A Meta-Analysis of the Effects of Digital Surveillance of Workers: A Psychology Focused Approach

Daniel M. Ravid

Jerod C. White

David L. Tomczak

Ahleah F. Miles

Tara S. Behrend

The George Washington University

Abstract

Digital surveillance of workers, also known as electronic performance monitoring (EPM), is increasing as individuals shift to remote work. We conducted a meta-analysis of the effects of EPM on workers, while taking into account the psychological characteristics of the monitoring. We found that organizations that monitor more transparently and less invasively can expect more positive attitudes from workers. We also found that monitoring without an explicit purpose was not associated with any increases in performance. Finally, we found that regardless of monitoring characteristics, individuals tend to find EPM as stressful. Results highlight that even as advances in technology make possible a variety of ways to monitor workers, organizations must continue to consider the psychological component of work. While it is tempting to monitor based on new technological capabilities, organizations should instead rely on the principles of human resource management to guide monitoring practices.

Keywords: electronic performance monitoring; meta-analysis; performance management

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Amid the COVID-19 pandemic, millions have shifted to remote work to ensure social distancing. In turn organizations have been forced to consider the consequences of electronic training, assessment, supervision, and performance management. Though this emergency dramatically increased the need for remote monitoring, extensive digital work surveillance practices were already ubiquitous for many workers. For example, many nurses are subject to location tracking via GPS [8] and hygiene tracking via electronic sanitizer dispensers [18]; RFID (radio-frequency identification) technologies track the productivity of manufacturing employees [23]; police-civilian interactions are tracked via body cameras [1]; and Walmart patented audio surveillance technology to track employee behaviors as customers check out [30].

Digital surveillance of workers, also known as electronic performance monitoring (EPM), is the use of technology to observe, record, and analyze information that directly or indirectly relates to employee job performance [32]. Unlike traditional close supervision, employers who use EPM can monitor individuals continuously or intermittently; discreetly or intrusively, and with or without warning or consent [3]. EPM can target internal states (e.g., biometric data) and private behaviors (e.g., email content, social media monitoring) that cannot be tracked via traditional means. Further, unlike traditional monitoring, where data is often collected deliberately, EPM allows for continuous data collection with little concern for its ultimate purpose. Advances in microtechnology and a shift of work into cyberspace has allowed for the monitoring of individuals in a variety of new, invasive, and relatively inexpensive ways [33]. As a result, there is increasing development and proliferation of work monitoring technologies [13], with the risk that the psychological effects of using such monitoring are often

ignored. Indeed, prior research suggests that EPM has the potential to negatively affect individual's experiences and performance at work [14,28,31]. Given the ubiquity of EPM today and its distinctiveness from traditional close supervision, a psychologically focused understanding of how individuals perceive and respond to EPM is critical to understanding modern work.

Over the past twenty years, researchers have diverged from examining EPM as unidimensional (i.e., present vs absent) towards a more precise exploration of the effects of EPM characteristics. EPM should be understood as multi-dimensional with varying psychological effects. Ravid, Tomczak, White, and Behrend [24] proposed a psychology-focused typology of EPM characteristics to organize the EPM literature. The current study builds on Ravid and colleagues' qualitative review by empirically synthesizing the EPM literature using the proposed typology and meta-analytic techniques.

We conducted two separate meta-analyses. The first meta-analysis (EPM Presence analysis) examines individual-level work outcomes for electronically monitored individuals compared to unmonitored individuals. We first examine the effects of EPM writ large on individuals, ignoring the differing psychological characteristics that may exist in EPM across studies, and then examine the degree to which psychological characteristics of EPM moderate those effects.

Additionally, a sizable body of the EPM literature has not included a control group of unmonitored participants, but instead directly compared the effects of EPM varying on a specific psychological characteristic (e.g., transparent monitoring versus less transparent monitoring). We therefore conducted a second meta-analysis (EPM Degree meta-analysis) to examine the relative effects of EPM with varying degrees of a specific psychological characteristic. Collectively,

these meta-analyses help to clarify the effects of EPM on working individuals and lay a foundation for future EPM research.

EPM Characteristics

We propose that the psychological effects of EPM on work outcomes largely depend on the characteristics of the monitoring. The behaviors that are emphasized and constrained, the contingencies that are strengthened, and the values that are signaled to individuals by EPM vastly differ depending on the characteristics of monitoring. Ravid and colleagues [24] proposed that effects of monitoring on individual-level work outcomes depend on interactions among the *purpose*, *invasiveness*, *synchronicity*, and *transparency* of the monitoring. Below, we briefly describe each of these EPM characteristics [for a fuller discussion of each characteristic, see 24].

Purpose

EPM Purpose is the communicated function of or rationale for EPM use. It has four categories:

Performance Appraisal, Loss Prevention, and Profit. EPM used for performance appraisal, loss prevention, and profit (Performance EPM) intends to incentivize effort and performance through between-individual comparisons, strengthening of performance contingencies, and discouragement of loafing and deviant work behaviors [24]. A defining characteristic of Performance EPM is that it intends to hold individuals accountable for performance behaviors and is often used for rewards and punishments.

Development, Growth, and Training. EPM used for development, growth, and training, (Development EPM) intends to provide individuals with constructive performance feedback to identify strengths and weaknesses and aid in learning, skill acquisition, and performance improvement over time [24]. Development EPM typically does not tie performance directly to

rewards or punishments, but instead appeals to an individual's own desire to grow or develop.

Administrative and Safety EPM. Administrative and Safety EPM refers to monitoring with the purpose of documenting behavior for legal, administrative, or informational purposes or protect employees and organizations from harm. [24]. Some examples of Administrative and Safety EPM include video monitoring for job analysis (e.g., better understanding how a job is performed) or body-worn cameras for police officers to encourage safe interactions with civilians [1].

Surveillance EPM. Surveillance EPM describes monitoring that is implemented without any explicit rationale, beyond the collection of and access to employee information. Surveillance EPM describes monitoring without any clear purpose.

Invasiveness

Invasiveness describes the intrusiveness and constricting nature of EPM as it relates to an individual's sense of privacy or autonomy. Invasiveness has several sub-elements:

Scope. The scope of EPM is the number of ways an individual is monitored (*breadth*) and the degree to which EPM data are individualized or aggregated at a group level (*specificity*). The breadth of EPM places presence or absence on a continuous scale and therefore is likely more predictive in combination with other EPM characteristics. The *specificity* of EPM describes the level of analysis at which electronic monitoring takes place, ranging from most specific (i.e., individual level) to least specific (i.e., organizational level).

Target. EPM target refers to the qualitative foci of monitoring, including the kinds of information collected. Ravid and colleagues [24] posit that the most invasive target of EPM is the monitoring of a person's personal thoughts, feelings, or physiology (e.g., tracking personal e-mail content, biometric monitoring), followed by targeting a person's body or physical location

(e.g., GPS tracking, video monitoring), and EPM that targets task performance (e.g., typing speed).

Constraints and Target Control. *Constraints* are the extent an organization limits how and when EPM data is collected, including who can access the data and how it is used [24]. *Target control* is the extent that individuals have control over the methods and timing of monitoring. Constraints and target control represent explicit parameters placed on the expansiveness and invasiveness of monitoring.

Synchronicity

Synchronicity describes the temporal characteristics of EPM, both the *synchronicity of data collection* and the *synchronicity of delivery of feedback* [24]. Highly synchronous data collection involves continuously gathering information about employee behavior, while asynchronous data collection is periodic or passive (e.g., stored for viewing later). Synchronous feedback systems provide feedback to employees as they work, whereas asynchronous feedback may be an aggregated report of employee performance.

Transparency

EPM Transparency describes the degree to which individuals are privy to information regarding monitoring characteristics [24]. Transparency is a continuous measure ranging from the provision of no information about EPM practices, to the provision of all details (e.g., purpose, invasiveness, synchronicity).

Summary

Existing research suggests that EPM characteristics play a large part in how individuals perceive and respond to monitoring. The characteristics of EPM direct attention and effort towards different work tasks [7]; send differing signals about one's standing within and value to

an organization [19]; and shape perceptions about the fairness of organizational practices [20]. We expect that when examining the effects of EPM on work outcomes, accounting for monitoring characteristics should explain significant variance in the attitudes and behaviors of working individuals.

The current study represents the first systematic meta-analysis of EPM that takes into account the characteristics of the monitoring. Rather than proposing formal a-priori hypotheses regarding the relationship between specific EPM characteristics and work outcomes, we take a boarder and more exploratory approach that sets a foundation for future research to examine the effects of EPM more narrowly and under more specific circumstances. Our meta-analysis will further highlight aspects of EPM that have been well researched and aspects that remain un- or understudied.

Method

We conducted two separate meta-analyses. In the EPM Presence meta-analysis, we examine effects of EPM on work outcomes compared to no EPM and examine the characteristics of monitoring as between-study moderators. Second, to incorporate studies that investigated the effects of varying EPM characteristics directly (e.g. invasive and less invasive EPM), we conduct the EPM Degree meta-analysis.

Literature Search

We set nine inclusion/exclusion criteria for our meta-analyses prior to our literature search. We conducted an extensive literature search between June and October of 2019 with supplementary searches conducted in December of 2019. We started by searching Web of Science using combinations of key words related to electronic monitoring (e.g., computer monitoring, performance monitoring, computer surveillance) and then refined results to only

articles from psychology-, management-, business-, and human-resource-related fields. We next read titles and abstracts collecting citations to relevant articles and read each article to select only those that fit our inclusion criteria. Consistent with meta-analytic best practices [2,9], we included unpublished master's theses, doctoral dissertations, and conference papers by searching the ProQuest Dissertations and Theses database and also searched within conference programs of the Academy of Management Annual Meeting, the Society for Industrial-Organizational Psychology Annual Conference, and the American Sociological Association Annual Meeting from 2010 to 2019. In total, our meta-analytic database included data from $K = 67$ sources, $K = 73$ independent samples, and $N = 17{,}512$ individuals.

Study Coding

Four authors were responsible for coding all data. Prior to coding, authors took part in trainings to learn coding criteria and discuss independently coded exemplar studies. Next, study samples were split evenly, with two authors responsible for coding each independent sample in the meta-analytic database. All disagreements were reconciled through group discussion.

All studies that included a control group of nonmonitored individuals were coded and included in the EPM Presence meta-analysis, while studies that did not include a nonmonitored comparison group were coded for the Degree meta-analysis. Next, all studies were coded for EPM characteristics. When EPM characteristics were not clearly defined, they were derived from the monitoring rationale provided to study participants (e.g., if participants in a study were told that they were being monitored to compare them against others or some performance standard, the purpose was coded as "performance"). There were several characteristics from Ravid and colleague's typology not coded in the EPM Presence meta-analysis (i.e.., transparency, target control, constraints, breadth), as we did not feel there was sufficient justification for discerning

what constituted high or low levels of these characteristics. Therefore, these characteristics were not included in the EPM Presence analysis. Other characteristics were not included due to an insufficient sample (i.e., $K < 3$). A supplement containing all inclusion criteria, precise literature search parameters, precise coding rules, and all studies included in the meta-analysis is available on request.

Meta-Analytic Procedures

All analyses were conducted in R using the psychmeta package [10]. We corrected observed correlations for sampling and measurement error and estimated meta-analytic effect size estimates using Hunter and Schmidt's [16] random effects procedures. Artifact distributions were used when reliabilities for multi-item scales were not reported [16]. Linear composites were calculated [16] when an independent sample reported multiple correlations for the same relationship between an EPM variable and an outcome. Finally, for the EPM Presence meta-analysis, EPM characteristics (i.e., purpose, target, synchronicity) were treated as moderators of the relationship between EPM presence and work outcomes. Following best practice, we used hierarchical subgroup moderator analysis due to the relatively small subgroup K [29].

In addition to the sample size-weighted correlation (r) and the sample size-weighted and reliability-corrected correlation (r_c), we report the 95% confidence interval and the 80% credibility interval for r_c, as well as the variance attributable to statistical artifacts (%var). A sample size-weighted and reliability-corrected correlation is considered statistically significant when its associated confidence interval does not include zero [26]. In addition, 95% confidence can be directly compared across different levels of the same moderator, with non-overlapping 95% confidence intervals suggesting that moderator subgroups are statistically different from one another ($p < 0.05$). When a credibility interval includes zero, moderators are likely present

[12]. Additionally, %var can be compared across different levels of a moderator. A higher %var signifies a greater amount of variance is accounted for by a predictor. Prior studies have typically applied the 75% rule [i.e., a moderator is likely present when the variance accounted for by statistical artifacts <75%; 24]

Findings

Meta-analytic results for the relationships between EPM characteristics and work outcomes are summarized in Table 1-4 for the EPM Presence meta-analysis and Table 5 for the EPM Degree meta-analysis. All relationships meeting our $K \geq 3$ criterion were included in the results; however, note that in many cases, there was not sufficient *K* to make outcome comparisons across all EPM characteristics. Readers should interpret results from analyses with small *K*s with caution. However, as Valentine, Pigott, and Rothstein [34] note, even when $K = 2$, meta-analysis is superior to other means of synthesis (e.g., the "cognitive algebra" where one tries to mentally integrate findings). We broadly summarize results below.

EPM Presence Meta-analysis

EPM Presence. As expected, results from the meta-analysis of EPM presence on attitudinal outcomes strongly suggested the presence of moderators for nearly all relationships. As shown in Table 1, confidence intervals for all relationships between EPM and attitudinal outcomes were wide, even for relationships with relatively large *K*'s (e.g., satisfaction), with confidence intervals for all attitudinal relationships except EPM with privacy invasion ($r_c = .34$, CI: .043; .641) containing 0. Further, the credibility intervals for all relationships between EPM and attitudinal outcomes except perceived privacy invasion and for all relationships between EPM and performance outcomes contained 0; and for all relationships, the variance attributable to statistical artifacts fell well short of the 75% rule, indicating the presence of moderators.

Table 1
EPM Presence Meta-analysis

EPM Characteristic	Work Outcome	*K*	*N*	*r*	r_c	SD_{rc}	CI_L	CI_U	%Var	CV_L	CV_U
EPM Presence	Broad attitudes	21	5400	-0.07	-0.08	0.23	-0.18	0.03	10.24	-0.36	0.21
	Fairness & justice	10	2879	-0.03	-0.04	0.17	-0.16	0.09	16.97	-0.25	0.18
	Satisfaction	11	3044	-0.02	-0.02	0.15	-0.12	0.08	22.95	-0.20	0.16
	Commitment	7	1746	-0.08	-0.10	0.29	-0.37	0.18	5.77	-0.51	0.31
	Privacy invasion	4	1689	0.32	0.34	0.19	0.04	0.64	6.17	0.04	0.64
	Autonomy	3	1123	-0.11	-0.12	0.09	-0.33	0.10	41.64	-0.24	0.01
	Support	3	936	0.19	0.22	0.22	-0.32	0.76	8.91	-0.17	0.62
	Broad performance	37	6304	0.05	0.05	0.18	-0.01	0.12	17.31	-0.18	0.28
	Task performance	26	3714	0.10	0.11	0.19	0.03	0.19	17.69	-0.12	0.26
	Contextual performance	9	2291	-0.01	-0.01	0.15	-0.12	0.11	23.33	-0.19	0.18
	Learning	5	1344	-0.01	-0.01	0.08	-0.10	0.09	67.37	-0.07	0.06
	Motivation & engagement	7	1220	0.08	0.09	0.09	0.01	0.17	79.86	0.03	0.15
	Stress & strain	21	3467	0.17	0.19	0.08	0.15	0.23	74.35	0.15	0.23

Note. *K* = cumulative number of studies; *N*= cumulative sample size; r = sample size-weighted correlation; r_c = sample size-weighted and reliability-corrected correlation; SD_{rc} = standard deviation of r_c; CI =95% confidence interval for r_c; CV= 80% credibility interval for r_c; %var. = variance attributable to statistical artifacts (sampling error & unreliability).

Although the EPM presence significantly and positively related to work motivation and engagement (r_c = .08, CI: .004; .170), upon further inspection, we noticed there was very little variation in EPM Purpose or synchronicity for studies measuring motivation and engagement. The majority of studies included in analysis were coded as Performance EPM and synchronous collection. Thus, there was insufficient variance to examine purpose or synchronicity as a moderator of this relationship, nor can we draw inferences from these results about the broad effect of monitoring on motivation and engagement.

The relationship between EPM presence and stress and strain was positive and significant (r_c = .19, CI: .148; .230), with a credibility interval that did not include 0 and a %var nearly

meeting the 75% rule (%var = 74.35). Of note, no studies of Development EPM measured any stress or strain outcomes. There were sufficient samples of other EPM purposes included in analyses however, as well as variation in EPM target, and synchronicity of collection. As shown in Tables 1-4, all levels of purpose, target, and synchronicity were positively and significantly related to stress and strain, and no level of the moderators significantly differed from another. These results suggest that mere the presence of EPM may increase stress in those monitored.

Table 2

EPM Presence Meta-analysis with Purpose Included as A Hierarchical Moderator

EPM Characteristic	Work Outcome	*K*	*N*	*r*	r_c	SD_{rc}	CI_L	CI_U	%Var	CV_L	CV_U
Performance	Broad attitudes	9	1987	-0.18	-0.20	0.23	-0.38	-0.03	10.81	-0.50	0.10
	Fairness & justice	5	1423	-0.10	-0.12	0.21	-0.37	0.14	12.54	-0.41	0.18
	Satisfaction	3	940	-0.05	-0.06	0.11	-0.34	0.22	42.13	-0.22	0.10
	Broad performance	17	2524	0.05	0.05	0.13	-0.01	0.12	50.61	-0.07	0.17
	Task performance	11	1154	0.08	0.08	0.12	0.01	0.17	76.02	0.00	0.17
	Contextual performance	5	1388	0.05	0.05	0.16	-0.14	0.25	19.37	-0.17	-0.27
	Learning	3	942	-0.07	-0.07	0.08	-0.26	0.12	54.51	-0.16	0.03
	Motivation & engagement	7	1220	0.08	0.09	0.11	-0.01	0.19	45.00	-0.02	0.19
	Stress & strain	10	865	0.14	0.15	0.09	0.09	0.22	100.00	0.15	0.15
Development	Broad attitudes	3	651	0.15	0.20	0.31	-0.26	0.61	10.38	-0.35	0.75
Administrative	Broad attitudes	3	771	0.04	0.05	0.02	0.01	0.10	100.00	0.05	0.05
& Safety	Broad performance	12	2281	0.15	0.16	0.22	0.01	0.30	11.11	-0.13	0.45
	Task performance	10	1848	0.19	0.20	0.23	0.03	0.36	11.50	-0.10	0.49
	Stress & strain	4	538	0.15	0.16	0.13	-0.04	0.37	51.99	0.02	0.31
Surveillance	Broad attitudes	3	432	-0.24	-0.27	0.13	-0.59	0.05	25.13	-0.44	0.10
	Broad performance	9	973	-0.06	-0.07	0.15	-0.18	0.05	41.97	-0.23	0.10
	Task performance	8	915	-0.05	-0.05	0.14	-0.17	0.07	44.27	-0.20	0.10
	Stress & strain	6	783	0.18	0.19	0.11	0.08	0.30	41.37	0.11	0.27

Note. *K* = cumulative number of studies; *N*= cumulative sample size; r = sample size-weighted correlation; r_c = sample size-weighted and reliability-corrected correlation; SD_{rc} = standard deviation of r_c; CI =95% confidence interval for r_c; CV= 80% credibility interval for r_c; %var. = variance attributable to statistical artifacts (sampling error & unreliability).

EPM Purpose. Subgroup meta-analysis results for the effects of purpose on work outcomes were mixed in terms of their explanatory power, compared to results from EPM presence on work outcomes. In terms of the moderating effect of EPM Purpose on attitudinal outcomes, the effects of Performance EPM (r_c = -.20, CI: -.379; -.028) and Administrative and Safety EPM (r_c = .05, CI: .009; .095) on broad attitudes were significantly different from each other; however, note the small sample (*K*=3) for Administrative and Safety EPM. Further, the effect of Surveillance EPM and Developmental EPM on broad attitudinal outcomes trended negative and positive respectively, although neither effect was significant. Credibility intervals for nearly all relationships included 0, indicating the presence of further moderators.

Results from subgroup meta-analysis of the effects of purpose on performance outcomes largely suggest that accounting for the purpose of EPM helps explain variance in performance outcomes, particularly for task performance. Whereas the relationships between Performance EPM and task performance (r_c = .08, CI: .002; .165) and Administrative and Safety EPM and task performance (r_c = .19, CI: .033; .356) were positive and significant, the relationship between Surveillance EPM and task performance trended negative, although not significantly. Although all credibility intervals for analyses of EPM purposes and performance outcomes contained 0, the %var for these relationships were broadly greater than those found in the analysis of presence, indicating that accounting for EPM Purpose likely better explains variance in performance outcomes than EPM presence alone. Note there was an insufficient sample of studies (*K*= 2) examining the effects of Development EPM on performance outcomes.

EPM Target. Results from the subgroup meta-analysis of EPM target with work outcomes did not reveal any significant differences in the effects of task-targeted EPM and person-targeted EPM on any attitudinal outcomes or on motivation and engagement; further,

neither credibility intervals nor %var generally suggested that this subgroup analysis accounted for more variance in these outcomes than the analysis of EPM presence. Results from analysis of target on performance outcomes showed that person-targeted EPM positively and significantly related to broad performance (r_c = .17, CI: .037; .312) and more narrowly, task performance (r_c = .19, CI: .034; .338), while results for task-targeted EPM and performance were non-significant. Credibility intervals for all relationships included 0.

Table 3

EPM Presence Meta-Analysis with EPM Target Included as a Hierarchical Moderator

EPM Characteristic	Work Outcome	*K*	*N*	*r*	r_c	SD_{rc}	CI_L	CI_U	%Var	CV_L	CV_U
Task Targeted	Broad attitudes	13	3319	-0.02	-0.02	0.24	-0.16	0.13	8.98	-0.33	0.29
	Fairness & justice	5	1409	0.02	0.02	0.11	-0.11	0.16	38.12	-0.11	0.15
	Commitment	3	355	-0.25	-0.29	0.09	-0.52	-0.06	100.00	-0.29	-0.29
	Broad performance	21	2793	-0.02	-0.03	0.15	-0.09	0.04	41.76	-0.17	0.12
	Task performance	16	1690	0.01	0.01	0.14	-0.07	0.08	56.57	-0.12	0.13
	Contextual performance	3	860	-0.02	-0.02	0.24	-0.62	0.58	8.03	-0.46	0.42
	Motivation & engagement	3	238	0.06	0.07	0.20	-0.42	0.55	36.90	-0.23	0.36
	Stress & strain	14	1942	0.15	0.17	0.10	0.11	0.23	82.68	0.11	0.23
Person Targeted	Broad attitudes	8	2083	-0.11	-0.13	0.30	-0.38	0.12	5.55	-0.55	0.29
	Fairness & justice	4	1139	-0.13	-0.15	0.21	-0.49	0.18	11.42	-0.48	0.17
	Commitment	5	1473	-0.04	-0.05	0.31	-0.43	0.34	4.70	-0.51	0.42
	Broad performance	14	2303	0.16	0.17	0.24	0.04	0.31	12.80	-0.13	0.46
	Task performance	11	2066	0.18	0.19	0.23	0.03	0.34	10.78	-0.11	0.48
	Contextual performance	3	236	0.04	0.05	0.27	-0.63	0.73	23.05	-0.40	0.50
	Motivation & engagement	3	212	0.04	0.04	0.10	-0.21	0.29	100.00	0.04	0.04
	Stress & strain	9	1561	0.20	0.22	0.12	0.13	0.32	42.83	0.09	0.35

Note. *K* = cumulative number of studies; *N*= cumulative sample size; r = sample size-weighted correlation; r_c = sample size-weighted and reliability-corrected correlation; SD_{rc} = standard deviation of r_c; CI =95% confidence interval for r_c; CV= 80% credibility interval for r_c; %var. = variance attributable to statistical artifacts (sampling error & unreliability).

Synchronicity of Collection. Results from the subgroup meta-analysis of synchronicity of collection and work outcomes revealed no significant differences between synchronous and asynchronous EPM. The effect of synchronous EPM on broad attitudinal outcomes, however, was significant and negative (r_c = -.23, CI: -.426; -.012), while the effect of asynchronous EPM on broad attitudinal outcomes trended positive and was non-significant. Neither the credibility intervals nor the %var represented improvements on the relationship between presence and attitudinal outcomes.

Table 4

EPM Presence Meta-Analysis with Synchronicity Included as a Hierarchical Moderator

EPM Characteristic	Work Outcome	*K*	*N*	*r*	r_c	SD_{rc}	CI_L	CI_U	%Var	CV_L	CV_U
Synchronous Collection	Broad attitudes	6	710	-0.19	-0.22	0.20	-0.43	-0.01	5.43	-0.47	0.03
	Satisfaction	4	357	-0.11	-0.13	0.21	-0.46	0.22	34.00	-0.41	0.16
	Broad performance	20	1787	0.01	0.01	0.17	-0.07	0.06	46.81	-0.16	0.17
	Task performance	18	1639	0.02	0.02	0.16	-0.06	0.10	48.27	-0.13	0.17
	Stress & strain	14	1200	0.17	0.18	0.11	0.12	0.25	100.00	0.18	0.18
Asynchronous Collection	Broad attitudes	7	1842	0.00	0.00	0.27	-0.25	0.25	7.23	-0.36	0.37
	Satisfaction	3	837	0.02	0.03	0.24	-0.56	0.62	8.88	-0.40	0.45
	Broad performance	13	2567	0.11	0.12	0.25	-0.04	0.27	9.66	-0.21	0.44
	Task performance	8	1866	0.17	0.17	0.24	-0.03	0.38	7.65	-0.16	0.50
	Stress & strain	7	1500	0.19	0.21	0.10	0.12	0.30	55.24	0.12	0.30

Note. *K* = cumulative number of studies; *N*= cumulative sample size; r = sample size-weighted correlation; r_c = sample size-weighted and reliability-corrected correlation; SD_{rc} = standard deviation of r_c; CI =95% confidence interval for r_c; CV= 80% credibility interval for r_c; %var. = variance attributable to statistical artifacts (sampling error & unreliability).

Summary. When analyzing the relationships between EPM presence and work-outcomes, and ignoring the psychological characteristics of the monitoring, results indicate that moderators are present in approximately 81% of relationships. Exceptions include the effect of EPM on perceived privacy invasion (r_c = .34, CI: .043; .641), work motivation and engagement

(r_c = .08, CI: .004; .170), and stress and strain outcomes (r_c = .19, CI: .148; .230). Although including the individual psychological characteristics as moderators of the relationships helped explain greater amounts of variance in the outcome in some cases (e.g., including Purpose as a moderator helped to explain variance in performance outcomes), overall, results suggest that significant moderators remain even when accounting for individual psychological characteristics.

EPM Degree Meta-analysis

Effect sizes found in the EPM Degree meta-analysis represent the relative effects of monitoring with varying degrees of EPM characteristics.

Invasiveness. Greater invasiveness (i.e., EPM with greater breadth, more specificity, or less target control) negatively and significantly related to broad attitudinal outcomes (r_c = -.17, CI: -.249; -.083). More narrowly, greater invasiveness was negatively and significantly related to fairness and justice perceptions (r_c = -.16, CI: -.293; -.019) and autonomy (r_c = -.22, CI: -.312; -.121), and positively and significantly related to privacy invasion (r_c = .17, CI: .023; .323). Further, more invasive EPM was negatively related to broad performance outcomes (r_c = -.22, CI: -.424; -.012). Note that there was an insufficient sample of primary studies (*K = 2*) comparing the effects of EPM with varying specificity to analyze the effects of specificity on its own, but specificity artifacts were included in the broader analysis of EPM Invasiveness.

Regarding the sub-elements of invasiveness, breadth was significantly and negatively related to autonomy perceptions (r_c = -.24, CI: .318; -.169; although *K* was small), but not significantly related to any other work outcome. Greater target control over EPM, however, positively and significantly related to broad attitudinal outcomes (r_c = .24, CI: .118; .360). More narrowly, greater target control positively and significantly related to fairness and justice (r_c = .26, CI: .111; .408) and negatively related to privacy invasion (r_c = -.15, CI: -.265; -.032).

Table 5
EPM Degree Meta-Analysis

EPM Characteristic	Work Outcome	*K*	*N*	*r*	r_c	SD_{rc}	CI_L	CI_U	%Var	CV_L	CV_U
Invasiveness	Broad attitudes	17	5800	-0.15	-0.17	0.16	-0.25	-0.08	14.89	-0.37	0.03
	Fairness & justice	9	3190	-0.14	-0.16	0.18	-0.29	-0.02	10.47	-0.39	0.08
	Satisfaction	4	703	-0.05	-0.05	0.24	-0.44	0.34	11.17	-0.43	0.32
	Commitment	3	892	-0.15	-0.18	0.15	-0.55	0.18	27.53	-0.42	0.05
	Privacy invasion	6	2303	0.16	0.17	0.14	0.02	0.32	13.69	-0.37	0.02
	Autonomy	5	1502	-0.18	-0.22	0.08	-0.31	-0.12	76.49	-0.27	-0.16
	Broad performance	6	1153	-0.20	-0.22	0.20	-0.42	-0.01	15.64	-0.49	0.05
	Contextual performance	4	968	-0.17	-0.19	0.20	-0.51	0.13	12.10	-0.50	0.12
	Motivation & engagement	3	960	-0.06	-0.06	0.12	-0.35	0.22	29.92	-0.25	0.12
	Stress & strain	4	1396	0.13	0.15	0.14	-0.08	0.37	18.64	-0.06	0.36
Breadth	Broad attitudes	11	4614	-0.10	-0.17	0.15	-0.22	-0.01	12.76	-0.31	0.08
	Fairness & justice	6	2678	-0.04	-0.04	0.15	-0.20	0.12	10.87	-0.25	0.17
	Privacy Invasion	4	1719	0.13	0.14	0.21	-0.20	0.48	5.67	-0.20	0.48
	Autonomy	3	1204	-0.20	-0.24	0.03	-0.32	-0.17	100.00	-0.24	-0.24
	Contextual performance	3	778	-0.23	-0.25	0.17	-0.67	0.16	16.40	-0.54	0.04
	Stress & strain	3	1204	0.15	0.17	0.15	-0.20	0.54	15.18	-0.09	0.43
Target control	Broad attitudes	10	2966	0.21	0.24	0.17	0.12	0.36	16.26	0.03	0.45
	Fairness & Justice	7	2292	0.24	0.26	0.16	0.11	0.41	14.26	0.05	0.47
	Satisfaction	3	377	-0.06	-0.07	0.16	-0.46	0.33	37.04	-0.30	0.17
	Privacy invasion	5	2066	-0.14	-0.15	0.09	-0.27	-0.03	29.76	-0.27	-0.03
	Broad performance	3	375	0.06	0.06	0.25	-0.55	0.69	14.48	-0.37	0.50
Transparency	Broad attitudes	13	3559	0.22	0.24	0.24	0.10	0.39	8.33	-0.06	0.55
	Fairness & justice	8	2495	0.20	0.22	0.22	0.04	0.41	7.57	-0.08	0.53
	Satisfaction	4	1070	0.31	0.38	0.21	0.05	0.71	12.38	0.06	0.70
	Commitment	6	1451	0.24	0.29	0.22	0.06	0.52	11.48	-0.02	0.60
	Privacy invasion	3	1471	-0.08	-0.08	0.05	-0.20	0.03	100.00	-0.08	-0.08
	Support	5	1143	0.31	0.37	0.24	0.07	0.66	10.38	0.02	0.71
	Broad performance	5	864	0.08	0.10	0.13	-0.06	0.25	56.84	-0.03	0.22
	Contextual performance	3	501	0.10	0.13	0.17	-0.30	0.56	31.50	-0.14	0.40

Note. *K* = cumulative number of studies; *N*= cumulative sample size; r = sample size-weighted correlation; r_c = sample size-weighted and reliability-corrected correlation; SD_{rc} = standard deviation of r_c; CI =95% confidence interval for r_c; CV= 80% credibility interval for r_c; %var. = variance attributable to statistical artifacts (sampling error & unreliability); Invasiveness = EPM that is greater in breadth, higher in specificity, and has fewer constraints and less target control.

Transparency. EPM transparency was positively and significantly related to broad attitudinal outcomes (r_c = .24, CI: .101; .385). More narrowly, greater transparency was positively and significantly related to fairness and justice (r_c = .22, CI: .035; .408), commitment (r_c = .24, CI: .058; .520), feelings of support (r_c = .365, CI: .073; .658), and satisfaction (r_c = .377, CI: .045; .709). There was an insufficient sample to test the relationship between transparency and task performance (K = 2) or transparency and stress outcomes (K = 2).

Summary. Results from the EPM Degree meta-analysis indicate moderate-strength and significant relationships between more invasive EPM (i.e., EPM that is greater in breath, has fewer constraints, and provides individuals with less control) and a variety of negative attitudinal outcomes. Positive relationships exist between greater transparency in EPM use and several important attitudinal work outcomes.

Discussion

Popular press coverage suggests that organizations are incorporating electronic monitoring to track individuals as they work remotely [22,27]. Electronic forms of safety monitoring (e.g., location tracking to ensure safe distancing) may be required as individuals return to workplaces. We synthesized extant empirical findings of the relationship between EPM and work outcomes, examined the degree that accounting for the psychological characteristics of monitoring improves the ability to predict the attitudes and work behaviors of individuals, and identified areas in the EPM literature still in need of research.

Summary and Interpretation of Findings

As expected, the presence/absence of EPM alone was generally a weak predictor of work outcomes. One exception was the relationship with stress and strain outcomes, indicating that the presence of EPM increases stress, regardless of monitoring characteristics. Organizations should

recognize that even when the intent of EPM is not for evaluation, it may still increase stress in monitored individuals. Notably, no studies examining Development EPM were included in analyses of stress and strain. It is possible that individuals feel significantly less stressed when they perceive EPM to be for developmental purposes, and future research should examine this possibility.

Regarding our moderator analysis, accounting for a single EPM characteristic (i.e., purpose, target, synchronicity) generally did not greatly clarify the relationships between EPM and work outcomes. One exception involved EPM Purpose and task performance; our results suggest the effects of EPM on task performance likely vary across communicated purposes. Organizations communicating EPM as for performance, loss prevention, safety, or administrative purposes are likely to see positive outcomes for task performance, while EPM for surveillance purposes may have little or even negative effects on task performance. The implication is that organizations that use EPM to simply reassert the control lost from remote work are likely to be met with negative employee reactions and performance.

The EPM Degree meta-analysis provided clearer results regarding the relative effects of varying levels of EPM characteristics on work outcomes—specifically work attitudes. Greater invasiveness was generally associated with more negative attitudes without evidence of associated performance increases. In fact, results showed that more invasive EPM may result in decreases in contextual performance, suggesting that highly invasive EPM may be counterproductive in many circumstances. Results similarly suggested that even as monitoring technologies become increasing discreet and unobtrusive, organizations monitoring transparently rather than secretively can expect more favorable employee reactions.

Results from the current study may be particularly important in this moment, as many

organizations consider ways to monitor employees remotely. Our meta-analysis demonstrates that organizations should communicate a clear purpose for monitoring, one that connects to organizational and individual goals. Further, despite the advent of increasingly invasive forms of EPM (e.g., physiological monitoring), we recommend organizations be only as invasive as absolutely necessary when monitoring. Finally, our meta-analyses present clear evidence that organizations should maximize transparency when using EPM to minimize negative work attitudes in monitored individuals.

Limitations and Future Research

The current study has several limitations worth noting. First, meta-analyses are constrained by the population of studies available for a given research question. Consequently, there were several aspects of the EPM typology we could not test due to an absence of primary studies, and other characteristics were included but can be regarded as understudied (i.e. $K \leq 5$). For example, we were unable to include synchronicity of feedback in either meta-analysis. The future of work may be characterized by rapid and near instant behavioral and performance feedback; additional research is needed to understand how real time synchronous work feedback may influence performance, attitudes, and stress.

We could not examine the effects of Administrative and Safety EPM, Development EPM, or Surveillance EPM on any specific attitudinal outcomes, or the effects of Development EPM on stress and strain outcomes. Given the rapid increase in virtual and augmented reality technologies organizations use to track, train, and develop employees [i.e., Development EPM; e.g., 25], research should examine how Development EPM affects monitored individuals. Likewise, few primary studies have examined EPM technologies targeting individuals' thoughts, feelings, and physiology, which are among the most invasive forms of monitoring [17] and are

increasingly prevalent in workplaces [6,21].

Table 6
Avenues for Future EPM Research and Example Research Questions

Unstudied and understudied areas from the EPM characteristics typology
• How will individuals respond to increasingly invasive monitoring such as physiological tracking? • How will the use of Development EPM, including virtual and augmented reality trainers, affect work attitudes, and performance in the short term and long term? • To what degree does Development EPM (e.g., advanced trainers) induce stress and strain responses? • How might safety-focused EPM (e.g., RFID safety badges) affect contextual performance and safety behaviors? • How will the effects of EPM on work outcomes differ as a result of the synchronicity of performance feedback (i.e., instant feedback vs delayed)? • How does greater transparency in monitoring influence performance outcomes?
Unexamined potential work-related outcomes of EPM
• To what degree does the presence of EPM technologies during non-work periods (e.g., rest breaks) influence recovery experiences (e.g., detachment)? • To what extent does EPM influence organization-level work outcomes such as work climate and culture? • How does the use of EPM affect individuals' perceptions of management and organizational leadership?
More complex relationships between EPM characteristics and work outcomes such as mediators and individual and contextual moderators
• How do occupational characteristics (e.g., job complexity, automatability) interact with EPM characteristics to influence individual-level work outcomes? • How do individual differences (e.g., intelligence, personality, trait reactance, age, experience with monitoring) interact with the psychological characteristics of monitoring to predict work outcomes? • To what extent does work setting (e.g., central office, home office) moderate the effects of EPM on work outcomes such as privacy invasion and perceived justice? • How does national culture interact with EPM characteristics to influence individual-level work outcomes? • How do the characteristics of monitoring interact with the passage of time to influence work outcomes (i.e., do individuals desensitize or sensitize to the effects of EPM over time)? • To what degree do more proximal outcomes of EPM (e.g., privacy invasion, loss of autonomy, justice perceptions) mediate the relationships between EPM characteristics and other work outcomes?

A main goal of this meta-analysis was to highlight areas in EPM research that remain under- or unstudied, and in particular, those that are likely to characterize the future of work. Our meta-analytic study, including characteristics of the typology not found in the results section, should serve to guide future EPM research by highlighting those aspects of EPM that are well researched (e.g., the effects of Performance EPM on task performance) and those that are not (see Table 6).

Second, our meta-analysis focused on the bivariate associations between EPM characteristics and work outcomes commonly represented in the current EPM literature. However, more complex relationships between EPM characteristics and such variables exist; future research should explore mediators of these relationships [e.g., perceived fairness of the monitoring; 5] and contextual moderators of these relationships such as occupational type [15] and national culture [4].

Given the mass transition to remote and distributed work during the pandemic emergency, and uncertainty about the full extent to which work will return to centralized workplaces following the pandemic, an understanding of how individuals perceive work monitoring in their home or personal space is greatly needed. Few studies have accounted for the work setting in which monitoring took place; however, monitoring that is perceived as appropriate in a centralized work location may be perceived as overly invasive elsewhere. Understanding how characteristics of monitoring interact with work settings may be an important aspect for future of work researchers.

Finally, in this study we used a synthetic construct approach. That is, theoretically similar outcomes were grouped and coded as single synthetic constructs. While this approach was necessary to accumulate a sufficient sample of work outcomes, it is likely to produce greater

between-study variance in outcomes, and thereby larger standard errors and inferential uncertainty, than if we were able to include relationships between EPM and single variables measured via a single method. Thus, the wide confidence intervals and non-significant results in this study are likely, in part, due to the variance attributable to measurement.

Conclusion

Advances in information technologies and the transition of much of work into cyberspace means that organizations can monitor employees in more ways and with greater intensity and detail than ever before. Recent reports suggest huge increases in work monitoring software development and use [11]. Despite such technological advances, organizations must not lose sight of the psychological principles that have long guided human resource policies and organizational monitoring practices. Our meta-analysis demonstrates that best practices in human resource management such as honesty, procedural transparency, and employee empowerment continue to be the most effective ways to get the best out of workers, even as new technologies allow for alternatives.

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