Sociologica. V.19 N.1 (2025)
ISSN 1971-8853

The Ghost of Middle Management: Automation, Control, and Heterarchy in the Platform Firm

Janet A. Vertesi* Diana Enriquez

Department of Sociology, Princeton University (United States)

Submitted: February 2, 2023 – Revised version: September 22, 2024
Accepted: February 23, 2025 – Published: May 5, 2025

Abstract

In an effort to attend to the distinct organizational form of algorithmic management, we interrogate the arrangement of platform labor through the lens of the post-bureaucratic organization instead of that of the industrialized factory. Prior studies of gig workers rely heavily on sociological accounts of factory labor, but we posit that gig economy platforms represent a heterarchical organizational form, marrying the logics of industrial control induced by computational systems with the logics of post-bureaucracy inherited from flattening firms and downsizing middle management. In a technique we describe as automation by omission, we show how middle-managerial roles and responsibilities are excised entirely from the platform firm, how the vestigial traces of such roles are only imperfectly replaced by technical systems, and how "situated" managerial tasks essential to post-bureaucratic organizations are picked up by the worker, uncompensated. This heterarchical arrangement benefits the firm in multiple ways, while its competing structural conditions of labor leave workers to navigate multiple valuation systems at once. Appreciating gig work's embedded post-bureaucracy shifts our understanding of common worker experiences such as peer-to-peer organizing and just-in-time scheduling illuminates dissonant accounts of empowerment and algorithmic despotism, and exposes new avenues for worker disenfranchisement.

Keywords: Gig economy; management; organizations; configuration; labor.

Acknowledgements

This paper has undergone many transformations and we are grateful to its anonymous reviewers for improving and clarifying our thinking. Special thanks are due to Adam Goldstein, Lindsay Cameron, and Angèle Christin for their deep engagement with the work. This research was funded by the Sloan Foundation under a grant from its Outsourcing program.

* jvertesi@princeton.edu

Introduction

As sociological studies of the characteristics of algorithmically managed labor have expanded, the question of *the social organization* of gig economy firms and their externalized workforces remains pressing. Sociologists have described the qualities of an algorithmic manager as seen from the shop floor, yet the firms in which these work arrangements are embedded possess structural characteristics, role requirements, and valuation practices that influence the experience of labor and the market performance of the firm alike. A recent series of papers invites sociologists to inquire into the "distinguishing characteristics of the mode of management on these platforms," with attention to algorithmic management as its own distinct organizational form (Stark & Broeck, 2024; Stark & Pais, 2020; Watkins & Stark, 2018). While we agree that scholars must break free of considering algorithmic working arrangements as merely extended forms of industrialism, we observe further departures from the assumptions of industrialized labor beyond the capture of employee assets and the capabilities of machine learning (Stark & Broeck, 2024). By inquiring, "which features of management have been automated, which have not, and why," we suggest a novel interpretation of the gig firm and the experience of labor under its purview.

In this paper we argue that what sets the algorithmic management firm apart is precisely what has happened to *management* as a structural layer of the firm: that is, middle management has been eliminated entirely and replaced with computational tools. This removal must be understood within the historical trajectory of late 20th century capitalism, as firms reorganized to reclaim a larger share of profits through the flattening of their internal operations. It is thus an apotheosis of the form Charles Heckscher terms "post-bureaucracy" (Heckscher & Donnellon, 1994): an organizational logic describing flat firms that grew in popularity in the United States in the early 2000s. Accompanying this structural condition are worker experiences and functions unlike those in industrial firms.

This does not make the gig firm a pure post-bureaucracy, however. For as gig economy platforms replaced middle managers with algorithms, they have done so under industrialized assumptions of control and coordination, thus neglecting to program their algorithms to replace the necessary managerial components inherent to flatter firms. The result is not a rarified industrial form nor a flat distributed organization, but a *heterarchical* one (Girard & Stark, 2003; Stark, 2009). Heterarchies "are characterized by minimal hierarchy and by organizational heterogeneity" (Stark, 1999, p. 159), and accordingly the heterarchical management of gig labor somewhat awkwardly combines techniques of industrial oversight and control via automation, on the one hand, with many labor expectations of a flat, post-bureaucratic organizational structure on the other (Heckscher & Adler, 2006; Heckscher & Donnellon, 1994; Turco, 2016). This change in the structural conditions of the workplace produces worker experiences rife with frictions between competing pressures and logics of valuation. Such an environment requires we return to the original formulation of heterarchy, which celebrates its creative, innovative, and flexible qualities of recombination in marketplaces under transition, to appreciate how those of lower socioeconomic position experience the ambiguities associated with multiple concurrent forms of valuation and expectations for worker behavior.

Our argument proceeds in three parts. In Part I, we lay out the structural changes to the firm over the course of the 20th century that resulted in the "Middle-Managerless" form we observe achieve its apotheosis in the gig economy. Unlike in industrial labor contexts, the goal of such a post-bureaucracy is not to strengthen managerial oversight but to strangle it; and instead of automation replacing workers, technologies assist in the effort to efface managerial

layers from the firm (McCaffrey, 2023; McCann et al., 2008; Meyer, 2001). As firms pushed decision-making further into the ranks, we describe how they necessarily embraced a style of situated management in lieu of a managerial layer (Batt, 1996; Osterman, 1996). Importantly, activities considered resistance, rule-breaking, or contestations of control under hierarchical or industrial forms of organization, are understood as valuable and "good sociological citizenship" under post-bureaucratic situated management (Canales, 2011).

In Part II, we investigate the "human-machine re-configuration" (Suchman, 2006) of algorithmically infused organizations that were born middle-managerless. We do so by marrying perspectives on the organizational structure of platform capitalism (Srnicek, 2017; Stark & Pais, 2020) with a discussion of how these resulting pressures impact worker experience on the shop floor (Burawoy, 1985; Vallas & Schor, 2020). We describe worker experiences as the result of *partial replacement*, an automated arrangement in which middle management is structurally absent and the vestigial machinery that remains has only partially automated some of its necessary tasks. In the case of the gig firm, partial replacement leaves situated management tasks unaccounted for, diffused and invisibly shuffled off onto the worker. At the same time, algorithms are better suited for inflexible application of mathematizable, discrete properties or logistical optimization than situated decision-making, awkwardly reinforcing the industrial conditions of labor relations. These leaves workers subject to two competing structural conditions of labor: one an industrial form enforced by the algorithm, the other structurally emergent through lack of situated management. Both are required to do the job.

In Part III, we examine the benefits of these structural conditions for the firm and the dissonance experienced by the gig workforce. Recasting gig workers' well-known accounts of their activities in the light of these changing structural conditions of labor explains consistent paradoxes in their accounts. For instance, they report that their work feels simultaneously oppressive and empowering: i.e. "the good-bad job" (Cameron, 2024 & 2022). To get the job done, they are expected to *both* follow the rules *and* deviate from them, yet may be penalized for either action. This site of dissonance adds to our understanding of the friction — creative or otherwise — experienced in heterarchical firms. We close with implications for future studies of algorithmic management, labor relations, and heterarchy.

1 Factory, Meet Flat Hierarchy

1.1 The Limits of Industrialism

Scholarly perspectives on gig work owe a great debt to ethnographic studies of labor and automation in the industrial workplace (Braverman, 1974; Burawoy, 1979 & 1985; Stark, 1980; Vallas, 1993). Industrialism's hierarchies valorize managerial forms of labor over shopfloor work, while spatial distinctions further ingrain the domain of the workers from upper management's offices. In the Taylorist system and in Henry Ford's factories, profits increase through task differentiation, managerial oversight, and labor automation (Burawoy, 1985; Marx, 2008). Managerial activities and their associated technologies resolve worker compliance problems like lateness, turnover, inefficiency, or unionization (Braverman, 1974). Workers can resist this oppressive regime outright, or they may contribute to firm goals through alliances with managers or playing games on the shop floor to ensure standards are met and outputs remain high (Burawoy, 1985; Stark, 1980). Managers, for their part, maintain distinct positions under the guise that workers need constant surveillance and instruction to control production, protecting their own role as "high skill" and irreplaceable (Braverman, 1974). Job restructuring and increased

managerial control are the order of the day, as is the decline of worker voice, valorization, and representation (Vallas, 1993).

Scholars of the gig economy and automation have predominantly looked to models of the factory as analytical comparatives, especially as key scholars of industrialism have transitioned to studying contemporary conditions of digitally-managed labor (Vallas & Schor, 2020). Much as early studies of labor on the shop floor describe worker's processes for improvising, or resisting on the job (Burawoy, 1979), algocratic workplaces are also subject to "making out" (Cameron, 2022), resistance based on judgment (Brayne & Christin, 2021; Kellogg et al., 2020), or sabotage (Levy, 2015; Merchant, 2023). Despite being a terrain of contested control (Kellogg et al., 2020), in a presumed *algocracy* one cannot argue with the algorithmic manager — despite the fact that its instructions for completing a task are often simple, incomplete, and devoid of everyday complexities (Aneesh, 2009). Workers find themselves in an "invisible cage", without voice, subject to opaque workplace changes to which they must uncompromisingly adapt (Rahman, 2024). Hence workers describe their algorithmic bosses as cruel (Gray & Suri, 2019), despotic (Griesbach et al., 2019; Vallas et al., 2022), restrictive (Cameron & Rahman, 2022) or biased (Raghavan et al., 2020). With little in the way of a collocated workplace, crowdsourcing information on ancillary platforms online is seen as an important locus for collaboration, information exchange, training, identity work, and organizing among workers in analyses that align with prior industrialist forms (Orr, 1996; Petriglieri et al., 2019; Rosenblat, 2018; Schwartz, 2018).

This arrangement accounts for many elements of gig-work, especially visible in warehouses or automated assembly lines (Delfanti & Frey, 2020; Vallas et al., 2022; Vallas & Kronberg, 2023). Yet challenges to our theorizing about organizational structure remain. How should scholars interpret the extraordinary degree of worker discretion alongside app-based surveillance, the presumed sense of autonomy at the same time as being a "slave" to the algorithm (Alvarez de la Vega et al., 2023; Aneesh, 2009; Ravenelle, 2019; Rosenblat, 2018; Schor et al., 2020; Shestakofsky & Kelkar, 2020; Ticona, 2015)? What of the individuated work yet persistent and necessary lateral collaboration between various workers in order to get the work done (Dalal et al., 2023; Griesbach et al., 2019; Kellogg et al., 2006; Shestakofsky, 2017)? What of the continued space for resistance and challenges to controlling technologies (Brayne & Christin, 2021; Cameron & Rahman, 2022; Kellogg et al., 2020; K. Levy, 2024)? Scholars have grappled with these paradoxical conditions of gig work to elaborate the cultural reasons why this might be the case, including company rhetoric, compliance with management, solidarity among workers, or embracing forms of "making out" (Burawoy, 1979; Cameron, 2022).

Following Michael Burawoy's (1985) injunction to use worker experiences as a structural lens upon firm organization, we take these contradictions of gig work seriously as an indication of the gig firm's entrenched *dual structure*. After all, factories with industrial hierarchies are only one way of organizing a company, and worker control and surveillance only one way of producing profit or commitment. Further, the preponderance of gig economy systems and platform firms of the 21st century were born of the managerial philosophies of the 1990s, not those of the 1920s. In the intervening era, technology firms restructured from industrial to flat hierarchies, reconfiguring key elements of worker control and commitment, firm communication structures, and managerial discretion away from top-down control and toward shared organizational culture and, especially, worker self-discipline and self-starterdom (Heckscher & Donnellon, 1994; Kunda, 1992; Stark, 2009; Turco, 2016; Vallas, 2006; Vertesi, 2020).

Histories of these new firm structures do not begin with Ford or Taylor, as do studies of automation. Instead, they examine the consolidation and capture of markets and infrastructures

in the late 19th century, like small firms or railroads (Chandler, 1977; Langlois, 2023; Osterman, 1996). These firms experimented with distributing managerial tasks across lower tiers of the company, outsourcing core competencies, folding in competitors, and squeezing out middle management to redistribute and peripheralize tasks instead of centralizing them. Recent firms may even orient toward venture capital to buffer dramatic profits instead of through the implementation of a fully functional technical system (Shestakofsky, 2024). These visions and versions of firm management, control, and worker identity are arguably as ideologically sacred to contemporary Silicon Valley technology companies as Scientific Taylorism was to early industrial capitalists (Heckscher & Adler, 2006; O'Mara, 2019; Turner, 2009).

Most importantly for the gig firm, post-bureaucracies do not generate profit through increased efficiencies gained via increasing worker automation or control. Instead, they continually seek reinvention toward profitability, control, and commitment through creative restructuring (Kunda, 1992; Vallas, 2006). This makes for downstream changes to the scope of work, available roles within an organization, and the development of technologies that pick up the slack. In order to understand contemporary workplace pressures among the algorithmically-managed workforce, we must trace these structural changes and the pressures exerted upon managerial roles as firms flattened.

1.2 The Demise of the Managers

Post-bureaucracy as an organizational form did not achieve ascendancy out of nowhere. Its characteristic pressures must be understood in the historical trajectory of the American firm's evolution[1], which lends context to ensuing changes in managerial work within such firms. In the height of bureaucratic hierarchies in the 1970s, accounts of the ratio of managers to workers at the American firm make much of its perceived dis-proportionality: for instance, from 18 administrators per 100 workers in 1929, to 30 administrators per 100 workers in 1970 (Osterman, 1996). This is because by the 1970s, a significant bureaucratic layer of middle management was expected to coordinate many simultaneous, scaled-up production processes (Chandler, 1977). With multiple product lines and complex systems of coordination across geographies and time zones, middle managers were tasked with maintaining consistent communication between workers and teams, coordinating production and output, managing production cycles and operational decision-making. Middle managers also had to ensure workers had the necessary equipment they need to complete a task, established clear work schedules, and gave workers enough information, feedback and support to complete tasks and improve upon their work.

This pattern ended in the recession-fraught 1990s, when Wall Street investors pressured firms to adopt cost-cutting strategies such as the "High Performance Work Organization" or "Total Quality Management" (Ashton et al., 2002). This was marketed as an opportunity for firms to improve production output *and* redistribute higher gains to fewer remaining employees not by restricting worker wages, but by reducing the size of the internal bureaucracy, i.e. cutting *managerial* labor costs. Osterman argues that such companies became top-heavy, requiring ever greater numbers of upper managers in order to maintain relationships with stakeholders like executive board members, venture capitalists, and shareholders (Osterman, 2006).

1. Flatter firms also enjoyed ascendancy in social democracies, due less to capture of profitability through downsizing, than to reasons of expanding worker control and extending corporate governance (Muller & Kuhn, 1993). While outside the scope of this essay, these divergent expectations of the flat hierarchy and its implicators for worker voice deserves further study in the context of the expansion of algorithmically-managed app services around the globe.

Certainly, Goldstein shows that pushes to reduce middle managers in this period paradoxically resulted in an even greater managerial class under firm restructuring (Goldstein, 2012). Regardless, productivity gains between the 1970s and 2000s were largely captured by remaining senior managers rather than lower-tier workers. Under this paradigm, any large layer of middle management was subject to suspicion by external consultants and corporate boards alike, despite their core function of coordinating production and managing workers.

As middle management layers thinned, managerial styles evolved from roles with clear responsibilities and boundaries exerting direct oversight over a scaled workforce, to forms that encouraged more improvised managerial labor ever lower in the firm's hierarchy. Organizational fads during this period such as the Matrix Organization required workers to "manage up" and "manage across" (Burns, 1989; Davis & Lawrence, 1979; Morrill, 1995). Those managers that remained were supposed to be constantly "learning" and "innovating" by problem-solving on tasks outside their specific job descriptions: framed as an opportunity for gaining new and important skills required for expanding roles. Local improvisation and responsiveness to emergent issues were expected to be resolved by workers lower in the chain of command in the best interest of the firm. Culture did the work of control instead of direct authority (Kunda, 1992; Turco, 2016; Vallas, 2006). The discretion given to remaining middle managers in this model is variously described as *"situated"* or *"entrepreneurial"* management.[2] Managers were now expected to complete explicitly defined tasks of control *and* additional strategic "situated" work, to manage vertically as well as laterally.

By the close of the 20th century, centralized and hierarchical models of firms lost favor to these flatter organizations. The model of coordinating workforce in this era of bureaucracy-cutting and loss of local primary industry focused on methods of centralizing strategy and decentralizing operations in a balance to "allow for control and creativity" (MacDuffie, 1996). Courses on *management* at business schools pivoted to courses on *leadership* instead, reflecting both the rise of the charismatic CEO and new responsibilities distributed across all layers of the workforce. Stories of empowering laborers to "pull the chain" like Japanese automobile manufacturers abound, voice-rights and decision-making responsibilities are distributed across the firm as forms of "taking ownership", and power is all the while exerted but far less directly manifested in hierarchy (Dowding, 2015; Freeland & Zuckerman Sivan, 2018; McCaffrey, 2023; Turco, 2016; Vertesi, 2020; Zuckerman, 2010). Workers were expected to manage themselves and small adjacent teams, including projects that require lateral coordination among specialists (Girard & Stark, 2003; Kellogg, 2014; Kellogg et al., 2006; Stark & Broeck, 2024). Outsourcing increasingly excised core functions to outsiders (Kunda & Barley, 2006), lessening the importance of a manager's direct oversight of laborers as necessary or valued. Boundaries were effaced between "inside" and "outside" the corporation, workers and management, work and home. Companies embraced outsourcing not to tighten control over their workforce (as in the industrialist form) but to eject managerial responsibility entirely from their purview. Through these structural reinventions, the firm flattened its hierarchical pyramid. Competencies were extracted for outsourcing, middle management tasks were redistributed, and externalized workforces could be partially and laterally administered outside the boundaries of the firm.

The story of how middle-management is continually being expunged from the 21st century firm has been told elsewhere in more detail (and debated, see Goldstein, 2012). Our goal

2. Batt describes this as "entrepreneurial management" (Batt, 1996); such firm formations are also called "Neo-Fordist". We prefer the vocabulary of the "situated manager" both to avoid confusion with entrepreneurial tropes common to emic descriptions of gig work, and to draw attention to those "situated actions" that stand in contrast to computationally-salient logics and forms of control (Suchman, 2006).

in this brief retelling is to demonstrate how we might productively situate *the story of automated management on gig firm platforms* within this lineage rather than strictly within the industrial form. Such a perspective challenges our typical assumptions of control, resistance, and automated technologies.

For instance, driven by flattening structures and search for profitability, the role of middle management changed from one of worker control to one of situated responsivity. As "entrepreneurs" within their organizations, workers were expected to exhibit "creativity", to diverge from centrally-determined scripts to include contextually-important information or expert interpretation. They were even encouraged to be "rule-breakers" as their responsiveness to context instead of deference to hierarchy contributed to firm goals (Canales, 2011). Middle managerial work was now about improvising and anticipating organizational needs as much as it was about completing explicitly defined and routine coordination tasks.[3] Of course, there has always been an element of negotiation on the job, even in industrial organizational forms, as classic studies of the shopfloor describe (Burawoy, 1979; Stark, 1980). "Situated" management, however, escalates and extends this discretion. All workers are now their own managers. Further, all workers (even lowest-level ones) are acting as good "sociological citizens" (Silbey, 2011) on behalf of the firm's goals when they "exercise good judgment" (Turco, 2016) and respond flexibly as "situational" managers to local circumstance. This expands hegemonic activity beyond the managerial class, even as it simultaneously limits opportunities for worker empowerment (Vallas, 2006).

Tensions associated with automation that are common to post-bureaucratic organizations also echo through the contemporary gig firm. The cultural emphasis on "high performance organizations" in the 1990s suggested that automating industrial managerial functions — such as coordination, machinery logistics, and worker surveillance — could relieve the firm of perceived bureaucratic bloat and streamline operations while preserving shareholder value. The managerial jobs that remained no longer focused on routine administrative tasks but evolved to look more like technicians who needed to identify organizational needs within their production processes on their own *and* problem-solve until they addressed the issues they identified (Osterman, 1996). In response to concerns of an overabundance of managerial discretion, operations research attempted to make this management more predictable and routine (Cohen et al., 1996), feeding the production of workplace software to assist in standardizing managerial tasks. As a result, ever fewer middle managers were asked to oversee more teams and tasks than they had previously through the use of extensive monitoring technologies (Meyer, 1968; Osterman, 2006; Prechel, 1994). Workers on the ground, meanwhile, faced increasing layers of technical surveillance. They also faced increased workloads as they took up the leftover coordination tasks formerly handled by this shrunken managerial layer (Lambert, 2015).

Today's gig economy firms and their workers are the inheritors of this historical context, its structural shifts in the workplace, and associated characteristics of work. As the latest iteration in a long line of corporate restructuring, today's gig companies do not necessarily implement algorithmic tools to improve managerial oversight and control over their workers. Instead, they

3. Such non-vertically integrated arrangements of labor are not limited to the Silicon Valley startup, nor to the globalized firm of the twenty-first century. Similar arrangements are also apparent in the arrangement of taxi medallions, freelancers, online communities, and travelling repairmen (Kunda et al., 2002; Kunda & Barley, 2006; Occhiuto, 2017; Orr, 1996; Schwartz, 2018). These professional arrangements also exhibit laterally distributed forms with limited coordination, emergent peer-to-peer patterns of information exchange, and considerable degrees of self-management. These elements may also be readily visible in the "möbius" form of platform firms identified by Watkins and Stark, who describe how platforms co-opt resources, leverage such distributed assets, and reconfigure managerial roles accordingly (Watkins & Stark, 2018).

implement algorithmic management to excise managerial functions from their purview, removing worker oversight from the responsibility of the firm. Rather than the apotheosis of Taylorist control, then, we see the gig economy firm — with its absent, automated, managerial authority and outsourced, distributed labor-force — as the apotheosis of a multi-decadal story of the relentless purge of perceived managerial bloat from the 21st century corporation.[4] This perspective suggests new ways in which capitalism reinvents itself in the digital era (Srnicek, 2017). It also raises new interpretations of otherwise paradoxical experiences gig workers report on the ground.

2 Partial Replacement and Its Consequences

2.1 The Importance of Being Absent

It is difficult to study an absence. This may be why prior studies of gig work have taken the algorithmic manager at face value, focusing on its controlling characteristics as experienced by workers and its industrialist metrics of productivity. Unlike studies of automation where we might observe job loss or "shadow work" that remains (Lambert, 2015), on a gig platform *there never were any middle managers to begin with* whose jobs were taken away. They are founded both without workers (only contracted outside the firm) and without managers (now abstracted into computational tools). These absences from the outset make the outcomes of automation and labor displacement difficult to observe without explicitly invoking longstanding historical shifts in the organizational of work and their naturalization in this corporate form. Amid this trajectory, we consider these managing algorithms as a partial, vestigial trace of a missing managerial layer in the organization: a shadow of what was once an internal layer in a vertically integrated firm. The ghost of middle management.

In our view, algorithmic management relies on *partial replacement*, a term with tripartite implications. First, automated functions replace only one part an integrated production pipeline: in this case, logistical tasks of production control and worker coordination, not situated or entrepreneurial decision-making. After all, there are only a few managerial "problems" for which "solutions" are computationally available (Pinch & Bijker, 1984), and enough managerial functions can be enacted algorithmically to support the appearance that human managers are unnecessary. Second, with managers omitted from the firm and workers externalized, these situated management tasks necessary to get the job done are lost, unaccounted for in the sociotechnical system. This omitted labor is diffused invisibly among workers' ranks. Perhaps even more starkly than in the taxi industry or among contracting consultants (Camerer et al., 1997; Kunda & Barley, 2006; Occhiuto, 2017), under the gig firm's combination of flat hierarchies, labor externalization, and automation, gig workers are left alone to pick up the slack by becoming their own, uncompensated middle managers. This is form of productivity capture, as core responsibilities are excised from the firm's sphere and transferred to the external gig worker's own unsupervised self-management. Third, partial replacement is a flexible strategy, allowing for both industrial oversight and post-industrial situated entrepreneurialism. Partial replacement thus represents a triple win for the gig firm: the company profits by eliminating costly managers, displacing responsibility for many managerial tasks onto uncompensated workers, while inviting workers to take "ownership" of getting these tasks done.

4. This resonates with Shestakofsky's (2024) interest in how capital forces particular organizational arrangements within the firm.

Partial replacement forms a technocratic arrangement, too, in that it distributes tasks among humans and machines in such a way as to configure and inscribe these roles and responsibilities across the gig firm's platform (Suchman, 2006). In the social studies of technology we frequently observe tasks that are incompletely automated and require creativity on behalf of workers to get the job done, whether through "ghost work" that picks up the pieces left behind by artificial intelligence, the "frontier of control" or "assembly practices" that require human-to-human interactive negotiation, reconciliation, improvisation, or iteration, (Bailey et al., 2010; Gray & Suri, 2019; Kellogg et al., 2006; Stark, 1980). As designers assign certain code-able and discrete tasks to digital tools and relegate others to humans (Seaver, 2019; Suchman, 2011; Ziewitz, 2016), this presents implications for both the politics and experience of labor on the one hand and the presumed power of machinery on the other (Haraway, 1991; compare to Winner, 1986). Taken together, the co-presence of the industrial elements built into gig work algorithms and the situated managerial functions that are left out of this sociotechnical assemblage present political and practical implications for the gig workplace.

Automation in Ford's factory drew a boundary between middle management and laborers in a manner that both upheld the ideal industrial organizational form and supported middle management in increasing oversight and control over workers. The post-bureaucratic company, meanwhile, diffuses control among the ranks by encouraging all to become situated managers, automating replaced enough routine functions such that middle management could be further reduced and responsiveness more broadly shared among the lower-paid. Partial automation in the gig economy straddles these two worlds. It automates the barest traces of middle management using mechanisms of quantification and labor logistics reminiscent of industrial oversight. Its coordinated workers must pick up the situational slack, even as the app exerts industrialesque oversight and haphazard control. While the post-bureaucratic orientation effaces boundaries, the app reinforces a stark boundary between the gig firm and the workers who provide its services.

2.2 Gig Drivers as Situated Managers

Understanding the gig firm's sociotechnical configuration as a heterarchical arrangement explains certain dynamics familiar to studies of gig work. Instead of paradoxes explainable through culture or necessity, they become examples of displaced situated management that are simultaneously subject to industrial values of managerial control. For instance, many characteristics of gig labor have been described as moments of guesswork in the face of algorithmic opacity, local skills and fluencies, forms of organizing or resistance, or techniques of information sharing (Jarrahi et al., 2021; Lee, 2018; Rosenblat & Stark, 2016). Yet if we observe these same activities from the post-bureaucratic perspective, they become evidence of the diffusion of situated management responsibilities across a flat and outsourced workforce. Rather than deviating from scripts, they are acting as "good sociological citizens" to the corporation's benefit.

We illustrate these competing interpretations with empirical reference to interviews we conducted with forty drivers for Amazon Flex, Uber and Lyft, collected in 2019 and available to researchers as an open source dataset (Enriquez, 2021).[5] Our goal is not to be exhaustive, es-

5. The second author conducted interviews in 2019 with delivery drivers for Amazon Flex, Uber, and Lyft, and a gig Amazon warehouse worker. Interviewees were recruited on a streetcorner in New York City where day laborers typically assemble, as well as through a website for SNAP benefits recipients, through advertisements in English, French and Spanish. The dataset is posted online at https://doi.org/10.34770/4324-yn77.

pecially amid so many detailed extant studies of gig labor. Rather we refer to these interviews to illuminate the dual interpretations that arise once we re-examine worker activities from the post-industrial perspective: that is, embedded within a sociotechnical system that both omits middle managers (a post-bureaucratic structure) and only partially replaces them by favoring industrial tasks and neglecting situated ones.[6]

For instance, in industrial firms where employees work in shifts, a manager is responsible for allocating workers where they are most needed, optimizing local resources to meet the demand of customers. If the Taylorist middle manager was responsible for scheduling blocks or shifts, the post-bureaucratic situated manager is expected to respond to local situational needs flexibly and using their discretion. Gig economy algorithms, in turn, adapt in near-real-time to worker demand and encourage workers to sign on to drive through pricing updates that adapt to consumer demand. Technologists and business strategists see this as a logistics breakthrough, especially as labor has been framed as an expensive problem to solve by reducing "idle time" wages as much as possible. Yet despite the use of computational systems for scheduling gig work, schedule coordination in the post-bureaucratic firm is not a purely automatable task but includes situational knowledge and responses outside the purview of calculation.

When gig workers try to guess how the market will behave to schedule their time accordingly, this is a type of situated management (compare to Camerer et al., 1997). Rosenblat (2018) first identified how drivers spend considerable time trying to guess when there will be enough work and, in the absence of information about potential trips' profitability, evaluating whether the wear/tear on their cars is worth signing in. Drivers we interviewed also described "trying to watch... gas versus miles versus trip reviews... I like to watch that information so I can track to see where best to put myself, to put my time." One driver we spoke to used his graduate school skills in Excel sheet management to develop elaborate tracking mechanisms to shape their situational scheduling decisions. Responding to an evolving and dynamic situation mediated through the app, drivers reported to us that they stayed online until they met their paycheck goals, guessing patterns associated with pricing on the weekends versus weeknights, or seeking "blocks" of work by refreshing their phones at random times throughout the week.

Situated managers respond to immediate changes in equipment or on-the-job flexibility using a local calculus of productivity, and we observed these activities among our interviewees as well. Gig companies may develop these sensibilities among workers who innovate their own ways of managing equipment, repairs, and the fiscal and cognitive expenses of their shift work (on cognitive labor see Daminger, 2019). Licensing, gas, insurance, and repairs factor into each workers' own calculus for optimizing productivity, such that today's "working out" (Cameron, 2022) now entails managing multiple factors and currencies. More than one driver we interviewed talked through their complex calculus for balancing rental fees versus income, considered over a week of fluctuating rides. Even in tasks considered easily routinized for automation like package delivery, workers implement cognitive and material managerial techniques to complete assigned tasks, such as where to place packages in their cars for optimal grab-and-go. Drivers described to us their creative workarounds like screenshots to record deliveries in places with "no Wifi, no 3G, no 5G, nothing." We observe these practices as examples of innovative workarounds both in the face of changing circumstance *and* in the absence of managerial direction. Far from of unjustified or untrustworthy discretion, we argue, this situated decision-

6. Although this collected material initially formed the basis for theorizing our approach to the gig economy, we frame this paper as a theory intervention to introduce, first, the alternative framework with which to understand gig labor. Despite playing a central role in our theoretical work, these illustrative quotes here serve to illustrate the dual interpretation possible once gig labor is understood in a post-industrial perspective.

making is encouraged and even celebrated as a form of productive creativity and entrepreneurial management in post-bureaucratic firms.

Between ambiguity in scheduling and desire to make ends meet, many drivers we spoke to went to great lengths to improve their access to scheduling blocks or to make good decisions about a pickup. This improvisation also takes place in the gap between industrialized forms of automatable scheduling and situated management necessary in the manager-less firm. Gig workers thus develop just-in-time responses to just-in-time scheduling information to manage their own availability. Responding to "random" release, workers also must factor in considerable amounts of unpaid time waiting for shifts, as one driver explained: "I was spending four or five hours every morning because they drop them at random times, for me to get that block." Some engaged "Script Cartels" or "Block Extractor" companies to sign up on their behalf, essentially employing their own middle layer of management to handle the costs of coordination. Even in the presence of algorithmic tools that target logistics and scheduling, responsive practices associated with situated management are a routine part of the gig worker's unpaid workday.

It is well-known that gig workers turn to digital infrastructures to establish peer networks, offer support and learning opportunities, and to organize (Schwartz, 2018; Ticona, 2022; Watkins, 2022; Wood et al., 2019). This connective tissue is also a form of distributed situated managerial task assumed by the post-bureaucratic worker. Under post-bureaucratic companies' concept of "ownership", workers are expected to take personal responsibility for their own feedback, mobilize toward opportunities for improvement and collective problem solving. Instead of trusting the app's generic feedback, "tips", or and pre-recorded training videos (described in the dataset as "vague... not especially useful", "obvious", "a kindergartner could do this job", or "forgettable"), we observe workers crowdsource problems associated with their own professional development in the absence of managerial interactions or evaluation. Shadow professional development seminars, theories about scheduling scripts, and peer-to-peer tips on how to maximize income were often visible on online driver groups led by individuals who revealed secret strategies for payment. This need was especially keenly felt as drivers noted that emails or "tips" from the company were rarely aimed at performance improvement but were counted as tallies against them instead.

Active online groups also provide a form of mentorship and real-time assistance in problem-solving when something falls apart, again in the absence of management. This includes assisting someone on a delivery route when their map and location tools breaks, offering help responding to termination emails, or providing a direct phone number for a customer service agent known to answer questions beyond a proscribed template. Delivery workers strike up peer-to-peer relationships with in-store workers associated with other components of the platform's promised system (Maffie, 2024). Brokerage ties like these are familiar to the post-bureaucratic firm, enabling work to get done across lateral groups without direct oversight (Kellogg, 2014; Kellogg et al., 2006). Taken together, peer networks and lateral connections filled in for management or top-down directives, by taking on situated managerial tasks as workers' own problems to resolve.

3 Who Benefits from Heterarchy in the Gig Economy Firm?

In long historical view, the gig economy firm perfects the art of excising both workers and those middle-managers responsible for overseeing them from the purview of the firm. Meanwhile, the partially-automated algorithmic managers that remain only replace basic industrial man-

agerial functions of control and coordination algorithmically, leaving essential situated management tasks to be picked up by the worker. As a result, both industrial and postindustrial forms management co-exist and sit awkwardly alongside each other amid the gig economy's workforce.[7] It is, in essence, a heterarchy, whereby workers are subject to multiple forms of organizing, reporting, and valuation at the same time.

Early conceptions of heterarchy describe the "creative friction" experienced in flat corporations in the late 1990s and early 2000s, and the recombinant possibilities of post-socialist European companies in response to uncertainty, although they also point to the potential dark side of being pulled in too many directions (Girard & Stark, 2003; Stark, 1999, 2001, & 2009). We offer that in the heterarchical gig economy firm at least, workers and companies experience this mixed mode of organization differently based on power differentials. The *gig firm* experiences the benefits of enhanced industrial oversight and free "entrepreneurial" labor while eliminating a costly layer from the firm. Meanwhile, competing structural conditions require *gig workers* to navigate two concurrent yet competing forms of valuation at once. They are not empowered to navigate this dissonance, which they experience both as opportunities for creativity and ownership on the one hand, and moments of confusion, frustration, or disenfranchisement on the other.

For instance, we know that gig work brings with it additional managerial tasks, moments of contestation, and meaning-making in everyday work (Ticona, 2022; Watkins, 2022), through gaps in technological expectations versus the reality of delivery (Bailey et al., 2010; Gray & Suri, 2019; Shestakofsky, 2024). Peer-to-peer support is nothing new in technical professions (Orr, 1996) and certainly all workers must improvise to get the job done. Prior work on the gig economy focused on these forms of gig work overhead as filling in industrialist gaps. Viewing them as elements of excised situated management amid post-bureaucratic pressures, however, offers different analytic opportunities than a strict focus on control or resistance to algorithmic despotism. Recall, for instance, that post-industrial middle managers are supporting the company when they break the rules (Canales, 2011). Indeed, breaking with traditional hierarchical arrangements of control is expected and beneficial to the firm. Under the human-machine configuration of partial automation, these are "positive" acts of deviance that might be seen as Mertonian forms of "innovation" (Canales, 2011)! This rescripts moments of resistance, peer-to-peer organizing, and scheduling hijinks as supportive of company's aims, demonstrating new ways of manufacturing consent (Burawoy, 1979; Cameron, 2024; Vallas, 2006).

Yet this does not mean that workers are celebrated for their efforts. The essence of heterarchy is that multiple forms of valuation are simultaneously present (Stark, 1999 & 2009). Workers in a white-collar heterarchy may be exhausted by the need to be "accountable to many" amid laterally organized teams, embracing a form of "self-management" as they are only truly accountable to themselves (Stark, 2009, p. 113). At the lower rungs of the socioeconomic ladder, however, forms of creative, worker-initiated situated management that ultimately benefit the company, such as making the decisions to drive around a washed out bridge, or forms of lateral collaboration such as peer-to-peer training — are also at the same time an opportunity for worker injunction. Gig workers acutely experience the responsibility for ownership over situated tasks that float, unassigned, in the post-bureaucratic, manager-less structure in which they participate. Yet they are also expected to act without any concomitant organizational au-

7. It is of course common for "flat" firms to possess hierarchies, or for clashes between informal and formal decision-making mechanisms and pathways to persist even in bureaucratic corporations (Meyer & Rowan, 1977; Vertesi, 2020). In this case, however, we observe that both modes are formal, structurally imposed conditions upon the worker.

thority or empowerment to do so, without compensation or reward, and under fear of algorithmic punishment. Those who develop elaborate techniques for just-in-time scheduling or deep knowledge of a neighborhood for improved delivery, could just as easily be sanctioned for not following the coded instructions of the app or not making a delivery cutoff time. With no middle management involved in evaluation, the system even offsets such feedback as a form of "laundered control" (Maffie, 2022) via customer ratings. In many ways, too, workers' inability to contest penalties that result from creatively or collaboratively deviating from a prescribed course is less a signal of purposeful despotism than a vestigial trace of a lost managerial layer, accompanied by a lack of authority among workers to make situational decisions.

If workers are less likely to benefit from this heterarchical condition, the company is more fortunate. Through the deployment of algorithmic managers, the firm can both exert an industrial form of control upon the worker and eradicate the need to pay managerial salaries. Gig workers' resulting situated management as free labor benefits the company by improvising to get the job done without compensation, and gives a disjointed system the appearance of full functionality (Gray & Suri, 2019; Shestakofsky, 2017; Vertesi et al., 2020). Such good sociological citizenry allows for continued co-option of employee resources, adding to the externally-held assets and worker datastreams already captured by these corporations (Stark & Broeck, 2024; Stark & Pais, 2020; Vertesi et al., 2020; Watkins & Stark, 2018). The result is arguably a better outcome for company profitability than if management were fully automated or if workers attempted to manage the broader service market as micro-firms.

The heterarchical arrangement of gig work also suggests additional varieties of wage suppression and worker disenfranchisement (Dubal, 2017; Irani & Silberman, 2013; Lordan & Neumark, 2017; Vallas, 2006). As a form of classed labor, gig jobs are largely devalued while managerial work is classed as higher skill. Should their managerial work be recognized and compensated, gig workers might enjoy other benefits such as payment, regulation, visibility, or voice rights. At time of writing, it remains in gig economy firms' interest to transmute situated management functions into unpaid improvised tasks undertaken by the externalized worker. Yet although such activities remain uncompensated overhead with limited voice rights (Freeland & Zuckerman Sivan, 2018), they are locally celebrated as the worker's "entrepreneurship" and associated with pride in "being your own boss" (Cutolo & Kenney, 2021; Hyman, 2018; Ravenelle, 2019; Schneider & Harknett, 2019; Weil, 2014). In other words, omitted management and uncompensated labor is framed as a *privilege* of gig employment, part of what makes a "good-bad" job (Cameron, 2024), seem at least partially "good".[8]

4 Conclusion and Implications

Does gig work represent algorithmically induced industrial forms of control (Cameron, 2022; Cameron & Rahman, 2022; Rosenblat & Stark, 2016; Schor & Attwood-Charles, 2017; Vallas et al., 2022; Vallas & Kronberg, 2023; Vallas & Schor, 2020) or a technologically-infused post-bureaucratic departure from industrialism (Heckscher & Donnellon, 1994; Stark & Broeck, 2024; Watkins & Stark, 2018)? Our answer is: *both*. Consistent with corporate trends toward flatter hierarchies and externalized labor, gig economy firms have taken a leap of faith in replac-

8. Unlike Shestakofsky (2024), located at the programming center of a platform work firm, we are unfortunately unable to view the decision-making of platform designers themselves. However, "configuration" is not a one-time or even top-down process. Suchman, Haraway, and others demonstrate how we can intuit these arrangements based on the resulting human experiences of labor and read socio-technical systems as examples of assumptions about human and machine capabilities (Haraway, 1991; Suchman, 2006 & 2011).

ing an entire layer of middle management who might oversee their workers, with computational tools. In doing so they automated *some* managerial functions, specifically those associated with industrial organizing, but not others essential to managerless post-industrialism. What Kellogg et al. (2020) identify as the complete "disintermediation of managers" combined with an incomplete configuration of managerial tasks *and* a flattened firm results in something quite other than rational control. Workers thus experience the paradoxes and dissonances common to post-bureaucratic distributed workforces *and* those of industrial control at the same time: a heterarchy enacted through partial replacement.

It is imperative to place the gig economy firm in the context of the long decline of the industrialized organization and the rise of post-bureaucratic arrangements that characterize the early 21st century firm. This reveals hidden pressures and a historical trajectory that informs the organization and experience of gig work as we encounter it today. This is not to say that industrialist factors like worker surveillance and control do not matter. Rather, it is to recognize that we are encountering a mixed mode of working, one in which many forms of essential labor have been restructured away from the firm's internal design and delegated, unaccountably, upon low-status workers' shoulders. The widely-reported and commonly experienced human labor necessary to make the system "work" is therefore not an exception or a form of resistance. It instead acquires structural salience as a demonstration of the many omissions and managerial neglect at the heart of gig economy firm's operation. Future work should explore how other well-characterized elements of post-bureaucratic firms serve to enroll gig workers' compliance with company goals, to manage dissent, and to address opportunities for advancement or organizing.

Partial replacement has been so successful that most scholars of the gig economy do not even recognize middle management as an issue for such firms. After all, there were never any middle managers to observe in the first place! Without reclaiming the importance of this absent layer, however, we fail to understand a fundamental aspect of capitalism's reinvention in the platform economy (Srnicek, 2017), a site and source of its power over workers and its promised profits to its investors (Beckert & Bronk, 2018; Shestakofsky, 2024; Vertesi et al., 2020). Embracing the post-bureaucratic aspect of gig work structured by platforms in the contemporary firm requires looking past its most obvious technical element — the algorithmic manager — to make salient the firm's structural capabilities and antecedents in the background. We can thus inquire into which managerial components such an algorithm was meant to displace, why, and with which consequences (Pinch & Bijker, 1984; Seaver, 2019).

From this vantage point, we can also better observe how multiple logics compete and clash to produce contradictory experiences for contemporary workers. The combination of these heterarchical imperatives creates new lose-lose scenarios for workers and further win-win scenarios for companies. This perspective also allows us to account for the observed pressures of outsourcing and managerial downsizing and issues of control and surveillance while centering the experience of precarious labor. Importantly, too, it reveals how heterarchy is experienced by those further down the ladder of labor relations and economic control. And it enables us to better appreciate the downstream effects for firms and workers who labor under algorithmic management. Grappling with the long tail of these structural currents and their implications for work is essential if we are to better understand forthcoming firm transformations, especially as we enter the age of A.I. (Hinds & von Krogh, 2024).

References

Alvarez de la Vega, J.C., Cecchinato, M.E., Rooksby, J., & Newbold, J. (2023). Understanding Platform Mediated Work-Life: A Diary Study with Gig Economy Freelancers. *Proceedings of the ACM on Human-Computer Interaction*, *7*, 1–32. https://doi.org/10.1145/3579539

Aneesh, A. (2009). Global Labor: Algocratic Modes of Organization. *Sociological Theory*, *27*(4), 347–370. https://doi.org/10.1111/j.1467-9558.2009.01352.x

Ashton, D.N., Sung, J., & Office, I.L. (2002). *Supporting Workplace Learning for High Performance Working*. Geneva: International Labour Office.

Bailey, D.E., Leonardi, P.M., & Chong, J. (2010). Minding the Gaps: Understanding Technology Interdependence and Coordination in Knowledge Work. *Organization Science*, *21*(3), 713–730. https://doi.org/10.1287/orsc.1090.0473

Batt, R. (1996). From Bureaucracy to Enterprise? The Changing Jobs and Careers of Managers in Telecommunications Service. In P. Osterman (Ed.), *Broken Ladders: Managerial Careers in the New Economy* (pp. 55–80). Oxford: Oxford University Press. https://doi.org/10.1093/oso/9780195093537.003.0003

Beckert, J., & Bronk, R. (Eds.). (2018). *Uncertain Futures: Imaginaries, Narratives, and Calculation in the Economy*. Oxford: Oxford University Press. https://doi.org/10.1093/oso/9780198820802.001.0001

Braverman, H. (1974). *Labor and Monopoly Capital. The Degradation of Work in the Twentieth Century*. New York, NY: Monthly Review Press. https://doi.org/10.14452/MR-026-03-1974-07_1

Brayne, S., & Christin, A. (2021). Technologies of Crime Prediction: The Reception of Algorithms in Policing and Criminal Courts. *Social Problems*, *68*(3), 608–624. https://doi.org/10.1093/socpro/spaa004

Burawoy, M. (1979). *Manufacturing Consent: Changes in the Labor Process Under Monopoly Capitalism*. Chicago, IL: University of Chicago Press.

Burawoy, M. (1985). *The Politics of Production: Factory Regimes Under Capitalism and Socialism*. London: Verso.

Burns, L.R. (1989). Matrix Management in Hospitals: Testing Theories of Matrix Structure and Development. *Administrative Science Quarterly*, *34*(3), 349–368. https://doi.org/10.2307/2393148

Camerer, C., Babcock, L., Loewenstein, G., & Thaler, R. (1997). Labor Supply of New York City Cabdrivers: One Day at a Time. *The Quarterly Journal of Economics*, *112*(2), 407–441. https://doi.org/10.1162/003355397555244

Cameron, L.D. (2022). "Making Out" While Driving: Relational and Efficiency Games in the Gig Economy. *Organization Science*, *33*(1), 231–252. https://doi.org/10.1287/orsc.2021.1547

Cameron, L.D. (2024). The Making of the "Good Bad" Job: How Algorithmic Management Manufactures Consent Through Constant and Confined Choices. *Administrative Science Quarterly*, *69*(2), 458–514. https://doi.org/10.1177/00018392241236163

Cameron, L.D., & Rahman, H. (2022). Expanding the Locus of Resistance: Understanding the Co-constitution of Control and Resistance in the Gig Economy. *Organization Science*, *33*(1), 38–58. https://doi.org/10.1287/orsc.2021.1557

Canales, R. (2011). Rule Bending, Sociological Citizenship, and Organizational Contestation in Microfinance. *Regulation & Governance*, *5*(1), 90–117. https://doi.org/10.1111/j.1748-5991.2010.01095.x

Chandler, A.D. (1977). *The Visible Hand: The Managerial Revolution in American Business*. Cambridge, MA: Harvard University Press.

Cohen, M.D., Burkhart, R., Dosi, G., Egidi, M., Marengo, L., Warglien, M., & Winter, S. (1996). Routines and Other Recurring Action Patterns of Organizations: Contemporary Research Issues. *Industrial and Corporate Change*, *5*(3), 653–698. https://doi.org/10.1093/icc/5.3.653

Cutolo, D., & Kenney, M. (2021). Platform-dependent Entrepreneurs: Power Asymmetries, Risks, and Strategies in the Platform Economy. *Academy of Management Perspectives*, *35*(4), 584–605. https://doi.org/10.5465/amp.2019.0103

Dalal, S., Chiem, N., Karbassi, N., Liu, Y., & Monroy-Hernández, A. (2023). Understanding Human Intervention in the Platform Economy: A Case Study of an Indie Food Delivery Service. In A. Schmidt, K. Väänänen, & T. Goyal (Eds.), *Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems* (pp. 1–16). New York, NY: Association for Computing Machinery. https://doi.org/10.1145/3544548.3581517

Daminger, A. (2019). The Cognitive Dimension of Household Labor. *American Sociological Review*, *84*(4), 609–633. https://doi.org/10.1177/0003122419859007

Davis, S.M., & Lawrence, P.R. (1979). Problems of Matrix Organizations. In R. Hill & B.J. White (Eds.), *Matrix Organization & Project Management* (pp. 134–151). Ann Arbor, MI: Division of Research, Graduate School of Business Administration, University of Michigan.

Delfanti, A., & Frey, B. (2020). Humanly Extended Automation or the Future of Work Seen through Amazon Patents. *Science, Technology, & Human Values*, *46*(3), 655–682. https://doi.org/10.1177/0162243920943665

Dowding, K. (2015). Albert O. Hirschman, Exit, Voice and Loyalty: Responses to Decline in Firms, Organizations, and States. In M. Lodge, E.C. Page, & S.J. Balla (Eds.), *The Oxford Handbook of Classics in Public Policy and Administration* (pp. 256–271). Oxford: Oxford University Press. https://doi.org/10.1093/oxfordhb/9780199646135.013.30

Dubal, V.B. (2017). Wage Slave or Entrepreneur?: Contesting the Dualism of Legal Worker Identities. *California Law Review*, *105*(1), 65–123. https://repository.uclawsf.edu/faculty_scholarship/1596

Enriquez, D. (2021). *Delivery Gig Worker Interviews on Automation at Work* [Dataset]. Princeton University. https://doi.org/10.34770/4324-yn77

Freeland, R., & Zuckerman Sivan, E. (2018). The Problems and Promise of Hierarchy: Voice Rights and the Firm. *Sociological Science*, *5*, 143–181. https://doi.org/10.15195/v5.a7

Girard, M., & Stark, D. (2003). Heterarchies of Value in Manhattan-Based New Media Firms. *Theory, Culture & Society*, *20*(3), 77–105. https://doi.org/10.1177/0263276403020300 6

Goldstein, A. (2012). Revenge of the Managers: Labor Cost-Cutting and the Paradoxical Resurgence of Managerialism in the Shareholder Value Era, 1984 to 2001. *American Sociological Review*, *77*(2), 268–294. https://doi.org/10.1177/0003122412440093

Gray, M.L., & Suri, S. (2019). *Ghost Work: How to Stop Silicon Valley from Building a New Global Underclass*. Boston, MA: Houghton Mifflin Harcourt.

Griesbach, K., Reich, A., Elliott-Negri, L., & Milkman, R. (2019). Algorithmic Control in Platform Food Delivery Work. *Socius*, *5*. https://doi.org/10.1177/2378023119870041

Haraway, D.J. (1991). *Simians, Cyborgs, and Women: The Reinvention of Nature*. London: Routledge.

Heckscher, C.C., & Adler, P.S. (Eds.). (2006). *The Firm as a Collaborative Community: Reconstructing Trust in the Knowledge Economy*. Oxford: Oxford University Press. https://doi.org/10.1093/oso/9780199286034.001.0001

Heckscher, C.C., & Donnellon, A. (Eds.). (1994). *The Post-Bureaucratic Organization: New Perspectives on Organizational Change*. New York, NY: Sage Publications.

Hinds, P., & von Krogh, G. (2024). Generative AI, Emerging Technology, and Organizing: Towards a Theory of Progressive Encapsulation. *Organization Theory*, *5*(4). https://doi.org/10.1177/26317877241293478

Hyman, L. (2018). *Temp: The Real Story of What Happened to Your Salary, Benefits, and Job Security*. London: Penguin.

Irani, L., & Silberman, M.S. (2013). Turkopticon: Interrupting Worker Invisibility in Amazon Mechanical Turk. In W.E. Mackay (Ed.), *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems - CHI '13* (pp. 611–620). New York, NY: Association for Computing Machinery. https://doi.org/10.1145/2470654.2470742

Jarrahi, 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. (2014). Brokerage Professions and Implementing Reform in an Age of Experts. *American Sociological Review*, *79*(5), 912–941. https://doi.org/10.1177/0003122414544734

Kellogg, K.C., Orlikowski, W.J., & Yates, J. (2006). Life in the Trading Zone: Structuring Coordination across Boundaries in Postbureaucratic Organizations. *Organization Science*, *17*(1), 22–44. https://doi.org/10.2307/25146011

Kellogg, K.C., Valentine, M., & Christin, A. (2020). Algorithms at Work: The New Contested Terrain of Control. *The Academy of Management Annals*, *14*(1), 366–410. https://doi.org/10.5465/annals.2018.0174

Kunda, G. (1992). *Engineering Culture: Control and Commitment in a High-Tech Corporation*. Philadelphia, PA: Temple University Press.

Kunda, G., & Barley, S.R. (2006). *Gurus, Hired Guns, and Warm Bodies Itinerant Experts in a Knowledge Economy*. Princeton, NJ: Princeton University Press.

Kunda, G., Barley, S.R., & Evans, J. (2002). Why Do Contractors Contract? The Experience of Highly Skilled Technical Professionals in a Contingent Labor Market. *Industrial and Labor Relations Review*, *55*(2), 234–261. https://doi.org/10.2307/2696207

Lambert, C. (2015). *Shadow Work: The Unpaid, Unseen Jobs That Fill Your Day*. Berkeley, CA: Counterpoint.

Langlois, R.N. (2023). *The Corporation and the Twentieth Century: The History of American Business Enterprise*. Princeton, NJ: Princeton University Press. https://doi.org/10.1515/9780691247526

Lee, M.K. (2018). Understanding Perception of Algorithmic Decisions: Fairness, Trust, and Emotion in Response to Algorithmic Management. *Big Data & Society*, *5*(1). https://doi.org/10.1177/2053951718756684

Levy, K. (2024). *Data Driven: Truckers, Technology, and the New Workplace Surveillance* (Reprint ed.). Princeton, NJ: Princeton University Press. https://doi.org/10.1353/book.109251

Levy, K.E.C. (2015). The Contexts of Control: Information, Power, and Truck-Driving Work. *The Information Society*, *31*(2), 160–174. https://doi.org/10.1080/01972243.2015.998105

Lordan, G., & Neumark, D. (2017). *People Versus Machines: The Impact of Minimum Wages on Automatable Jobs* (Working Paper 23667; Working Paper Series). National Bureau of Economic Research. https://doi.org/10.3386/w23667

MacDuffie, J.P. (1996). Automotive White-Collar: The Changing Status and Roles of Salaried Employees in the North American Auto Industry. In P. Osterman (Ed.), *Broken Ladders: Managerial Careers in the New Economy* (pp. 81–125). Oxford: Oxford University Press. https://doi.org/10.1093/oso/9780195093537.003.0004

Maffie, M.D. (2022). The Perils of Laundering Control through Customers: A Study of Control and Resistance in the Ride-hail Industry. *ILR Review*, *75*(2), 348–372. https://doi.org/10.1177/0019793920972679

Maffie, M.D. (2024). Adversaries or Cross-Organization Co-workers? Exploring the Relationship between Gig Workers and Conventional Employees. *ILR Review*, *77*(1), 3–31. https://doi.org/10.1177/00197939231194254

Marx, K. (2008). *Das Kapital. Kritik der politischen Ökonomie*. Band 1-3. Berlin: Karl Dietz. (Original work published 1867-1894)

McCaffrey, M. (2023). Who's the Boss? The Persistence of Entrepreneurial Hierarchy in Flat Organizations. *Journal of Organization Design*, *12*(1–2), 37–40. https://doi.org/10.1007/s41469-022-00132-8

McCann, L., Morris, J., & Hassard, J. (2008). Normalized Intensity: The New Labour Process of Middle Management. *Journal of Management Studies*, *45*(2), 343–371. https://doi.org/10.1111/j.1467-6486.2007.00762.x

Merchant, B. (2023). *Blood in the Machine: The Origins of the Rebellion Against Big Tech*. Boston, MA: Little, Brown and Company.

Meyer, J.W., & Rowan, B. (1977). Institutionalized Organizations: Formal Structure as Myth and Ceremony. *American Journal of Sociology*, *83*(2), 340–363. https://doi.org/10.1086/226550

Meyer, M.W. (1968). Automation and Bureaucratic Structure. *American Journal of Sociology*, *74*(3), 256–264. https://doi.org/10.1086/224639

Meyer, M.W. (2001). What Happened to Middle Management? In I. Berg & A.L. Kalleberg (Eds.), *Sourcebook of Labor Markets* (pp. 449–466). Boston, MA: Springer. https://doi.org/10.1007/978-1-4615-1225-7_18

Morrill, C. (1995). *The Executive Way: Conflict Management in Corporations*. Chicago, IL: University of Chicago Press.

Muller, M.J., & Kuhn, S. (1993). Participatory Design. *Commun. ACM*, *36*(6), 24–28. https://doi.org/10.1145/153571.255960

Occhiuto, N. (2017). Investing in Independent Contract Work: The Significance of Schedule Control for Taxi Drivers. *Work and Occupations*, *44*(3), 268–295. https://doi.org/10.1177/0730888417697231

O'Mara, M. (2019). *The Code: Silicon Valley and the Remaking of America*. London: Penguin.

Orr, J.E. (1996). *Talking about Machines: An Ethnography of a Modern Job*. Ithaca, NY: Cornell University Press.

Osterman, P. (1996). *Broken Ladders: Managerial Careers in the New Economy*. Oxford: Oxford University Press. https://doi.org/10.1093/oso/9780195093537.001.0001

Osterman, P. (2006). The Changing Employment Circumstances of Managers. In E. Lawler & J. O'Toole (Eds.), *America at Work: Choices and Challenges*. London: Palgrave Macmillan. https://doi.org/10.1057/9781403983596_11

Petriglieri, G., Ashford, S.J., & Wrzesniewski, A. (2019). Agony and Ecstasy in the Gig Economy: Cultivating Holding Environments for Precarious and Personalized Work Identities. *Administrative Science Quarterly*, *64*(1), 124–170. https://doi.org/10.1177/0001839218759646

Pinch, T.J., & Bijker, W.E. (1984). The Social Construction of Facts and Artefacts: Or How the Sociology of Science and the Sociology of Technology might Benefit Each Other. *Social Studies of Science*, *14*(3), 399–441. https://doi.org/10.1177/030631284014003004

Prechel, H. (1994). Economic Crisis and the Centralization of Control Over the Managerial Process: Corporate Restructuring and Neo-Fordist Decision-Making. *American Sociological Review*, *59*(5), 723–745. https://doi.org/10.2307/2096445

Raghavan, M., Barocas, S., Kleinberg, J., & Levy, K. (2020). Mitigating Bias in Algorithmic Hiring: Evaluating Claims and Practices. In M. Raghavan, S. Barocas, J. Kleinberg, & K. Levy (Eds.), *Proceedings of the 2020 Conference on Fairness, Accountability, and Transparency* (p. 469–481). New York, NY: Association for Computing Machinery. https://doi.org/10.1145/3351095.3372828

Rahman, H. (2024). *Inside the Invisible Cage: How Algorithms Control Workers*. Oakland, CA: University of California Press. <https://doi.org/10.1525/9780520395558

Ravenelle, A. (2019). *Hustle and Gig: Struggling and Surviving in the Sharing Economy*. Oakland, CA: University of California Press. https://doi.org/10.1525/9780520971899

Rosenblat, A. (2018). *Uberland: How Algorithms are Rewriting the Rules of Work*. Oakland, CA: University of California Press. https://doi.org/10.1525/9780520970632

Rosenblat, A., & Stark, L. (2016). Algorithmic Labor and Information Asymmetries: A Case Study of Uber's Drivers. *International Journal of Communication*, *10*, 3758–3784. http://dx.doi.org/10.2139/ssrn.2686227

Schneider, D., & Harknett, K. (2019). Consequences of Routine Work-Schedule Instability for Worker Health and Well-Being. *American Sociological Review*, *84*(1), 82–114. https://doi.org/10.1177/0003122418823184

Schor, J.B., & Attwood-Charles, W. (2017). The "Sharing" Economy: Labor, Inequality, and Social Connection on For-profit Platforms. *Sociology Compass*, *11*(8), e12493. https://doi.org/10.1111/soc4.12493

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

Schwartz, D. (2018). Embedded in the Crowd: Creative Freelancers, Crowdsourced Work, and Occupational Community. *Work and Occupations*, *45*(3), 247–282. https://doi.org/10.1177/0730888418762263

Seaver, N. (2019). Knowing Algorithms. In J. Vertesi, D. Ribes, C. DiSalvo, Y. Loukissas, L. Forlano, D.K. Rosner, S.J. Jackson, & H.R. Shell (Eds.), *digitalSTS* (pp. 412–422). Princeton, NJ: Princeton University Press.

Shestakofsky, B. (2017). Working Algorithms: Software Automation and the Future of Work. *Work and Occupations*, *44*(4), 376–423. https://doi.org/10.1177/0730888417726119

Shestakofsky, B. (2024). *Behind the Startup: How Venture Capital Shapes Work, Innovation, and Inequality*. Oakland, CA: University of California Press. https://doi.org/10.1525/9780520395046

Shestakofsky, B., & Kelkar, S. (2020). Making Platforms Work: Relationship Labor and the Management of Publics. *Theory and Society*, *49*, 863–896. https://doi.org/10.1007/s11186-020-09407-z

Silbey, S.S. (2011). The Sociological Citizen: Pragmatic and Relational Regulation in Law and Organizations. *Regulation & Governance*, *5*(1), 1–13. https://doi.org/10.1111/j.1748-5991.2011.01106.x

Srnicek, N. (2017). *Platform Capitalism*. Cambridge: Polity.

Stark, D. (1980). Class Struggle and the Transformation of the Labor Process. *Theory and Society*, *9*(1), 89–130. https://doi.org/10.1007/BF00158894

Stark, D. (1999). Heterarchy: Distributing Intelligence and Organizing Diversity. In J.H. Clippinger (Ed.), *The Biology of Business: Decoding the Natural Laws of Enterprise* (pp. 153–179). San Francisco, CA: Jossey-Bass.

Stark, D. (2001). Ambiguous Assets for Uncertain Environments: Heterarchy in Postsocialist Firms. In P. DiMaggio (Ed.), *The Twentieth Century Firm: Changing Economic Organization in International Perspective* (pp. 69–104). Princeton, NJ: Princeton University Press.

Stark, D. (2009). *The Sense of Dissonance: Accounts of Worth in Economic Life*. Princeton, NJ: Princeton University Press. https://doi.org/10.1515/9781400831005

Stark, D., & Broeck, P.V. (2024). Principles of Algorithmic Management. *Organization Theory*, *5*(2). https://doi.org/10.1177/26317877241257213

Stark, D., & Pais, I. (2020). Algorithmic Management in the Platform Economy. *Sociologica*, *14*(3), 47–72. https://doi.org/10.6092/issn.1971-8853/12221

Suchman, L. (2006). *Human-Machine Reconfigurations: Plans and Situated Actions* (2nd ed.). Cambridge: Cambridge University Press. (Original work published 2006).

Suchman, L. (2011). Subject Objects. *Feminist Theory*, *12*(2), 119–145. https://doi.org/10.1177/1464700111404205

Ticona, J. (2015). Strategies of Control: Workers' Use of ICTs to Shape Knowledge and Service Work. *Information, Communication & Society*, *18*(5), 509–523. https://doi.org/10.1080/1369118X.2015.1012531

Ticona, J. (2022). Red Flags, Sob Stories, and Scams: The Contested Meaning of Governance on Carework Labor Platforms. *New Media & Society*, *24*(7), 1548–1566. https://doi.org/10.1177/14614448221099233

Turco, C. (2016). *The Conversational Firm*. New York, NY: Columbia University Press. https://doi.org/10.7312/turc17898

Turner, F. (2009). Burning Man at Google: A Cultural Infrastructure for New Media Production. *New Media & Society*, *11*(1–2), 73–94. https://doi.org/10.1177/1461444808099575

Vallas, S. (1993). *Power in the Workplace: The Politics of Production at AT&T*. Albany, NY: State University of New York Press.

Vallas, S. (2006). Empowerment Redux: Structure, Agency, and the Remaking of Managerial Authority. *American Journal of Sociology*, *111*(6), 1677–1717. https://doi.org/10.1086/499909

Vallas, S., Johnston, H., & Mommadova, Y. (2022). Prime Suspect: Mechanisms of Labor Control at Amazon's Warehouses. *Work and Occupations*, *49*(4), 421–456. https://doi.org/10.1177/07308884221106922

Vallas, S., & Kronberg, A.K. (2023). Coercion, Consent, and Class Consciousness: How Workers Respond to Amazon's Production Regime. *Socius*, *9*. https://doi.org/10.1177/23780231231216286

Vallas, S., & Schor, J.B. (2020). What Do Platforms Do? Understanding the Gig Economy. *Annual Review of Sociology*, *46*(1), 273–294. https://doi.org/10.1146/annurev-soc-121919-054857

Vertesi, J. (2020). *Shaping Science: Organizations, Decisions, and Culture on Nasa's Teams*. Chicago, IL: The University of Chicago Press.

Vertesi, J., Goldstein, A., Enriquez, D., Liu, L., & Miller, K.T. (2020). Pre-Automation: Insourcing and Automating the Gig Economy. *Sociologica*, *14*(3), 167–193. https://doi.org/10.6092/issn.1971-8853/11657

Watkins, E.A. (2022). "Have you learned your lesson?" Communities of Practice under Algorithmic Competition. *New Media & Society*, *24*(7), 1567–1590. https://doi.org/10.1177/14614448221099229

Watkins, E.A., & Stark, D. (2018). The Möbius Organizational Form: Make, Buy, Cooperate, or Co-opt? *Sociologica*, *12*(1), 65–80. https://doi.org/10.6092/issn.1971-8853/8364

Weil, D. (2014). *The Fissured Workplace: Why Work Became So Bad for So Many and What Can Be Done to Improve It*. Cambridge, MA: Harvard University Press. https://doi.org/10.4159/9780674726123

Winner, L. (1986). Do Artifacts Have Politics? In *The Whale and the Reactor: A Search for Limits in an Age of High Technology* (pp. 19–39). Chicago, IL: Chicago University Press.

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

Ziewitz, M. (2016). Governing Algorithms: Myth, Mess, and Methods. *Science, Technology & Human Values*, *41*(1), 3–16. https://doi.org/10.1177/0162243915608948

Zuckerman, E.W. (2010). Speaking with One Voice: A "Stanford School" Approach to Organizational Hierarchy. In C.B. Schoonhoven & F. Dobbin (Eds.), *Stanford's Organization Theory Renaissance, 1970-2000*. Research in the Sociology of Organizations, Vol. 28. (pp. 289–307). Bingley: Emerald Group Publishing Limited. https://doi.org/10.1108/S0733-558X(2010)0000028020

Janet A. Vertesi – Department of Sociology, Princeton University (United States)
https://orcid.org/0000-0003-4579-6252 | jvertesi@princeton.edu
https://janet.vertesi.com
Janet A. Vertesi is Associate Professor of Sociology and Associate Director of the Keller Center for Innovation in Engineering Education at Princeton University (USA). A sociologist of science, technology, and organizations, her ethnographies of NASA missions include *Shaping Science* (Chicago University Press, 2015) and *Seeing Like a Rover* (Chicago University Press, 2020) and she is a leader in the *digital-STS* (Princeton University Press, 2014) community.

Diana Enriquez – Department of Sociology, Princeton University (United States)
https://orcid.org/0000-0002-6254-5503
http://denrsch.com/
Diana Enriquez completed her PhD in Sociology at Princeton University (USA). Her dissertation research focused on high-skill freelancers as a subset of the alternative workforce facing new challenges before and during COVID-19. Other research projects examine the role of platforms in managing gig workers and automation in the workplace. Her research interests include economic sociology, labor, law, and technology.