

# The Two Faces of Algorithmic Management in the Gig Economy

Antoine Bujold  
HEC Montréal  
[antoine.bujold@hec.ca](mailto:antoine.bujold@hec.ca)

Xavier Parent-Rochelleau  
HEC Montréal  
[xavier.parent-rocheleau@hec.ca](mailto:xavier.parent-rocheleau@hec.ca)

## Abstract

*Algorithmic management of workers is a relatively new phenomenon which impacts workers in diverse manners. The growing literature on this disruptive and technology-mediated form of management suggest that, through different mechanisms, it can result in both beneficial and harmful consequences. Aiming to examine these two faces empirically and simultaneously, time-lagged data was collected from 366 gig workers. The results show that, on the one hand, high perceived exposure to AM is associated to greater perceived procedural justice. On the other hand, workers reporting high AM exposure also perceive lower job autonomy. This has the simultaneous effect of indirectly fostering and worsening the level of gig workers' engagement.*

**Keywords:** Algorithmic management, gig work, job autonomy, work engagement, procedural justice.

## 1. Introduction

In today's workplace, technological advances, coupled with digitization and artificial intelligence, allow computer algorithms to automate tasks traditionally performed by managers (Duggan et al., 2020; Kellogg et al., 2020; Meijerink & Bondarouk, 2023; Parent-Rochelleau & Parker, 2022). This phenomenon has been termed algorithmic management (AM) (Lee et al., 2015).

AM is the main mode of management in the gig economy and platform work. Gig economy platforms operate through a technological intermediate responsible for the coordination and management of work and workers, such that there are normally no human managers (Duggan et al., 2020; Meijerink et al., 2021). In other words, gig workers have algorithms as bosses (Rosenblat, 2018; Möhlmann et al., 2021).

AM has received increasing interest from scholar due to its disruptive nature. So far, empirical research have mostly shown that that gig workers experience unfavorable outcomes under AM in terms of emotions, attitudes or behaviors and of working conditions and

work organization (for reviews: Baiocco et al., 2022; Gagné et al., 2022; Nojonen et al., 2023).

However, theoretical developments have pointed to the fact that AM could be more nuanced, heterogeneous, presenting both downsides for workers and potential benefits (Meijerink & Bondarouk, 2023; Parent-Rochelleau & Parker, 2022; Wiener et al., 2021). As a reflect on this complex relationship, the empirical literature remains equivocal on various behavioral or attitudinal reactions to AM. The present study focuses on work engagement as a core aspect of gig worker experience for which research has yielded inconsistent or contradictory findings, aiming to shed light at the mechanisms behind this complex relationship. Specifically, this study examines the impacts of perceived exposure to AM on work engagement among gig workers through two potential pathways: job autonomy and procedural justice. These constructs were chosen based on their relevance in the context of gig work, and the increasing but equivocal weight of evidence they have received.

## 2. Conceptualization and Hypotheses Development

### 2.1 Algorithmic management

In this study, AM is defined as “[...] a system of control that relies on machine-readable data and software algorithms that support and/or automate managerial decision-making about work” (Meijerink & Bondarouk, 2023, p. 3). Parent-Rochelleau et al. (2023) conceptualize 5 dimensions of AM; monitoring, goal setting, scheduling, performance rating, and compensation. We refer to AM as the extent to which workers perceive to be exposed to these 5 dimensions, forming a construct assessing overall exposure to AM. The definitions of those dimensions are presented in Table 1.

Even if some studies have focused on different subsets of AM (Wiener et al., 2021), this study focuses on the larger construct. Since AM is a “[...] multidimensional phenomenon involving several management functions that are partially or totally executed using algorithmic systems” (Parent-

**Table 1. Definitions of AM dimensions (from Parent-Rocheleau et al. 2023)**

Dimensions	Definitions
Monitoring	The use of algorithmic systems by organizations to collect, aggregate, and report data, usually in real time, on workers' behaviors and actions or on their work.
Goal setting	The use of algorithmic systems to assign tasks, organize employees' work, or set performance or productivity targets.
Scheduling	The use of algorithmic systems to determine or influence employees' schedules or working times.
Performance Rating	The use of algorithmic systems to appraise, rate or rank workers' performance or productivity, usually in real time, typically through the calculation of several metrics or quantified indicators
Compensation	The use of algorithmic systems to calculate workers' pay, typically based on algorithmically-managed conditions and metrics, and according to various indicators such as the number of tasks carried out, individual performance, customer satisfaction, or other data associated with, directly or indirectly, productivity

Rocheleau et al., 2023, p. 3), using this conceptualization allows to capture the integrated experience of gig workers who are subjected to such interconnected systems. Given that knowledge of the overall experience of gig workers subjected to AM has been mainly studied empirically through qualitative or experimental studies (for reviews: Gagné et al., 2022; Noponen et al., 2023, Parent-Rocheleau et Parker, 2022), it is important to advance scientific knowledge of the impact of the degree of overall exposure to AM through various methodology. By examining the complex impacts of the degree of overall AM exposure on workers with quantitative measurement, this research will contribute to the AM domain.

## 2.2 AM and work engagement in gig work

Researchers have examined workers' reactions and consequences of being managed by algorithmic systems. A large part of this research has focused on the negative outcomes of AM for gig workers, such as lower motivation, trust, or job satisfaction, high sense of dehumanization or resistance behaviors, information and power asymmetry, intensification and precariousness of work, and safety issues (Baiocco et al., 2022; Gagné et al., 2022; Noponen et al., 2023). Several authors also outlined the complexity and undetermined repercussions. For instance, Wiener et al. (2021) propose a legitimacy perspective based on the principle that AM can have a guiding effect while also exert a gatekeeping power. Based on this perspective, Cram et al. (2022) found that both sides of AM can positively relate to positive and negative technostress, further highlighting the multifaceted character of AM repercussions.

The relationship between worker's exposure to algorithmic management and their level of work engagement is particularly interesting in this regard. Work engagement is an important feature because it results from the balance between the demands and the resources emanating from work, such that an excess of demands combined to low or insufficient job resources

will deplete work engagement, which has been found to be an important shield against burnout (Bakker et al., 2014).

Work engagement is viewed as a "[...] positive, fulfilling, work-related state of mind that is characterized by vigor, dedication, and absorption" (Schaufeli et al., 2002, p. 74). Vigor refers to high levels of energy and mental resilience while working, as well as a willingness to invest in one's work. Dedication refers to being strongly involved in one's work and having a sense of importance, pride and challenge. Finally, absorption refers to being totally focused and deeply absorbed in one's work and happy to be engaged in it, so that time passes quickly (Bakker, 2011; Bakker & Albrecht, 2018; Bakker & Demerouti, 2008).

Early evidence is mixed regarding work engagement in gig work (Pereira et al., 2022; Roberts & Douglas, 2022; Wang et al., 2022). Qualitative data from Malik et al. (2020) shows that AM that improves the overall worker experience positively affects work engagement. In contrast, other researchers have argued and shown that AM can bring a variety of negative experiences to workers, augmenting their job demands and thus reducing their work engagement (Wang et al. 2022). For example, Newman et al. (2020) show that workers express lower levels of organizational commitment when subjected to decisions made by algorithms compared to the same decisions made by humans. We thus consider that the notion of work engagement is a relevant angle to tackle the question of whether and how, from a psychological standpoint, AM in the gig economy can both result in better or worse work.

## 2.3 AM and job autonomy

First, the literature suggests that AM can both restrict and enable the job autonomy of workers (Noponen et al., 2023). Job autonomy refers to "the extent to which a job allows freedom, independence, and discretion to schedule work, make decisions, and choose the methods used to perform tasks" (Morgeson

& Humphrey, 2006, p. 1323). In the gig economy context, AM can give workers a certain autonomy over decisions pertaining to their working hours, schedule, and place (Jarrahi, 2018; Lehdonvirta, 2018; Wood et al., 2019). The freedom to self-determine the spatiotemporal aspect of one's work, doubled with the possibility to work with no boss, have been the most widely spread arguments of platform companies to attract workers (Rosenblat, 2018). However, some studies show that this autonomy is mostly illusory (Baiocco et al., 2022; Jarrahi et al., 2021; Pignot, 2021; Wood, 2021) and varies greatly from one worker to another (Schor et al., 2020), namely because of the tight and pervasive platform control over workers that a high degree of AM provides (Lammi, 2021; Möhlmann & Zalmanson, 2017; Noponen et al., 2023; Shapiro, 2018). Indeed, even though gig workers technically have the freedom to work when they want, a greater exposure to AM would negatively impact their perception of job autonomy, as the system imposed a data-driven control on them, nudging them to "work for data" instead of pursuing their own schedules, goals, or decisions related to their daily work (Parent-Rocheleau & Parker, 2022).

We thus posit that an increased exposure to AM will decrease the job autonomy of gig workers due to a loss of control in their jobs and that job autonomy will be positively linked to work engagement. Job autonomy, considered a resource emanating from work, has been found to be one of the most important antecedents of work engagement (Bakker et al., 2014). This entails an indirect negative effect of AM on work engagement through job autonomy. We thus suggest the following.

*H1: Job autonomy mediates the negative relationship between algorithmic management and work engagement.*

## 2.4 AM and perceived justice

The literature also shows ambiguities with respect to the impacts of AM on worker perception of justice (Gagné et al., 2022). Procedural justice refers to "[...] the perceived fairness of decision-making processes [...]" (Colquitt et al., 2013, p. 200). The construct of procedural justice is formed by seven dimensions : perceptions of 1) control over the decision and 2) control over the process (Thibaut & Walker, 1975, 1978), 3) consistency, 4) absence of bias, 5) accuracy, 6) correctness, and 7) ethics (Leventhal, 1980) (as mentioned by Colquitt, 2001; Lind & Tyler, 1988). Newman et al. (2020) show that "[...] algorithm-driven decision-making processes are seen to be unfair across a range of scenarios [...]" (p. 161), as people seem to believe that AM relies on less accurate data than human decision-makers, or that some contextual information is

not taken into account by the system. However, Ötting and Maier (2018) underline the importance of procedural justice regardless of the decision-maker, and show that there is no difference in perceptions of procedural justice concerning decisions made by humans or systems. Nagtegaal (2021) found for its part that the perception of (in)justice could depend on the way algorithms are used. Bujold et al. (2022) show for their part that, regardless of the level of exposure to the system, transparent AM systems can foster procedural justice perceptions.

We argue that, in the gig economy, because procedures are expected to be highly automated, low levels of human intervention (or high exposure to AM) will lead to higher perceptions of justice. An increase in AM exposure could notably increase the perception that procedures on the platform are consistent and more accurate (Lee, 2018). In addition, increased exposure to AM could reduce procedural ambiguities, giving gig workers a greater sense of possible influence over the procedures and their outcomes, because they will feel like they know what is going on and what to expect when they engage in certain behaviors or perform at a certain level on the platform (Song et al., 2020). Also, as gig workers normally expect to have AM procedures in place when engaging in this type of work, a greater exposure to AM is more likely to be aligned with their values regarding their work and thus increase the perception of ethic dimension of procedural justice (Cropanzano et al., 2023; Pfeffer & Kawalec, 2020). All in all, in the gig economy context, we believe that a greater exposure to AM will increase the perception of procedural justice.

Because procedural justice has been found to be an important job resource fostering work engagement (Agarwal, 2014; Kim & Park, 2017; Strom et al., 2014), we also posit that procedural justice will be positively linked to work engagement, which brings us to the second hypothesis :

*H2: Perceived procedural justice mediates the positive relationship between algorithmic management and work engagement.*

All in all, as it keeps growing at a rapid pace, the literature on AM increasingly shows a duality when it comes to its impacts on workers across contexts (Meijerink & Bondarouk, 2023).

## 3. Methodology

### 3.1 Procedure

We collected data in two time-separated waves. We measured perceived AM exposure and control variables at T1. Two weeks later, we measured the three outcome variables (i.e., job autonomy, procedural

justice and work engagement). The main platform the worker works on, hours of work per week on the platform, the centrality of income, age, and education were included as demographic and control variables.

The platform Prolific was used to invite 650 pre-screened individuals who worked for a gig work platform at least 20 hours per week. Prolific is an online platform that is part of the gig economy and is most often used by researchers to recruit study participants. The platform acts as an intermediary between researchers looking for participants and the participants, who are paid for their work and managed by the platform's system. In addition, many Prolific workers primarily work on other platforms, which has the advantage of allowing us to control for the main platform the worker worked on in our analysis. All in all, Prolific's context fits in well with this study, which focuses on gig work experiences.

Participants received a 6\$USD compensation upon completion of the two surveys. After removing participants who failed attention checks or had incomplete data, a final sample of 366 respondents successfully completed the two surveys, corresponding to a 56% response rate. The respondents were 56% male, 87% were below 45 years old, and 64.5% had a university degree. A large portion of respondents were working for Prolific most of the time, but a significant part (45%) had another (appwork or crowdwork) main platform.

### 3.2 Measures

The complete list of items is provided in the appendix. Exposure to AM was measured using a 20-item scale recently developed by Parent-Rocheleau et al. (2023) which captures perceived exposure to five AM functions. Sample items are “An automated system tracks me carefully to ensure I am completing my tasks” (monitoring); “My daily tasks are assigned by an automated system” (goal setting); “An automated system decides when I work and when I don't” (scheduling); “The evaluation of my work performance is handled by an electronic system” (performance

rating); “A large part of my compensation is determined by an automated system” (compensation). Job autonomy was measured by 9 items from Morgeson and Humphrey (2006). A sample item is “The job provides me with significant autonomy in making decisions”. Procedural justice was measured by the 7 items of Colquitt (2001). A sample item is “Those procedures have been applied consistently”. Finally, work engagement was measured by the 9 items of the UWES-9 questionnaire (Schaufeli et al., 2006). A sample item is “At my job, I feel strong and vigorous”.

### 4. Analysis and results

Prior to testing the hypotheses, we ran a confirmatory factor analysis to assess the statistical fit of our measurement model. Results show that the fit of the model is good ( $\chi^2=1750.7$ ,  $df=920$ ,  $CFI=.922$ ,  $TLI=.917$ ,  $RMSEA=.049$ ,  $SRMR=.059$ ), and better than all alternative models. Correlations and descriptive statistics were also calculated and shown in Table 2. Moreover, we used Harman's one-factor test to examine the potential common method bias in our study. The results showed that the first unrotated factor explained 24.40% of the total variance, which is lower than 30%, indicating that the common method variance in this study was effectively controlled.

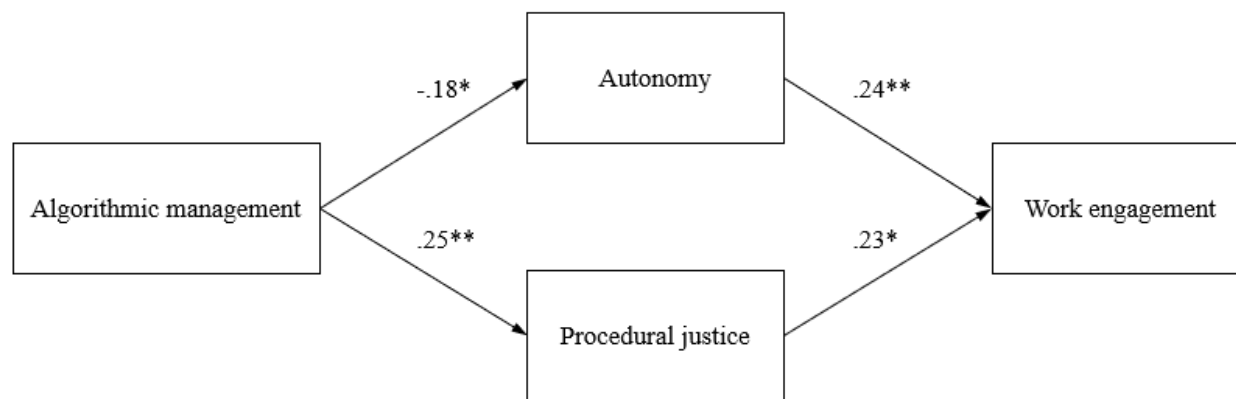
To test our hypothesis, we used the bootstrap technique. More precisely, we performed a path analysis of our model (including control variables) using the R package "lavaan" with 5000 bootstrapped samples and a 95% confidence interval. The fit of this structural model was acceptable ( $\chi^2=1860.9$ ,  $df=931$ ,  $CFI=.911$ ,  $TLI=.905$ ,  $RMSEA=.052$ ,  $SRMR=.073$ ).

Exposure to AM (T1) was significantly and negatively related to job autonomy at T2 ( $\beta = -.18$ ,  $p < .01$ ) and positively related to procedural justice at T2 ( $\beta = .25$ ,  $p < .001$ ) as well as to work engagement at T2 ( $\beta = .15$ ,  $p < .05$ ). Like AM, job autonomy ( $\beta = .24$ ,  $p < .001$ ) and procedural justice ( $\beta = .23$ ,  $p < .01$ ) were also both positively, but more significantly related to work engagement at T2. Moreover, the bootstrap path

**Table 2. Descriptive statistics and correlations (N= 366)**

Variable	Mean	S.D.	1.	2.	3.	4.	5.	6.	7.	8.	9.
1. Platform type	.55	.50	--								
2. Main income	.59	.49	.28**	--							
3. Hours/week	3.75	1.16	-.39**	-.46**	--						
4. Education	4.55	1.41	-.04	.10	-.04	--					
5. Age	3.28	0.99	-.05	.14**	-.14**	.20**	--				
6. AM	4.03	1.18	-.09	-.16**	.10	.02	-.01	(.77)			
7. Autonomy(T2)	5.03	1.20	.04	-.04	.02	.04	-.12*	-.15**	(.93)		
8. PJ (T2)	4.44	1.04	-.05	-.14**	.09	-.01	-.14**	.23**	.27**	(.83)	
9. WE (T2)	4.48	1.35	.06	-.03	.06	.02	-.08	.15**	.24**	.30**	(.95)

Notes. \*\* $p < .01$ ; \* $p < .05$ . Platform type : 1 = Prolific. 0 = Other. Main income: 1 = Yes. Hours/week was coded in categories (1 to 5). Education was coded in categories (1 to 6). Age was coded in categories (1 to 9). Cronbach's alpha in parentheses along the diagonal. AM = Algorithmic management. PJ = Procedural justice. WE = Work engagement.



**Figure 1. Standardized parameter estimates for the mediation model**

Note: \* $p < .01$ ; \*\* $p < .001$ . For parsimony, control variables are not presented.

analysis revealed that mediating effect of job autonomy in the relationship between AM exposure and work engagement was significant and negative ( $\beta = -.04$ , LLCI =  $-.084$ , ULCI =  $.002$ ) and that the mediating effect of procedural justice in the relationship between AM exposure and work engagement was also significant, but positive ( $\beta = .06$ , LLCI =  $.015$ , ULCI =  $.096$ ). Hypotheses 1 and 2 are thus supported. Also, the  $R^2$  for work engagement was  $.15$ , for procedural justice it was  $.09$ , and for job autonomy it was  $.06$ , meaning our model explains 15%, 9%, 6% of the observed variance of the respective constructs. The findings reported are presented in Figure 1.

## 5. Discussion

The findings show that the degree of exposure to AM leverage procedural justice perceptions but reduces perception of autonomy among gig workers. Our results thus confirm our presumption that AM can indirectly either foster or hamper gig workers' level of engagement, through these two pathways. On balance, in our model, the indirect link between AM exposure and work engagement is positive, and the positive link between AM and procedural justice is stronger than the negative link between AM and job autonomy. In other words, although associated with lower perceived autonomy, greater exposure to AM leads to higher work engagement due to its positive effect on procedural justice perceptions.

This study yields several contributions to the AM literature. First, it sheds more light on the capability of gig work and AM to foster work engagement. Specifically, it shows on the one hand that algorithmic decision-making may be associated with better fairness perception regarding procedures. This contributes to the ongoing question around the fairness of AM systems in gig work and adds to recent research showing similar findings (Lee, 2018). On the other hand, the results are consistent with our hypothesis and previous research on

the negative effect of AM exposure on autonomy perceptions. These findings thus bring support to previous research highlighting that algorithmic control of the platform exceeds the somewhat illusory job autonomy expected in platform work (Baiocco et al., 2022; Jarrahi et al., 2021; Pignot, 2021; Wood, 2021).

More generally, the study brings clear empirical support to the growing assumption that workers' experiences and reactions to AM are not inherently good or bad, calling for a nuanced, contextualized, and balanced research. Our findings are unequivocal in showing the two faces of AM exposure. The conceptual literature and current empirical findings have only begun to capture the complexities of workers' reactions to AM. In that sense, our findings echo recent perspectives such as the duality of algorithmic management (Meijerink & Bondarouk, 2023), or the guiding/gate-keeping facets of algorithmic control (Wiener et al., 2021). This research conversation is ultimately guided by sociotechnical systems perspective (Guest et al., 2022; Jarrahi et al., 2021), which namely claims that the effects of technology depend on social systems, or on the organizational choice surrounding the use of technology in the workplace. Decades of research have indeed shown that the repercussions of technology have always depended on how and why companies decided to use it. We convey researchers to keep engaging in such nondeterministic ways to examine algorithmic management.

On the practical plan, the study indicates that algorithmic management can be associated to positive experiences, namely higher justice and work engagement. By suggesting that "good gig work" is possible, the results highlight the importance of developing AM systems that support autonomy (Jabagi et al., 2020). However, it is important to position these findings in the more global and predominant evidence showing that gig work is, overall, characterized by poor work conditions. More research is needed to unpack this

paradoxical or mixed evidence, but practitioners should keep in mind that choices and decisions around the design and the use of algorithmic systems shape workers' experiences and, consequently, their engagement, well-being and safety.

Moreover, this research has limitations. Notably, it focuses on gig work where AM is well spread, but recent studies suggest that AM is also spreading in more traditional work environments (e.g., trucking (Levy, 2023), care (Moore & Hayes, 2017), or the hospitality industry (Spektor et al., 2023)). Future research could investigate and compare the impact of degree of exposure to AM on workers in gig and traditional work contexts. Also, this research focuses on the overall perception of exposure to AM. While it provides insight into the more holistic experience of gig workers and its link to work engagement, further studies could break down the effect of sub-characteristics or facets of the system (e.g., transparency (Möhlmann et al., 2023) or algorithmic control (Wiener et al., 2021)) on work engagement to further deepen our understanding of the complexity of AM systems.

Perhaps a diversification in the research methods and approaches will also contribute to a finer-grained understanding of psychological, cognitive, or safety-related consequences of algorithmic management. Taken together, future research should examine the two faces of AM in different contexts and, more importantly, the impacts of different AM characteristics (Parent-Rocheleau & Parker, 2022).

In sum, as our study suggests, AM systems are not inherently good or bad, and don't necessarily trigger positive or negative outcomes. Rather, it is platforms that set the use and the scope of algorithmic management that will determine its level of responsibility towards workers.

## 6. References

- Agarwal, U. A. (2014). Linking justice, trust and innovative work behaviour to work engagement. *Personnel Review*, 43(1), 41-73. <https://doi.org/10.1108/pr-02-2012-0019>
- Baiocco, S., Fernandez-Macias, E., Rani, U., & Pesole, A. (2022). The algorithmic management of work and its implications in different contexts. *JRC Working Papers Series on Labour, Education and Technology*, 2022/02.
- Bakker, A. B. (2011). An Evidence-Based Model of Work Engagement. *Current Directions in Psychological Science*, 20(4), 265-269. <https://doi.org/10.1177/0963721411414534>
- Bakker, A. B., & Albrecht, S. (2018). Work engagement: current trends. *Career Development International*, 23(1), 4-11. <https://doi.org/10.1108/cdi-11-2017-0207>
- Bakker, A. B., & Demerouti, E. (2008). Towards a model of work engagement. *Career Development International*, 13(3), 209-223. <https://doi.org/10.1108/13620430810870476>
- Bakker, A. B., Demerouti, E., & Sanz-Vergel, A. I. (2014). Burnout and Work Engagement: The JD-R Approach. *Annual Review of Organizational Psychology and Organizational Behavior*, 1(1), 389-411. <https://doi.org/10.1146/annurev-orgpsych-031413-091235>
- Bujold, A., Parent-Rocheleau, X., & Gaudet, M.-C. (2022). Opacity behind the wheel: The relationship between transparency of algorithmic management, justice perception, and intention to quit among truck drivers. *Computers in Human Behavior Reports*, 8, 1-14.
- Colquitt, J. A. (2001). On the dimensionality of organizational justice: A construct validation of a measure. *Journal of Applied Psychology*, 86(3), 386-400. <https://doi.org/10.1037//0021-9010.86.3.386>
- Colquitt, J. A., Scott, B. A., Rodell, J. B., Long, D. M., Zapata, C. P., Conlon, D. E., & Wesson, M. J. (2013). Justice at the millennium, a decade later: a meta-analytic test of social exchange and affect-based perspectives. *Journal of Applied Psychology*, 98(2), 199-236. <https://doi.org/10.1037/a0031757>
- Cropanzano, R., Keplinger, K., Lambert, B. K., Caza, B., & Ashford, S. J. (2023). The organizational psychology of gig work: An integrative conceptual review. *Journal of Applied Psychology*, 108(3), 492-519. <https://doi.org/10.1037/apl0001029>
- Duggan, J., Sherman, U., Carbery, R., & McDonnell, A. (2020). Algorithmic management and app-work in the gig economy: A research agenda for employment relations and HRM. *Human Resource Management Journal*, 30(1), 114-132.
- Gagné, M., Parent-Rocheleau, X., Bujold, A., Gaudet, M.-C., & Lirio, P. (2022). How Algorithmic Management Influences Worker Motivation: A Self-Determination Theory Perspective. *Canadian Psychology/Psychologie canadienne*, 63(2), 247-260. <https://doi.org/10.1037/cap0000324>
- Guest, D., Knox, A., & Warhurst, C. (2022). Humanizing work in the digital age: Lessons from socio-technical systems and quality of working life initiatives. *Human Relations*, 75(8), 1461-1482. <https://doi.org/10.1177/00187267221092674>
- J Jabagi, N., Croteau, A.-M., Audebrand, L. K., & Marsan, J. (2021). Unlocking perceived algorithmic autonomy-support: Scale development and validation. 54th Hawaii International Conference on System Sciences, Maui, Hawaii. <https://doi.org/10.24251/HICSS.2021.781>
- Jarrah, M. H. (2018). Artificial intelligence and the future of work: human-AI symbiosis in organizational decision making. *Business Horizons*, 61(4), 577-586.
- Jarrah, M. H., Newlands, G., Lee, M. K., Wolf, C. T., Kinder, E., & Sutherland, W. (2021). Algorithmic management in a work context. *Big Data & Society*, 8(2). <https://doi.org/10.1177/20539517211020332>
- Kellogg, K. C., Valentine, M. A., & Christin, A. (2020). Algorithms at Work: The New Contested Terrain of Control. *Academy of Management Annals*, 14(1), 366-410. <https://doi.org/10.5465/annals.2018.0174>
- Kim, W., & Park, J. (2017). Examining Structural Relationships between Work Engagement, Organizational Procedural Justice, Knowledge Sharing, and Innovative Work Behavior for Sustainable

- Organizations. *Sustainability*, 9(2).  
<https://doi.org/10.3390/su9020205>
- Lammi, I. J. (2021). Automating to control: The unexpected consequences of modern automated work delivery in practice. *Organization*, 28(1), 115-131.
- Lee, M. K. (2018). Understanding perception of algorithmic decisions: Fairness, trust, and emotion in response to algorithmic management. *Big Data & Society*, 5(1), 1-18.
- Lee, M. K., Kusbit, D., Metsky, E., & Dabbish, L. (2015). *Working with Machines : The Impact of Algorithmic and Data-Driven Management on Human Workers*. Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems, Seoul, Republic of Korea.
- Lehdonvirta, V. (2018). Flexibility in the gig economy: managing time on three online piecework platforms. *New Technology, Work and Employment*, 33(1), 13-29.
- Leventhal, G. S. (1980). What should be done with equity theory? New approaches to the study of fairness in social relationships. In *Social exchange: Advances in theory and research* (pp. 27-55). Plenum Press.
- Levy, K. (2023). *Data driven: truckers, technology, and the new workplace surveillance*. Princeton University Press.
- Lind, E. A., & Tyler, T. R. (1988). *The social psychology of procedural justice*. Springer.  
<https://doi.org/https://doi.org/10.1007/978-1-4899-2115-4>
- Malik, A., Budhwar, P., Patel, C., & Srikanth, N. R. (2020). May the bots be with you! Delivering HR cost-effectiveness and individualised employee experiences in an MNE. *The International Journal of Human Resource Management*, 1-31.  
<https://doi.org/10.1080/09585192.2020.1859582>
- Meijerink, J., Boons, M., Keegan, A., & Marler, J. (2021). Algorithmic human resource management: Synthesizing developments and cross-disciplinary insights on digital HRM. *The International Journal of Human Resource Management*, 32(12), 2545-2562.
- Meijerink, J., & Bondarouk, T. (2023). The duality of algorithmic management: Toward a research agenda on HRM algorithms, autonomy and value creation. *Human Resource Management Review*, 33(1), 1-14.
- Möhlmann, M., Alves de Lima Salge, C., & Marabelli, M. (2023). Algorithm Sensemaking: How Platform Workers Make Sense of Algorithmic Management. *Journal of the Association for Information Systems*, 24(1), 35-64.  
<https://doi.org/10.17705/1jais.00774>
- Möhlmann, M., & Zalmanson, L. (2017). *Hands on the wheel: Navigating algorithmic management and Uber drivers' autonomy*. Proceedings of the International Conference on Information Systems (ICIS 2017), Seoul, South Korea.
- Möhlmann M, Zalmanson L, Henfridsson O, Gregory RW. (2021). Algorithmic Management of Work on Online Labor Platforms: When Matching Meets Control. *MIS Quarterly*, 45(4), 1999-2022.  
<https://doi.org/10.25300/MISQ/2021/15333>
- Moore, S., & Hayes, L. J. B. (2017). Taking worker productivity to a new level? Electronic Monitoring in homecare—the (re)production of unpaid labour. *New Technology, Work and Employment*, 32(2), 101-114.
- Morgeson, F. P., & Humphrey, S. E. (2006). The Work Design Questionnaire (WDQ): developing and validating a comprehensive measure for assessing job design and the nature of work. *Journal of Applied Psychology*, 91(6), 1321-1339.
- Nagtegaal, R. (2021). The impact of using algorithms for managerial decisions on public employees' procedural justice. *Government Information Quarterly*, 38(1).  
<https://doi.org/10.1016/j.giq.2020.101536>
- Newman, D. T., Fast, N. J., & Harmon, D. J. (2020). When eliminating bias isn't fair: Algorithmic reductionism and procedural justice in human resource decisions. *Organizational Behavior and Human Decision Processes*, 160, 149-167.  
<https://doi.org/10.1016/j.obhdp.2020.03.008>
- Noponen, N., Feshchenko, P., Auvinen, T., Luoma-aho, V., & Abrahamsson, P. (2023). Taylorism on steroids or enabling autonomy? A systematic review of algorithmic management. *Management Review Quarterly*.  
<https://doi.org/10.1007/s11301-023-00345-5>
- Ötting, S. K., & Maier, G. W. (2018). The importance of procedural justice in Human–Machine Interactions: Intelligent systems as new decision agents in organizations. *Computers in Human Behavior*, 89, 27-39. <https://doi.org/10.1016/j.chb.2018.07.022>
- Pfeiffer, S., & Kawalec, S. (2020). Justice expectations in crowd and platform-mediated work. *The Economic and Labour Relations Review*, 31(4), 483-501.  
<https://doi:10.1177/1035304620959750>
- Parent-Rocheleau, X., & Parker, S. K. (2022). Algorithms as work designers: How algorithmic management influences the design of jobs. *Human Resource Management Review*, 32(3).  
<https://doi.org/10.1016/j.hrmr.2021.100838>
- Parent-Rocheleau, X., Parker, S. K., Bujold, A., Gaudet, M-C. (2023). Creation of the algorithmic management question (AMQ): A six-phase validation process. *Human Resource Management*. <https://doi.org/10.1002/hrm.22185>
- Pereira, V., Behl, A., Jayawardena, N., Laker, B., Dwivedi, Y. K., & Bhardwaj, S. (2022). The art of gamifying digital gig workers: a theoretical assessment of evaluating engagement and motivation. *Production Planning & Control*, 1-17.
- Pignot, E. (2021). Who is pulling the strings in the platform economy? Accounting for the dark and unexpected sides of algorithmic control. *Organization*, 28(1), 208-235.
- Roberts, R. A., & Douglas, S. K. (2022). Gig workers: Highly engaged and leadership independent. *Psychology of Leaders and Leadership*, 25(3-4), 187-211.  
<https://doi.org/10.1037/mgr0000131>
- Rosenblat, A. (2018). *Uberland: how algorithms are rewriting the rules of work*. University of California Press.
- Schaufeli, W. B., Bakker, A. B., & Salanova, M. (2006). The Measurement of Work Engagement With a Short Questionnaire: A Cross-National Study. *Educational and psychological measurement*, 66(4), 701-716.
- Schaufeli, W. B., Salanova, M., Gonzalez-Roma, V., & Bakker, A. B. (2002). The measurement of engagement and burnout: A two sample confirmatory factor analytic approach. *Journal of Happiness studies*, 3(1), 71-92.

- Schor, J. B., Attwood-Charles, W., Cansoy, M., Ladegaard, I., & Wengronowitz, R. (2020). Dependence and precarity in the platform economy. *Theory and Society*, 49, 833-861. <https://doi.org/10.1007/s11186-020-09408-y>
- Shapiro, A. (2018). Between autonomy and control: Strategies of arbitrage in the “on-demand” economy. *New Media & Society*, 20(8), 2954-2971. <https://doi.org/10.1177/1461444817738236>
- Song, X., Lowman, G. H., & Harms, P. (2020). Justice for the crowd: Organizational justice and turnover in crowd-based labor. *Administrative Sciences*, 10(4), 93-103. <https://doi.org/10.3390/admsci10040093>
- Spektor, F., Fox, S. E., Awumey, E., Riordan, C. A., Rho, H. J., Kulkarni, C., Martinez-Lopez, M., Stringam, B., Begleiter, B., & Forlizzi, J. (2023). Designing for Wellbeing: Worker-Generated Ideas on Adapting Algorithmic Management in the Hospitality Industry. Proceedings of the 2023 ACM Designing Interactive Systems Conference, 623-637. <https://doi.org/10.1145/3563657.3596018>
- Strom, D. L., Sears, K. L., & Kelly, K. M. (2014). Work Engagement: The Roles of Organizational Justice and Leadership Style in Predicting Engagement Among Employees. *Journal of Leadership & Organizational Studies*, 21(1), 71-82. <https://doi.org/10.1177/1548051813485437>
- Thibaut, J., & Walker, L. (1975). *Procedural justice: A psychological analysis*. Erlbaum Associates.
- Thibaut, J., & Walker, L. (1978). A Theory of Procedure. *California Law Review*, 66(3), 541-566.
- Wang, C., Chen, J., & Xie, P. (2022). Observation or interaction? Impact mechanisms of gig platform monitoring on gig workers’ cognitive work engagement. *International Journal of Information Management*, 67. <https://doi.org/10.1016/j.ijinfomgt.2022.102548>
- Wiener, M., Cram, W., & Benlian, A. (2021). Algorithmic control and gig workers: a legitimacy perspective of Uber drivers. *European Journal of Information Systems*, 1-23. <https://doi.org/10.1080/0960085x.2021.1977729>
- Wood, A. J. (2021). Algorithmic management consequences for work organisation and working conditions. *JRC Working Papers Series on Labour, Education and Technology*, 2021/07.
- Wood, A. J., Graham, M., Lehdonvirta, V., & Hjorth, I. (2019). Good Gig, Bad Gig: Autonomy and Algorithmic Control in the Global Gig Economy. *Work, Employment and Society*, 33(1), 56-75. <https://doi.org/10.1177/0950017018785616>



## Appendix - List of measurement items

### Exposure to algorithmic management

Please indicate to what extent do you agree with the following statements, using a scale ranging from 1 (completely disagree) to 7 (completely agree).

- An automated system tracks me carefully to ensure I am completing my tasks.
- An automated system closely monitors me while I am doing my work.
- An automated system inspects my work closely.
- I am constantly being watched by an automated system to see that I obey the rules pertaining to my job.
- My daily tasks are assigned by an automated system.
- An automated system decides what tasks I will be doing.
- In my job, an automated system determines what needs to be done.
- An automated system determines the targets I must attain at work (productivity targets, time targets, sales target, etc.).
- The targets I have to reach are set by the automated system.
- An automated system decides when I work and when I don't.
- My work schedule is made by an automated system.
- An automated system is responsible for determining my working hours.
- My working hours are determined automatically by an electronic system.
- The evaluation of my work performance is handled by an electronic system.
- An automated system generates the metrics used to assess my performance.
- My performance evaluation is based on metrics computed by an automated system.
- A large part of my compensation is determined by an automated system.
- The decisions related to my earnings are mostly made by the automated system.
- An automated system is responsible for calculating my pay, with no human intervention.
- What I earn is the result of an automated system calculation only.

### Job autonomy

To what extent do you agree with the following statements (from 1=not at all, to 7= absolutely)

- The job allows me to make my own decisions about how to schedule my work.
- The job allows me to decide on the order in which things are done on the job.
- The job allows me to plan how I do my work.
- The job gives me a chance to use my personal initiative or judgment in carrying out the work.
- The job allows me to make a lot of decisions on my own.
- The job provides me with significant autonomy in making decisions.
- The job allows me to make decisions about what methods I use to complete my work.
- The job gives me considerable opportunity for independence and freedom in how I do the work.
- The job allows me to decide on my own how to go about doing my work.

### Perceived procedural justice

The following items refer to the general procedures performed by the platform's automated system. To what extent (:

- I had influence over the outcomes of those procedures.
- Those procedures have been applied consistently.
- Those procedures have been free of bias.
- Those procedures have been based on accurate information.
- I have been able to express my views and feelings during those procedures.
- I have been able to appeal the outcomes arrived at by those procedures.
- Those procedures upheld ethical and moral standards.

### Work engagement

Please indicate to what extent do you agree with the following statements, using a scale ranging from 1 (completely disagree) to 7 (completely agree).

- At my work, I feel that I am bursting with energy.
- At my job, I feel strong and vigorous.
- When I get up in the morning, I feel like going to work.
- I am enthusiastic about my job.
- My job inspires me.
- I am proud of the work that I do.
- I am immersed in my work.
- I get carried away when I am working.