters trust in the direct supervisor, we assume a buffering effect of participative leadership on the relationship between electronic monitoring and employees' attitudes and stress:

Hypothesis 4. Participative leadership moderates the relationship of the extent of electronic monitoring with work satisfaction, stress, and work engagement, insofar as the relationship is weaker in situations where participative leadership is high.

If SIP theory is correct in assuming that employees adapt their attitudes, behaviors, and beliefs based on social information from their environment [62,80], then works councils might play a crucial role in shaping these perceptions within the organizational context. Works councils, prevalent in several countries within the European Union [22,23,49], serve as a significant source of social information. Unlike trade unions, works councils do not initiate strikes or negotiate wages; instead, they use their influence to improve employees' situations within organizations. The specific rights of works councils vary between countries, but they often need to be informed about management decisions in advance [49]. In Germany, works councils must be involved in the implementation of new systems or work processes like the implementation of monitoring systems and can block certain organizational changes [31]. However, the assertiveness of a works council may depend on its members and their abilities. In other words, employees may perceive the endeavors of works councils differently depending on previous successes of their works council. Thus, we propose that an assertive works council is able to reduce the number of monitoring techniques within an organization:

Hypothesis 5. The more perceived influence the works council has, the lower the extent of electronic monitoring.

Furthermore, the presence of an assertive works council that effectively advocates for employee interests may signal to employees that they are protected from potentially detrimental monitoring procedures. This form of social information can reduce the salience of negative aspects of monitoring and foster a sense of trust and security among employees. According to SIP theory [62,80], this should lead to a reduced perception of monitoring as detrimental, thereby mitigating its negative impact on work attitudes and stress, leading to the following hypothesis:

Hypothesis 6. The perceived influence of works councils moderates the relationship between the extent of electronic monitoring and work satisfaction, stress, and work engagement, such that the relationship is weaker when the influence of the works council is high.

Moreover, if the salience of the negative effects of monitoring is reduced through the influence of social information provided by works councils, this change should cascade into employees' perceptions of monitoring purposes. According to SIP theory [62,80], social cues and information from the environment, such as those provided by an assertive works council, can alter how employees interpret and react to organizational practices. A stronger works council, perceived as more supportive and effective in advocating for employee interests, may shift the focus from the controlling aspects of monitoring to its potential developmental benefits. This shift in perception is consistent with the idea that social information can reshape attitudes and beliefs by highlighting certain aspects of the work environment while downplaying others. Thus, monitoring may be viewed more favorably as a tool for development and support rather than control.

Hypothesis 7. The higher the perceived influence of the works council is, the more electronic monitoring is perceived as supportive and the less it is perceived as controlling.

3. Method

The hypotheses, variables, data collection information, and analysis procedure were registered prior to conducting this study, with the preregistration available at https://aspredicted.org/xdd2-9gsy.pdf. In addition, this paper was written as a reproducible manuscript using R (see [6]). All files to reproduce statistical analysis and reports of statistics are available at the Open Science Framework (https://osf.io/xkq2b).

3.1. Participants

To recruit participants for this study, we reached out to multiple companies in the industrial sector in southwest Germany and invited them to participate in our research. If interested, companies forwarded information about the study to their employees, who were then asked to volunteer for participation. All data collection took place within working hours. We employed two primary methods of data collection: (1) primary researchers went to participating company locations, distributing questionnaires and collecting completed versions from participants; or (2) we sent questionnaires directly to participating companies, which distributed them among their employees. In the latter case, questionnaires were sent back to us via postal mail in a sealed envelope. There were no incentives for companies or employees to take part in the study.

In total, 391 questionnaires of employees from 29 organizations were collected. In our preregistration, we stated that we will exclude participants with more than 20 % of missing values, but we conduct a multilevel analysis in the current paper and thus will keep all participants regardless of the number of missing values. Consequently, the final sample also consists of 391 participants. The average number of participants per organization was $M = 13.48$ ($SD = 6.79$). Table 1 presents sample and organizational characteristics.

Table 1
Sample ($N = 391$) and Organization ($N = 29$) Characteristics.

			Count	%
Participants	Gender	male	318	81.3
		female	54	13.8
		no answer	19	4.9
	Age	<24	29	7.4
		25 – 34	81	20.7
		35 – 44	83	21.2
		45 – 54	119	30.4
		>55	60	15.3
		no answer	19	4.9
Organizations	Size (employees)	<100	8	27.6
		101 – 500	11	37.9
		501 – 1000	1	3.4
		1001 – 2500	1	3.4
		2501 – 5000	1	3.4
		>5000	7	24.1

3.2. Measures

If not otherwise stated, all items were rated on a Likert scale ranging from 1 to 5. For all scales, larger numbers correspond to higher agreement on the respective scale. If a participant had more than two missing values on a scale, we did not calculate the mean for this participant. As a result, the number of participants per analysis may vary slightly (we report the actual number of cases for each analysis). A full list of items is available from the supplementary material on the Open Science Framework webpage. Due to a lack of standardized measures within the research on electronic monitoring and works councils (cf., [67]), we had to develop new measures or adapt existing measures to fit the current study's context. This was accomplished through collaboration with subject matter experts (SMEs) to obtain valid and reliable measures. The SMEs worked in trade unions or were consultants of works councils and therefore have good background knowledge of works councils as well as monitoring techniques that occur at production and maintenance sites.

3.2.1. Electronic monitoring index

To obtain a measure of the extent of monitoring, an index of several monitoring techniques was developed together with the SMEs. The 15-item index assesses the prevalence of common monitoring procedures at production and maintenance sites. Example items are "My company records when I perform which activity" and "My company tracks how fast I work." The participants could respond by choosing "yes", "no", or "I don't know" to every item. The index was calculated by summing up all "yes" answers. Due to its nature as a formative construct, we refrain from reporting reliability indices for this measure (see [73]).

3.2.2. Perceived purpose of electronic monitoring

A scale to measure the perceived purposes of electronic monitoring was developed for this study together with the SMEs. The scale consisted of two dimensions: a controlling and a developmental dimension. Example items are: "The collection of my work-related data fosters my development" (developmental dimension) and "The collection of my work-related data leads to increased pressure regarding performance and time" (controlling dimension). To gather insights into the structure of our scale, we applied a factor analysis (with oblimin rotation) which yielded a two-factor structure using a scree test. All four items developed to measure the developmental dimension of monitoring showed high loadings on the first factor (range: 0.68 to 0.86) and low loadings on the second factor (range: −0.13 to 0.11). The four items developed to measure the controlling dimension showed a reversed pattern with low loadings on the first factor (range: −0.10 to 0.17) and high loadings on the second factor (range: 0.72 to 0.80). This result supported our initial assumption of a two-factor structure for our scale.

3.2.3. Influence of the works council

As works councils remain a rather understudied topic in psychology and computer science, there was no existing scale to measure their influence. Therefore, together with SMEs, we developed a scale reflecting the perceived influence of works councils focusing on employee privacy in order to obtain information about a topic that is related to electronic monitoring. Example items are "The works council in my company stands up for the data security of the employees" and "The works council in my company can limit negative consequences of technological developments for the employees." Note that not every organization in our sample had a works council and this scale were omitted in such cases. A factor analysis yielded a one factor structure of our scale using a scree test. All six items loaded highly on the single factor (range: 0.74 to 0.87). Thus, we assumed a one-factor structure of our scale.

3.2.4. Work satisfaction

To assess work satisfaction, we applied the German-language Work Satisfaction Scale by Neuberger et al. [51]. We adapted the questions to start with "I am satisfied with …" to fit the other questions in our survey. Example items are "I am satisfied with my working conditions" and "I am satisfied with my colleagues."

3.2.5. Stress

The *Personal Burnout* subscale of the Copenhagen Burnout Inventory [37,52] was used to measure stress. SMEs suggested to remove the item "How often are you emotionally exhausted?" due to probable misunderstandings. In addition, the questions were adapted to fit with our other questions (from "How often do you feel tired?" to "I often feel tired."). Example items are "I often feel exhausted" and "I often feel weak and susceptible to illness."

3.2.6. Work engagement

Engagement was measured using the German version of the Utrecht Work Engagement Scale (Dedication subscale, [63]). Example items are "My work is useful and meaningful" and "I am enthusiastic about my work."

3.2.7. Participative leadership

Participative leadership was measured using the subscale *Participative Decision Making* of the Empowering Leadership Questionnaire [5]. Example items are "My supervisor encourages me and my colleagues to express ideas and suggestions" and "My supervisor offers me and my colleagues the opportunity to express our opinion."

3.3. Data analysis

Due to the considerable number of companies and as well as multiple dependent variables, we opted for an analysis that best fits the structure of our data. Therefore, we used Bayesian mixed models to be able to nest individual employees in their respective organization and analyze multiple dependent variables at the same time. Accordingly, we estimated a mixed model with two levels. In addition, the analysis benefited from the opportunities of Bayesian statistics, which emphasize estimates and their distribution (or their uncertainty, [38]) and avoid dichotomous decisions based on *p*-values [18,74]. This shift in statistical reporting and interpretation has been endorsed for several years (e.g., [4]).

In Bayesian statistics, the uncertainty of estimates is expressed in Bayesian credible intervals (CI). Unlike a frequentist confidence interval, a Bayesian CI states the probability that a given parameter will fall into this interval depending on prior beliefs and the observed data [17]. A CI including zero does not indicate a non-significant result but suggests that an estimate of zero may occur within a certain probability. We

report 95 % CIs (based on quantiles) and medians to describe coefficient estimates. Bayesian statistics require prior knowledge to be specified in so-called prior distributions which allow prior knowledge to be entered into the analysis. A rationale for our chosen prior distributions can be found in the appendix.

Variables were not standardized before being entered into the analysis. Thus, all estimates are on the scale on which participants answered the questions in the survey (ranging from 1 to 5). However, we followed the recommendations by Hoffman and Walters [28] to center every predictor variable and gain two different predictor variables, each on its own level. The predictor variable on the organizational level was created by averaging the individual values within each organization. The predictor variable on an employee level was created by the deviation of each individual to the mean of the individual's organization. This way, estimates on the organizational level can be interpreted as the influence of organizational differences on a relationship and estimates on the employee level as differences in attitudes and workplaces within an organization.

To test our hypotheses, we interpreted the width of CIs of our estimates ([38]; see also [15]). For example, a 95 % CI of [.12, .34] is reliable positive and suggests a stable positive relationship between the dependent and the independent variable. A 95 % CI of [− .02, .15] is not reliable positive but suggests that the effect is most likely positive but could also be close to zero (and practically irrelevant). In contrast, a 95 % CI of [− .14, .15] is inconclusive: The effect could be positive or negative or close to zero.

Bayesian mixed models were estimated using the *brms* package (Version 2.22.0, [10]) for R (R [57]). *brms* is based on the probabilistic programming language Stan [25]. Stan uses a Markov chain Monte Carlo sampling that derives parameter distributions from a multi-dimensional parameter space whose number of dimensions depends on the number of parameters. This estimation process runs iteratively (thus there are different *iterations*) and can be executed multiple times (thus in multiple *chains*). Parameter distributions should be similar between different chains and across iterations. An indicator of differences between chains is the $\widehat{R}$ value, which should be lower than 1.01 [75], and can be inspected in chain plots. The latter can also be used to inspect the results of the iterative process [43]. In the current study, we used six chains ([75], recommends at least four chains) with 40,000 iterations (20,000 of which were warm-up samples). These chains and iterations should result in an effective sample size (valid number of values to determine parameter estimates) of at least 1000 [10]. We obtained a lowest $\widehat{R}$ value of 1.001 and a minimum effective sample size of 42,598. Chain plots looked well-mixed and stationary. Thus, we obtained good model fits.

4. Results

Table 2 presents descriptive statistics of the measured scales. As a measure of reliability, we report Revelle's omega total [45].

4.1. Hypothesis testing

Hypothesis 1 posited that the extent of electronic monitoring would be negatively correlated with work satisfaction and engagement, but positively associated with stress. Utilizing a Bayesian multivariate mixed model, work satisfaction, work engagement, and stress were predicted by an index of electronic monitoring procedures. The model incorporated organizations as a group effect (in terms of frequentist statistics as a random effect). Notably, organizations where employees reported more monitoring also exhibited increased levels of stress, $b = 0.10$, 95 % CI $[0.03, 0.18]$, whereas no association between monitoring and work satisfaction, $b = 0.00$, 95 % CI $[-0.10, 0.11]$, or engagement, $b = -0.03$, 95 % CI $[-0.12, 0.07]$, was found in these organizations. In contrast to the organizational level, there were no discernible relationships between employee-level monitoring procedures and work satisfaction, $b = -0.02$, 95 % CI $[-0.05, 0.01]$, work engagement, $b = -0.03$, 95 % CI $[-0.12, 0.07]$, or stress, $b = 0.05$, 95 % CI $[-0.01, 0.10]$. The estimates of the fitted model are depicted in Fig. 1. In summary, electronic monitoring was only linked to increased stress on an organizational level, thereby partially supporting Hypothesis 1.

Hypotheses 2 and 3 proposed that perceptions of a developmental purpose of electronic monitoring would weaken the relationship of the extent of monitoring with work attitudes and stress, and that perceptions of a controlling purpose would strengthen this relationship. To examine these assumptions in a moderation analysis, developmental and controlling perceived purposes and their interactions with data collection were introduced into the model for Hypothesis 1. On the organizational level, the interaction term of monitoring procedures and reported developmental purposes was negative in the case of work satisfaction, $b = -0.27$, 95 % CI $[-0.47, -0.07]$, and engagement, $b = -0.25$, 95 % CI $[-0.46, -0.05]$. The results indicated that with higher levels of developmental purposes, the relationship of monitoring with work satisfaction and engagement was more negative. Thus, the moderation was in the opposite direction than expected (see Fig. B1 for a more

Table 2
Means, standard deviations, reliabilities, and correlations using a frequentist approach.

Variable	*M*	*SD*	1.	2.	3.	4.	5.	6.	7.	8.
1. Monitoring index	5.70	2.94		.30 [.16, .43]	.40 [.26, .52]	− .02 [− .17, .13]	− .16 [− .30, .00]	.13 [− .03, .27]	− .07 [− .22, .08]	− .13 [− .27, .03]
2. Purpose develop.	2.55	1.08	.13 [− .25, .47]	(.89)	.19 [.04, .33]	.14 [− .01, .29]	.18 [.03, .33]	− .07 [− .22, .08]	.24 [.09, .37]	.27 [.12, .40]
3. Purpose control	2.41	1.04	.42 [.06, .68]	.51 [.17, .74]	(.91)	− .10 [− .25, .05]	− .36 [− .48, − .22]	.40 [.26, .52]	− .22 [− .36, − .07]	− .21 [− .35, − .06]
4. Works council inf.	3.39	1.06	− .15 [− .49, .22]	− .35 [− .64, .01]	.32 [− .19, .69]	(.94)	.29 [.14, .42]	− .20 [− .34, − .05]	.25 [.11, .39]	.26 [.11, .39]
5. Work satisfaction	3.81	0.73	.16 [− .35, .60]	− .17 [− .60, .34]	− .29 [− .59, .09]	− .16 [− .60, .35]	(.91)	− .40 [− .52, − .26]	.58 [.47, .67]	.56 [.44, .65]
6. Stress	2.48	0.95	− .59 [− .83, − .15]	.51 [.18, .74]	− .12 [− .47, .26]	.74 [.51, .87]	.59 [.28, .78]	(.93)	− .30 [− .43, − .16]	− .20 [− .34, − .05]
7. Work engagement	3.69	0.82	.22 [− .30, .63]	− .01 [− .38, .36]	.39 [.03, .66]	− .28 [− .58, .10]	− .30 [− .60, .08]	.79 [.59, .90]	(.90)	.42 [.29, .54]
8. Part. leadership	3.34	0.92	− .02 [− .38, .35]	.30 [− .07, .60]	− .22 [− .54, .16]	− .18 [− .51, .20]	− .26 [− .66, .26]	− .42 [− .68, − .06]	.58 [.27, .78]	(.92)

Note. The upper triangle of the table shows correlation coefficients within organizations ($n = 391$). The upper triangle of the table shows correlation coefficients between organizations (ratings of employees were averaged, $n = 29$). Numbers in parentheses indicate McDonald's ω. For correlations, a 95 % confidence interval is given in squared brackets. Note that sample size per correlation varies. Purpose develop. = Purpose developmental; Works council inf. = Works council influence; Part. leadership = Participative leadership.

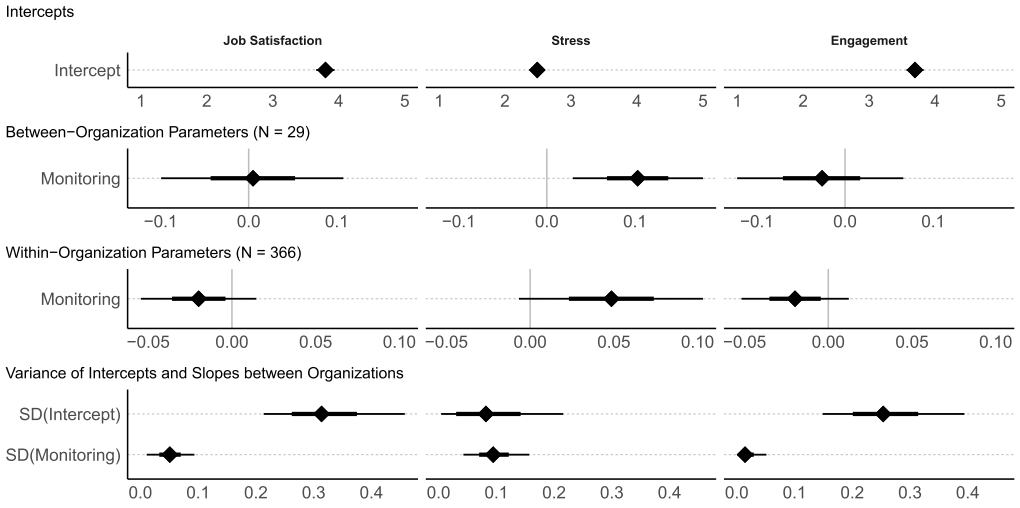

Fig. 1. Results of the Bayesian Mixed Model, fitted to Examine Hypothesis 1. *Note.* Diamonds indicate the median of estimate posterior distributions. Thicker lines show 65 % CI, whereas thinner lines show 95 % CI.

detailed depiction of the interaction). With regard to stress, there was no clear direction of effect, $b = 0.05$, 95 % CI $[-0.16, 0.24]$. In contrast, controlling purposes showed no clear influence on the relationship of monitoring with work satisfaction, $b = 0.01$, 95 % CI $[-0.20, 0.22]$, engagement, $b = 0.07$, 95 % CI $[-0.14, 0.30]$, and stress, $b = -0.04$, 95 % CI $[-0.24, 0.16]$, on the organizational level (see also Fig. B2 for a more detailed depiction of the interaction). On the employee level, the interaction term of developmental purposes and monitoring showed the expected positive relationship with engagement, $b = 0.04$, 95 % CI $[0.00, 0.07]$, indicating that the higher the developmental purposes, the more positive the relationship between monitoring and engagement. However, no clear relationship was observed of for work satisfaction,

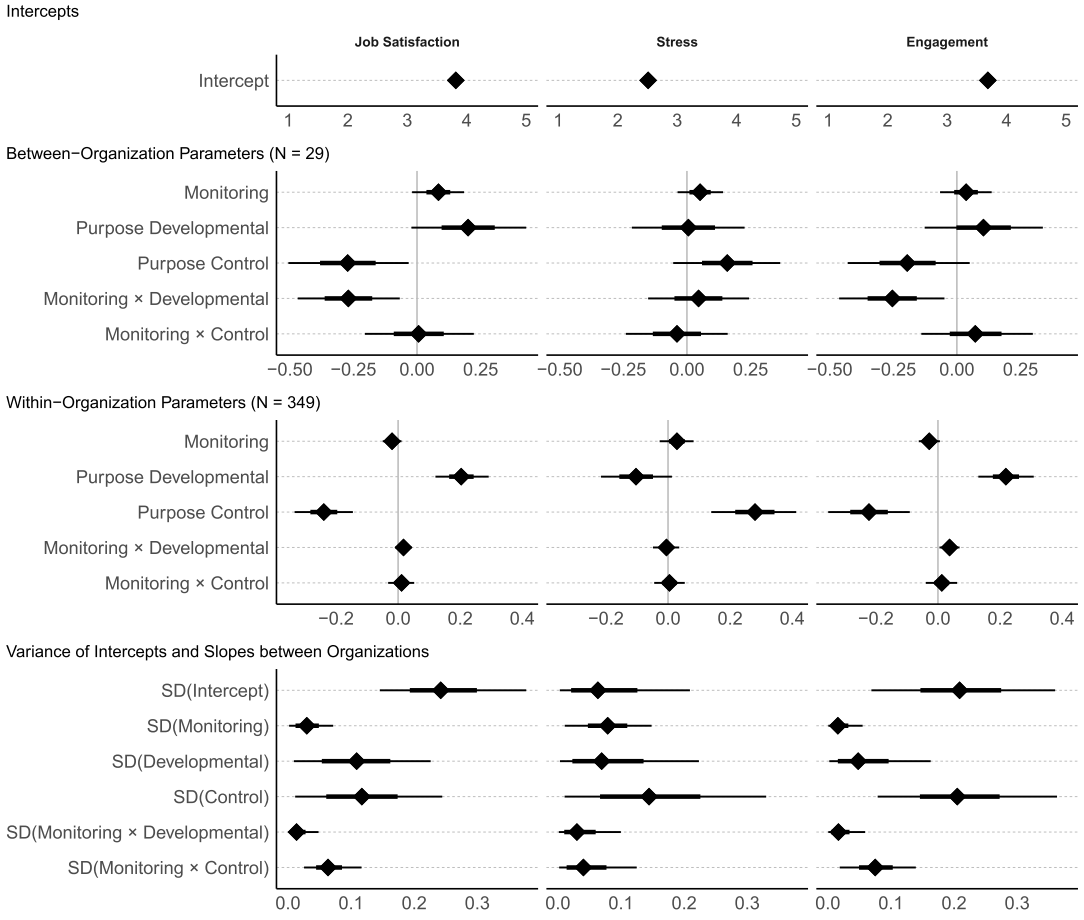

Fig. 2. Results of the Bayesian Mixed Model, fitted to Examine Hypothesis 2 and 3. *Note.* Diamonds indicate the median of estimate posterior distributions. Thicker lines show 65 % CI, whereas thinner lines show 95 % CI.

$b = 0.02$, 95 % CI [− 0.01,0.04], and stress, $b = -0.01$, 95 % CI [− 0.05, 0.04]. The interaction term of controlling purposes and monitoring showed no clear relationship with work satisfaction, $b = 0.01$, 95 % CI [− 0.03,0.05], engagement, $b = 0.01$, 95 % CI [− 0.04,0.06], and stress $b = 0.00$, 95 % CI [− 0.04,0.05]. See Fig. 2 for a depiction of all regression parameters. See Figs. B1 and B2 for a more detailed depiction of the interactions. In conclusion, there is no compelling evidence in favor of Hypotheses 2 and 3.

Analogous to the previous moderation analysis, we tested the influence of the interaction between participative leadership and electronic monitoring on the dependent variables (Hypothesis 4). This hypothesis stated that participative leadership moderates the relationship between the extent of electronic monitoring and the dependent variables. Differences between organizations in the interaction between the number of monitoring procedures and participative leadership did not predict work satisfaction, $b = -0.01$, 95 % CI [− 0.20,0.17], engagement, $b = 0.06$, 95 % CI [− 0.19, 0.28], and stress, $b = -0.06$, 95 % CI [− 0.27, 0.14], reliably. Thus, no influence of this interaction on the dependent variables could be found on the organizational level. On the employee level, participative leadership showed no reliable influence on the relationship between monitoring and work satisfaction, $b = 0.04$, 95 % CI [− 0.02, 0.09], engagement, $b = 0.03$, 95 % CI [− 0.01, 0.07], and stress, $b = 0.00$, 95 % CI [− 0.06, 0.06]. Thus, we found no support for Hypothesis 4. See Fig. 3 for a depiction of all regression parameters and Fig. B3 for a more detailed depiction of the interactions.

Hypothesis 5 stated that the more perceived influence the works council has, the lower the extent of electronic monitoring. To test this assumption, we fitted a Bayesian generalized mixed model to predict our monitoring index by the influence of the works councils. We used the organization's mean as a predictor for the current analysis as it is implausible that an individual employee's perception of the works councils decreases the number of monitoring techniques. As the monitoring index summed up "yes" answers, we employed a Poisson distribution to reflect this in the analysis. Contrary to our hypothesis, we found evidence that the perceived influence of works councils increases the reported number of monitoring techniques within an organization, $b = 1.05$, 95 % CI [0.84, 1.33]. Thus, we found no evidence to support Hypothesis 5. However, the number of reported monitoring techniques was similar in organizations with a works council, $M = 5.82$, 95 % CI [5.10,6.67], and those without a works council, $M = 5.59$, 95 % CI [4.82, 6.52].

Hypothesis 6 was examined in a similar way to previous moderation analysis. The hypothesis proposed that the influence of works councils has a buffering effect on the relationship of the extent of monitoring with work attitudes and stress. On the organizational level, the interaction term of works councils influence and monitoring showed no reliable relationship with work satisfaction, $b = 0.08$, 95 % CI [− 0.20, 0.39], engagement, $b = 0.08$, 95 % CI [− 0.26,0.45], or stress, $b = 0.04$, 95 % CI [− 0.24, 0.30]. On the employee level, the interaction term also showed no reliable relationship with work satisfaction, $b = -0.02$, 95 % CI [− 0.08,0.03], engagement, $b = -0.01$, 95 % CI [− 0.08,0.06], and stress, $b = -0.04$, 95 % CI [− 0.11, 0.04]. Thus, there was no evidence to suggest that employees who stated a higher influence of works councils perceived a reduced association between the number of monitoring techniques and the dependent variables (see Fig. 4 for a depiction of regression parameters and Fig. B4 for a more detailed depiction of the interactions).

Hypothesis 7 stated that the higher the perceived influence of the works council, the more electronic monitoring is perceived as supportive and the less it is perceived as controlling. To test this hypothesis, we used a Bayesian mixed model including organization as group effect. On the organizational level, the influence of the works council contradicted the prediction and showed a stable negative relationship with a developmental purpose, $b = -0.41$, 95 % CI [− 0.73, − 0.10]. There was no such relationship with controlling purposes, $b = 0.07$, 95 % CI [− 0.43, 0.56]. On an employee level, the influence of the works council showed no influence on developmental purposes, $b = 0.16$, 95 % CI [− 0.06, 0.37], and controlling purposes, $b = -0.15$, 95 % CI [− 0.38, 0.08].

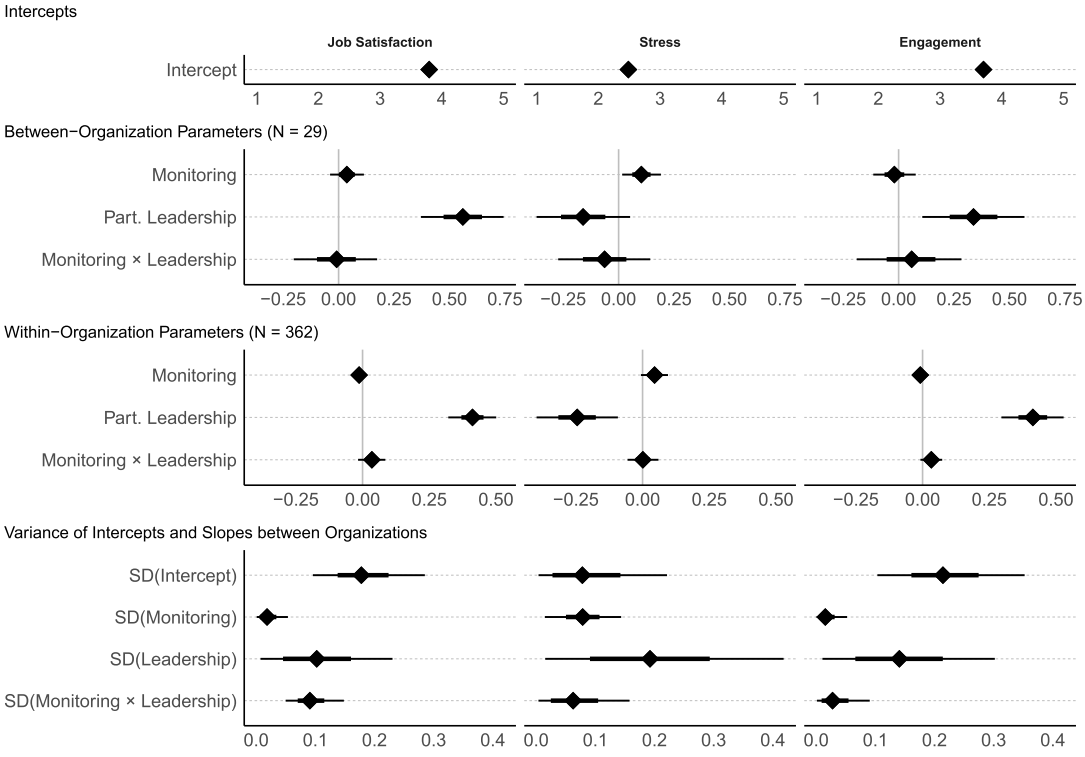

Fig. 3. Results of the Bayesian Mixed Model, fitted to Examine Hypothesis 4. *Note.* Diamonds indicate the median of estimate posterior distributions. Thicker lines show 65 % CI, whereas thinner lines show 95 % CI.

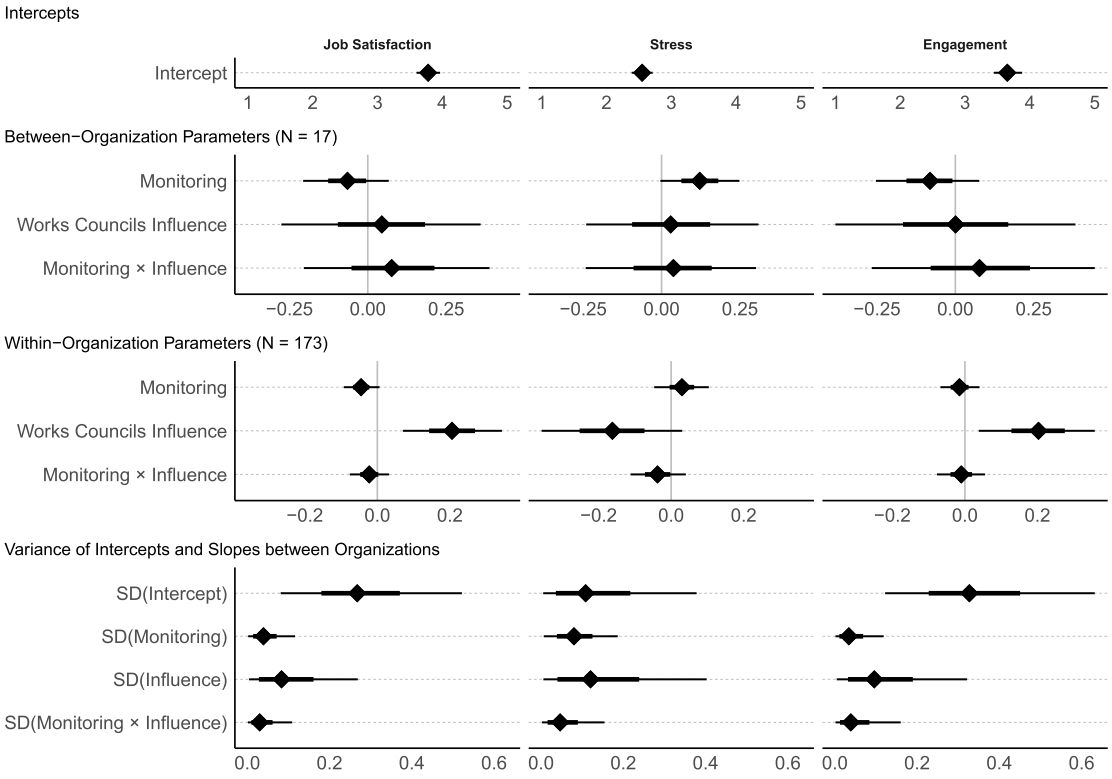

Fig. 4. Results of the Bayesian Mixed Model, fitted to Examine Hypothesis 6. *Note.* Diamonds indicate the median of estimate posterior distributions. Thicker lines show 65 % CI, whereas thinner lines show 95 % CI.

Hence, the influence of works councils showed no relationship in the expected direction with controlling and developmental purposes. On an exploratory basis, we investigated whether developmental and controlling purposes differed between organizations with and without a works council. Employees in an organization with a works council did not state higher perceptions of developmental purposes, $M = 2.63$, 95 % CI $[2.41, 2.85]$ (vs. $M = 2.51$, 95 % CI $[2.09, 2.98]$), but stated a higher perception of controlling purposes, $M = 2.61$, 95 % CI $[2.35, 2.86]$ (vs. $M = 2.06$, 95 % CI $[1.86, 2.32]$).

5. Discussion

Based on social information processing theory [62,80], this study explored the relationship of electronic monitoring with work satisfaction, engagement, and stress. This study was the first to apply a two-level model in the area of electronic monitoring research allowing to disentangle differences between organizations and individuals. Consistent with prior findings [7,58,67,70], a higher number of monitoring procedures was associated with increased stress at the organizational level. However, contrary to existing literature, we found no significant relationship between electronic monitoring and work satisfaction or engagement. These findings actually align well with the findings of two recent meta-analysis ([59,67]; see also [36]). These meta-analyses also reported a small relationship of monitoring with stress. Even though the meta-analyses found a negative relationship with work attitudes, the current results are well within the respective prediction intervals. The variances of organization-level effects (see Fig. 1) suggests that there are considerable differences between organizations in regard to work satisfaction, stress, and engagement. This might indicate that other organizational factors, such as work design (e.g., [55]), have a greater impact on employee attitudes and stress than electronic monitoring alone. However, it is very likely that electronic monitoring accompanies other work design decision that employees perceive as detrimental (cf., [36]).

However, none of our moderation analyses revealed strong support for the proposed relationships. Following, we want to discuss these null findings from two perspectives: First, from a theoretical perspective, we explore how these findings align with or diverge from previous studies and theories. Second, from a methodological perspective, we examine why such null findings might have occurred and what implications this has for future research.

Our moderation analyses did not support the idea that developmental or controlling purposes, participative leadership, and works councils' influence moderate the relationship between electronic monitoring and the dependent variables. However, these examined variables had a strong impact on work attitudes and stress on their own, suggesting that it may be insufficient to focus solely on electronic monitoring and that a more holistic approach, incorporating additional organizational variables, is warranted. With regard to monitoring purposes, the lack of observed moderator effects in our study is puzzling, particularly given previous research that found similar effects (e.g., [16,76]). Monitoring purposes might play a relatively minor role in shaping perceptions of electronic monitoring procedures in Germany, where a robust legislative framework exists [40]. This could imply that the proposed moderator effects are more likely to be present in countries with weaker employee and privacy rights ([34]; cf [36]).

With regard to participation leadership, we could not find the proposed effects neither on the organizational level nor on the employee level. Our analysis failed to yield evidence that the leadership style

moderates the relationship between monitoring and employee attitudes and stress. A recent study suggests that such interactions are more complex in an organizational setting [77]. In this study, leader-member exchange was found to influence the perception of privacy invasion as a result of electronic monitoring, but did not affect motivation and turnover intentions. These results may hint at an attraction-selection-attrition effect [16,64]: employees might either accept or welcome certain monitoring and leadership behaviors in an organization, or drop out.

Beyond this, we found no indication that the influence of works councils buffers the effects of monitoring on employees' work attitudes and stress. Furthermore, we found no influence of the presence of a works council in an organization, and no influence of works councils on the number of reported monitoring techniques. Critics of works councils argue that they are often a hindrance to the introduction of new systems and procedures (cf., [31]). Our findings contradict this perception, as they do not reveal that organizations with a works council have a lower number of monitoring techniques. Regarding the perception of developmental and controlling purposes, works councils showed different impacts on the organizational and the employee level: Between organizations, a higher influence of the works council reduced the perception of developmental purposes, and employees with a works council did not report higher levels of developmental purposes. This is contrary to our assumption but might indicate that a works council communicates a more realistic image of the advantages of innovative technologies than the management does. Moreover, works councils are responsible for protecting employees from the undesired use of technologies, rather than themselves introducing technologies that promote employees' interests [24].

From a methodological perspective, the current null findings may not be as surprising as they initially appear. One possible explanation lies in the differentiation between organizational-level and employee-level factors. This might have eliminated potential differences between organizations which could be captured in moderator effects. For some time, moderator effects have been criticized in organizational research [14,53]. Despite their small effect size, they are often reported as significant, and it is likely that they are prone to type I errors (false positives). Furthermore, in the two meta-analyses on electronic monitoring, moderator effects have been found to be limited in explanatory power (cf., [59,67]). The current study tried to implement open science practices (like preregistration, open data, open analysis) and used a multilevel model to disentangle employee- and organization-specific effects. Thus, it is likely that previous findings are in part also an effect of skewed reporting practices and may not be as reproducible as expected.

The present study represents a first effort in applying a multilevel model within electronic monitoring research. Moreover, it marks the first investigation into participation beyond traditional employee-leader relationships, extending to a broader organizational context facilitated by works councils. The current results corroborate previous findings regarding the relationship between electronic monitoring, work satisfaction, engagement, and stress. However, none of the proposed moderator analyses yielded support for our hypotheses. Nonetheless, we believe that this study can contribute valuable insights into the topic of electronic monitoring: Firstly, due to small effect sizes that are consistent with two recent meta-analyses [59,67], the findings suggest that it may not be sufficient to investigate electronic monitoring in isolation. Instead, a more comprehensive examination of additional factors within the organizational context is warranted, particularly variables related to work design. Secondly, the lack of evidence for proposed moderator effects may indicate that future research should prioritize notable main effects. Thirdly, works councils remain an understudied topic within this field. Consequently, the findings should be interpreted with caution. Nevertheless, our results offer preliminary insights into this area, suggesting that works councils may not hinder the introduction of innovative technologies and appear to play a crucial role in communicating the advantages and disadvantages of these technologies to employees.

5.1. Limitations

There are at least two limitations of the present study that need to be considered: We based all measurements on a single survey at one point in time. Thus, a common method bias might limit the implications and generalization of our study [56]. However, previous research has shown that the effect of common method bias is often overestimated and may actually reduce relations [13,69]. In particular, Siemsen et al. [69] showed that interaction effects cannot be artifacts of common method bias, and our study is mainly based on moderation analysis. Moreover, our multivariate approach does account for covariation between dependent variables. Nevertheless, further research could mitigate this issue by directly observing monitoring techniques in a certain company or obtaining this information from the management of the corresponding companies. Additionally, sampling at one time point implies that it is only possible to interpret relationships between variables and no causal effects can be derived. Future research could circumvent this issue by investigating how the implementation of new monitoring systems within organizations affects employee behavior and well-being.

When interpreting the results, readers should keep in mind that the sample came from the German industrial sector, which is known to have strong unionization and workers' representation. Compared to other (non-EU) countries, German laws put significant barriers on employee monitoring. Therefore, effects observed in our study may be stronger or manifest differently in other contexts.

5.2. Future research

The current findings suggest several avenues for future research to consider. It may be insightful to explore how electronic monitoring procedures correlate with other work design components. For instance, examining how organizations design employees' work processes in the presence of electronic monitoring compared to their absence. Another potential area of investigation is to consider the impact of electronic monitoring when taking into account other work design factors. Specifically, it might be interesting to see which additional effects electronic monitoring has on employee well-being and health compared to other work design factors.

Beyond this, the study was one of the first to test the influence of participative decision making on the perception of electronic monitoring. The results suggest that an attraction-selection-attrition model can also be applied to electronic monitoring. While this finding is in line with research on the effect of organizational culture on the perception of electronic monitoring (e.g., [1,16]), further research is warranted in this area. For example, it might be possible that especially people with higher performance or competitiveness might be attracted to or unconcerned about monitoring procedures (cf., [26]). In addition, there are no long-term studies on electronic monitoring. It might be the case that intensive monitoring procedures (like at Amazon, see [12]) result in a high dropout of personnel even if they are well performing. Moreover, works councils are an under-researched area in psychology and computer science, and their impact on organizational decision-making and

working procedures is unknown. Thus, the current study sheds first light on the impact of works councils on organizational decisions, but these findings need to be expanded and replicated. For example, knowledge on the interplay of employees, works councils, and organizations is insufficient.

5.3. Practical implications

The current study shows that examining the effects of monitoring alone does not suffice. Rather, it is crucial to also pay attention to the organization in which monitoring is embedded, and to draw inferences for employees' well-being from the monitoring implementation and participative decision-making processes. Practitioners and HR managers should carefully investigate how monitoring procedures in their organizations are perceived and how this perception can be shaped by communicating their use and function. Works councils probably play an important role in this area and should be strongly involved in monitoring implementation decisions.

6. Conclusion

Our study demonstrated that electronic monitoring increases employees' reported stress, consistent with prior research, but revealed no significant impact on work satisfaction or engagement. Using a two-level model, we differentiated between organizational and individual effects, offering a nuanced understanding of electronic monitoring's role. Theoretically, these findings contribute to the Social Information Processing Theory by emphasizing the context-dependent nature of monitoring effects. Methodologically, our use of multilevel modeling and open science practices enhances the robustness and reproducibility of our results. Practically, organizations should implement electronic monitoring within a broader framework of work design and involve works councils in decision-making to ensure balanced and respectful use. In summary, our study highlights the importance of a comprehensive approach to electronic monitoring, providing valuable theoretical, methodological, and practical insights for future research and organizational practices.

CRediT authorship contribution statement

Rudolf Siegel: Writing – original draft, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Cornelius J. König:** Writing – review & editing, Supervision, Funding acquisition, Conceptualization. **Julia Jörg:** Writing – review & editing, Investigation, Data curation, Conceptualization.

Declaration of competing interest

The authors have no conflicts of interest to declare.

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Appendix

A. Prior specification

For all models, we set the prior intercept for all dependent variables to a normal distribution with $M = 3$ and $SD = 0.8$, $N(3, 0.8^2)$. This way, 95 % of the prior mass is between $[1.43, 4.57]$ which aligns well with our scales for the dependent variables ranging from 1 to 5.

For the model regarding Hypotheses 1, we additionally set the priors for regression slopes for the relationship between the monitoring index and work satisfaction to $N(-0.10, 1)$. Similarly, we set the priors for the regression slopes with stress to $N(0.11, 1)$ and work engagement to $N(-0.10, 2^2)$. We based these informative priors on a recent meta-analysis [67] which found these relationships between electronic monitoring and work satisfaction as well as stress. Unfortunately, work engagement was not examined in the meta-analysis. However, due to the high correlation between work satisfaction and engagement, we use the same prior for both variables, but set the standard deviation higher in the case of engagement. The used standard deviation allows the posterior parameters still to be in the opposite direction (if the data suggests so).

Regarding Hypotheses 2 and 3, we used the same priors as for Hypothesis 1. In addition, we set flat priors, $N(0, 10^2)$, for the slopes of the relationships between developmental and controlling purposes with the dependent variables. The same prior was also used for the interaction effects between the monitoring purposes and the monitoring index. We had no good justifications for these relationships, so we decided to use flat priors.

Regarding Hypothesis 4, we used the same priors for Hypothesis 1. A recent meta-analysis [41] estimated the relationship between leader-member exchange (participative leadership) and satisfaction with task (work satisfaction) to $r = 0.10$ and with job engagement (work engagement) to $r = 0.36$. Another meta-analysis [27] estimated the relationship between leader-member exchange and stress to $r = -0.30$. We used this information in our model and used the value of the correlation coefficient as mean and set the standard deviation to 1.00 for the prior distribution (normal distribution). We had no good justifications for interactions, so we decided to use flat priors, $N(0, 10^2)$.

Regarding Hypothesis 5, we had no good justification for the relationship and used our common flat prior, $N(0, 10^2)$. This was also the case for Hypothesis 6. In addition to the priors of Hypothesis 1, we used flat priors for the relationship of the works council with the dependent variables and the interactions, $N(0, 10^2)$.

Regarding Hypothesis 7, we used the same prior for the intercepts as in Hypothesis 1, $N(3, 0.8^2)$. For all other variables, we used flat priors as there were no known relationships before the study, $N(0, 10^2)$.

B. Interaction plots

B.1 Hypotheses 2 and 3

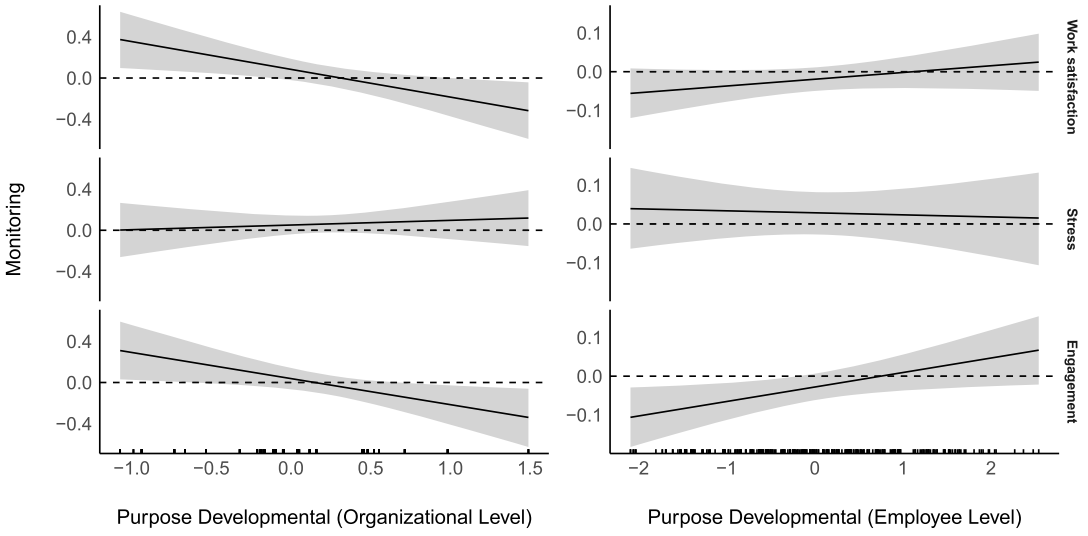

Fig. B1. Johnson-Neyman Plot to Examine the Interaction Between Developmental Purpose and the Monitoring Index. *Note*. The plot shows the effect (slope) of the monitoring index (y-axis) on the dependent variables work satisfaction, stress, and engagement (facets) conditioned on the moderator developmental purpose (x-axis). Vertical lines at the bottom of the plot show the distribution of actual data in the sample.

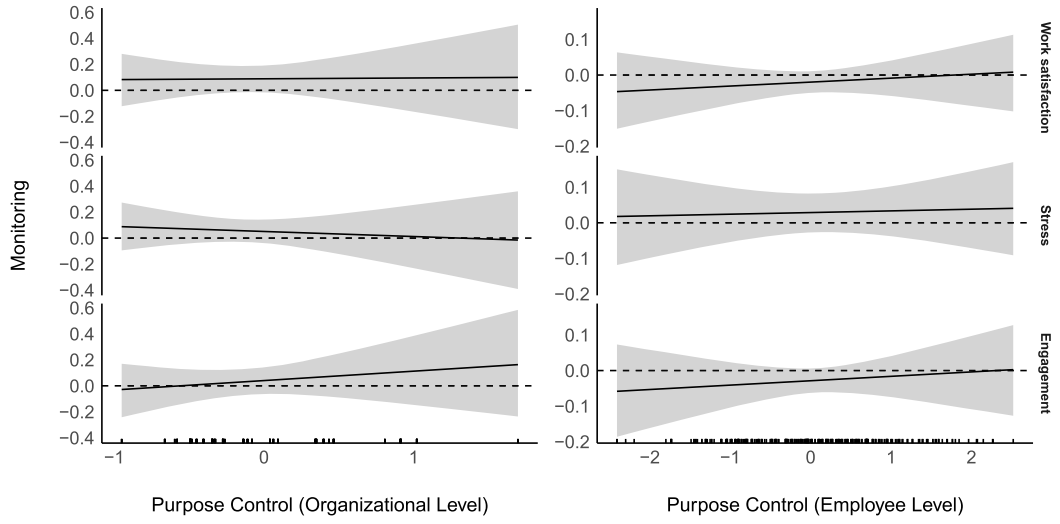

Fig. B2. Johnson-Neyman Plot to Examine the Interaction Between Controlling Purpose and the Monitoring Index. *Note*. See Fig. B1 for more information.

B.2 Hypothesis 4

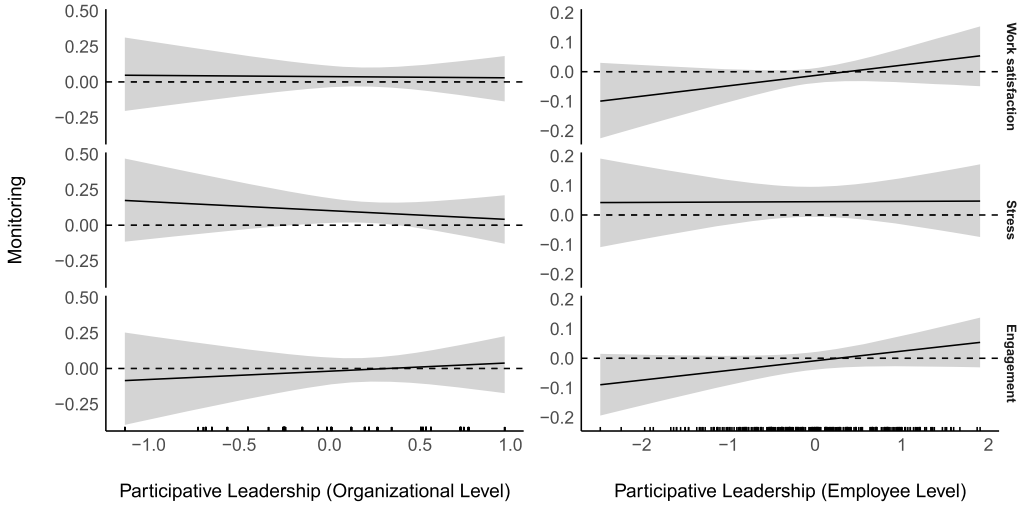

Fig. B3. Johnson-Neyman Plot to Examine the Interaction Between Participative Leadership and the Monitoring Index. *Note*. See Fig. B1 for more information.

B.3 Hypothesis 6

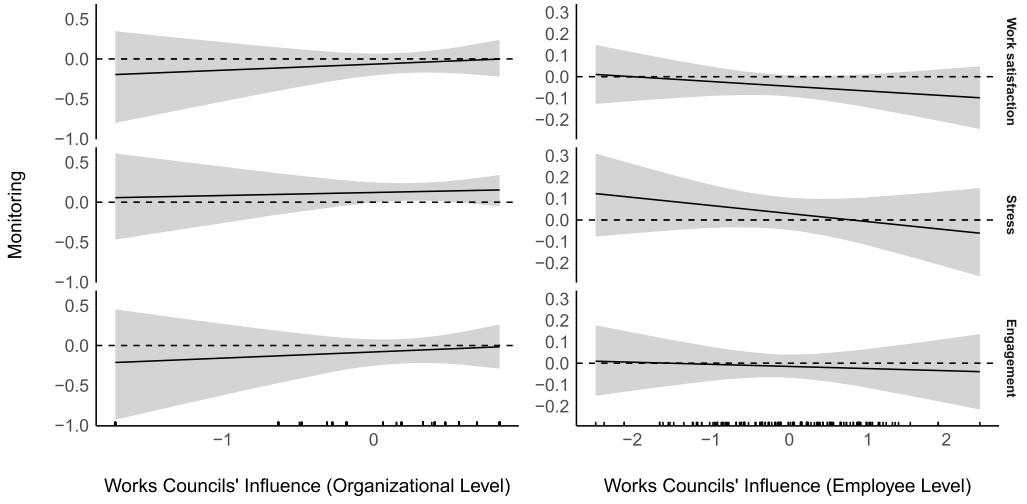

Fig. B4. Johnson-Neyman Plot to Examine the Interaction Between Works Councils' Influence and the Monitoring Index. *Note*. See Fig. B1 for more information.

Data availability

All files to reproduce statistical analysis and reports of statistics are available at the Open Science Framework (https://osf.io/xkq2b/).

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