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Stewards of the Organization: The Management of Repair and Maintenance Work in Large Organizations

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Abstract

Studies of repair and maintenance work have pointed to a gap between the way repair and maintenance work is prescribed and the way it is done in practice. This article seeks to contribute an empirical and conceptual account of what transpires in this gap. It focuses on repair and maintenance team supervisors who are both trained repair workers and managers. The article argues that supervisors use their knowledge of the organization alongside their knowledge of materials, people, and objects. To do their work, they articulate and negotiate competing interests and values, drawing on their experience as repair workers and on their managerial autonomy. In developing the concept of "working knowledge," existing studies have tended to focus on the triangular relationship between customers, repair workers, and machines. This article contributes another dimension to "working knowledge," arguing that supervisors and repair workers strive to unpack and interpret, to the best of their ability, not only what constitutes a breakdown or a repair but also what is desirable and beneficial for the organization. By closely tracing three cases in which team supervisors engage in organizational work and interpret managerial preferences, the article shows that repair and maintenance work is shaped not only from below, by interactions with materials, environments, and people, but also from above, by repeated attempts to order, organize, and manage it.

Keywords

repair and maintenance; working knowledge; team supervisors; organizational work; customer service

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Introduction

Robert is an HVAC mechanic and a team supervisor at Eastern University, a large research university in the northeastern United States.[1] Just shy of his 40th work anniversary at Eastern, Robert is a repair and maintenance veteran. While Robert is deeply committed to his work, he is a reluctant manager. He complains about the constant documentation and office work that comes at the expense of "real work," the manual repair of HVAC systems. "I don't want to be behind a desk all day long, like a high-paid secretary," he says. He prefers to be seen by his team members and customers alike.

While repair work is deeply embodied and mobile work, requiring reliance on one's body in manipulating objects and environments (Harper 1987; Henke 2000; Dant and Bowles 2003), team supervisors experience managerial work as static and constrained. Supervisors' work settings are designed without mobility in mind. Supervisors are allocated individual offices equipped with desktop computers. While repair workers carry a dedicated tablet to handle work orders on the go, supervisors can only access the central work order system from their desktop computers.

Robert's frequent absences from his office create a problem when work orders must be logged or reallocated. In such cases, Robert directs his team members to contact the customer service center, a call center that services "customers"—faculty, students, and staff at Eastern University. Once the call center's employees take care of the office work, Robert is free to go where the "real work" is situated. Robert repurposes the call center to reallocate labor in a way that aligns with his understanding of repair and maintenance work.

Team supervisors occupy an intermediate place on Eastern's campus. On the one hand, they are skilled repair and maintenance workers with a trade license and intimate knowledge of materials and machines. Having had years of experience in repair work, team supervisors at Eastern still view themselves as part of a community organized around practice and occupation (Orr 1996; van Maanen and Barley 1984). On the other hand, as supervisors, they enjoy increased job security, better compensation, and significant autonomy. Unlike their team members, who are unionized hourly workers, team supervisors receive a monthly salary and are not union members. They are not required to track and log their work hours, nor are they paid for overtime. At Eastern, repair and maintenance supervisors head twenty teams, ranging from four workers in the smaller teams to almost 20 in the larger ones.

Studies of repair and maintenance work have pointed to a gap between the way repair and maintenance work is prescribed and the way it is done in practice (Orr 1996; Henke 2000). This article seeks to contribute an empirical and conceptual account of what transpires in this gap. It focuses on team supervisors in repair and maintenance who are both trained repair workers and managers. I argue that rather than simply follow managerial directives, team supervisors engage in the articulation and negotiation of competing organizational values. Drawing on their experience as repair workers and on their managerial

[1] Eastern University is a fictitious name. All repair and maintenance workers and supervisors have been given pseudonyms. Some of the teams' specifications have been changed to avoid identification. HVAC stands for Heating, Ventilation, and Air Conditioning.

autonomy, they rely on their knowledge of the organization alongside their knowledge of materials, people, and objects. The article shows that, at least in large organizations, repair and maintenance work includes interpreting not only what constitutes a breakdown or repair but also what is desirable and beneficial for the organization.

Conceptually, the article integrates scholarly work in science and technology studies (STS) on repair and maintenance with sociological studies of organizations and technical work. It does so to overcome a blind spot: while studies of repair and maintenance work have been profound in providing an account of repair and maintenance that combines materiality and sociality, they have been largely confined to the triangular relationship between machines, repair workers, and customers. Sociological studies focused on workplaces and organizational hierarchies, on the other hand, had little to say about the deeply material and embodied nature of repair work. This article attempts to provide a fuller account of repair and maintenance work by widening the lens of analysis to include management as a crucial component of repair and maintenance work in large organizations.

The article builds on previous work in repair and maintenance studies (RMS), a diverse research field at the intersection of STS, sociology, history, anthropology, geography, and information science. The common thread of repair and maintenance scholarship is its focus on the ongoing, often mundane and invisible work that is required to produce technologies, environments, and institutions as stable and orderly (Denis et al. 2015). Important works in the first generation of RMS articulated the materiality of repair and maintenance, their social importance, and the skill and sophistication required to fix people and things (Harper 1987; Orr 1996; Dant and Bowles 2003; Henke 2000; Graham and Thrift 2007). Since then, the study of repair and maintenance has expanded to challenge the centrality of innovation (Suchman and Bishop 2000; Edgerton 2007; Jackson 2014; Russell and Vinsel 2018), highlight the fragility and vulnerability of infrastructure while conceptualizing repair as care work (Edwards 2002; Denis and Pontille 2014, 2015; Connolly 2013), and widen the geographic scope of RMS (Ureta 2014; Jackson et al. 2012; Houston 2019; Lejeune 2019).

Through an ethnography of team supervisors in repair and maintenance, this study contributes to the study of repair and maintenance work as knowledge work. Early studies of repair work sought to collapse the long-held distinction between mental and manual work by highlighting the creativity, judgment, and experimental approach that technical and repair work required (Harper 1987; Shapin 1989; Henke 2000; Barley and Orr 1997). Through the concept of "working knowledge," sociologists of work demonstrated how repair knowledge is both material—embodied, tacit, intuitive, and sensual, and intellectual—requires analysis, hypothesis formation, and testing (Harper 1987; Henke 2000; Dant 2010).

RMS scholars were among the first to show that repair workers draw on their social knowledge in addition to their mechanical knowledge (Harper 1987; Orr 1996; Henke and Sims 2020). Repair and maintenance workers draw heavily on their "people knowledge" to gather information, diagnose a problem, and mend the ruptured social fabric. Addressing the social breakdown, what sociologist Christopher Henke termed "repairing the customer" (Henke 2000), sometimes extends beyond the physical repair work. Repair workers can help their customers make sense of the machines with which they interact by providing the necessary vocabulary and context (Orr 1996).

Finally, recent studies have also shown that repair work is fundamentally knowledge work—that it requires epistemological work (Denis and Pontille 2021). These studies show that repair and maintenance workers engage in the active articulation of knowledge objects—they take part in defining what is broken, what is repair, and what is public order (Henke and Sims 2020; Denis and Pontille 2021). Objects, systems, and even public order itself are not stable and fixed but things to be conceptually unpacked in the course of maintenance work.

This article argues that repair and maintenance work is knowledge work in another sense: in large organizations, repair and maintenance work requires a familiarity with and a deep knowledge of the organization. Repair and maintenance supervisors and workers continuously interpret and make sense of what is possible and desirable for the organization as a whole. Both team supervisors and repair workers are employees of a hierarchical organization as much as they are repair people. And although their job formally delineates their work as customer service work, they constantly incorporate additional, informal considerations into their everyday work. They organize maintenance work into routine procedures, craft solutions to reoccurring organizational problems, and assess customers' requests in light of what they perceive to be wider organizational interests.

Sociological work on technicians provides the necessary backdrop for analyzing how repair and maintenance supervisors interpret their work and organizational position. These studies show that technical workers occupy an in-between space between horizontally and vertically organized labor (Whalley and Barley 1997). Like artisans or professionals, they are trained in occupational communities (van Maanen and Barley 1984) that rely on apprenticeship and on-the-job training, but the organizations that ultimately employ them rely on a contrasting model of hierarchical control. Technical workers maintain this duality even as they assume managerial positions. Technical workers treat managerial duties with suspicion, opting for the most immediate supervisory responsibility over other technicians (like team supervision) (Zabusky and Barley 1996). They also tend to orient themselves to their occupational communities rather than their workplaces (Whalley and Barley 1997; Zabusky 1997). Despite the suspicion towards "management," managerial practices and organizational schemes trickle down and shape how maintenance teams do their work, what they value, and what they consider to be problematic (Orr 1996; Dubois 1981).

The analysis that follows draws on a series of observations, conversations, and interviews with repair and maintenance team supervisors, workers, and administrators conducted between December 2017 and March 2019 at Eastern University. I observed team supervisors as they went about their days, in their offices, work sites, and on the move. I attended work meetings of repair and maintenance teams and senior managers and administrators at Eastern University and conducted follow-up interviews. In addition, I consulted reports, brochures, and internal memoranda provided by supervisors and managers in addition to Eastern's website. My observations were documented in detailed fieldnotes at the time or immediately after the observations, meetings, and conversations. Follow-up interviews were audio recorded and transcribed.

The article proceeds in three parts. First, I show how supervisors engage in classificatory and triage work to enact, in practice, an organizational scheme meant to track and quantify repair and maintenance work. I then examine how team supervisors assess and sometimes override customer requests and how they justify these decisions. Finally, I elucidate how team supervisors respond to reoccurring organizational problems by transforming them into routine maintenance procedures. Through these case studies, the

article provides an account of how team supervisors interpret managerial preferences and draw on their organizational knowledge to respond to them.

Reactive, Corrective, Preventive: Classification in Repair and Maintenance Work

For decades, repair and maintenance work at Eastern University was mostly reactive. One team supervisor characterized Eastern's approach as "run it 'till it breaks," a fire-fighting approach driven by breakdowns and malfunctions. Operating with a meager budget, the facilities department had few resources to devote to proactive maintenance. It was also unable to address deferred maintenance, leading to a backlog of necessary maintenance activities that had accumulated for decades. A mixed methods study carried out between 2005 and 2008 found that 90 percent of repair and maintenance work in Eastern was reactive, and only 10 percent was preventive (Lyneis and Sterman 2009).

In the mid-2000s, Eastern University began shifting its approach to be more proactive. With an increased budget and the aid of a consultancy firm, it added additional preventative maintenance teams and implemented a new maintenance protocol for newly constructed buildings. In 2003, Eastern traded paper documentation for a computerized work management system. The change turned work orders into detailed data (this data was central to John Lyneis' and John Sterman's study from 2009). Automating work orders went hand in hand with "informating," i.e., using computer-generated data to gain greater control over the workforce (Pine and Mazmanian 2017; Zuboff 1988). Even though repair and maintenance teams at Eastern varied significantly in trade, size, and geographical scope, their weekly performance (measured by closed work orders) was widely shared and used to foster a competitive work environment. Eastern's management used increased funding and automation to overhaul repair and maintenance, treating long-time repair and maintenance workers as antiquated and inefficient. As a result of these combined changes, in 2017, the proportion of reactive maintenance had come to constitute roughly a third of all repair and maintenance work (with preventive and corrective maintenance each accounting for an additional third).

While facilities management scholars describe the shift from reactive to preventive maintenance as an "evolution" necessarily progressing towards more predictability and control (Moubray 1997; Swanson 2001; Khazraei and Deuse 2011; Cooke 2003; Gallimore and Penlesky 1988), fieldwork at Eastern shows that reactive maintenance continues to be an important component of repair and maintenance work. Since breakdown, malfunction, and decay cannot be fully anticipated, some resources must always be reserved for the unexpected. The main effect of the turn to preventive maintenance was not the elimination of reactive maintenance, but rather the constant classificatory work needed to distinguish the two.

Classification *at*/*as* Work: Work Orders and the Timely Allocation of Work

Nowadays, repair and maintenance work at Eastern University includes the continued classification, tracking, and quantification of work. Team supervisors and team members operate according to a classification schema that distinguishes reactive, corrective, and preventive maintenance work. The inscription process, turning problems into work orders, is interwoven with classification. Before any work can be done, a work order must be created in the work order management system. A work order is created in tandem with a team allocation. Work orders remain the units of work—they connect repair workers' records with university-wide statistics used by managers to allocate money and personnel.

The classification schema colors the everyday practices of repair and maintenance work. Repair and maintenance workers identify, classify, and allocate tasks, thus transforming "issues" into "problems" and "work orders." In the process of diagnosis and classification, time plays a central role. Although supervisors and managers formally distinguish between types of maintenance work based on the control they have on the situation (responding versus initiating), in practice, it is time that drives the classification of work. Two factors determine to whom the work will be allocated: the urgency of the issue, and the time required to complete the work.

Reactive maintenance is formally defined as work in response to an external event. Robert, a reactive team supervisor, provides the example of a customer who complains that her office is too cold. "We go out there, to correct the problem," explains Robert. It is the customer's complaint that provokes action. Eastern's management shares this view, defining reactive maintenance in an internal memo as "work performed in direct response to a failure that causes process down time or imminent hazard to assets or personnel."

Preventive maintenance, on the other hand, is formally defined as initiated action. An internal memo defines it as "[an] activity performed in some routine or regularly scheduled fashion designed to keep equipment in an existing state, prevent deterioration or failure, and identify work of corrective nature." Preventive maintenance is driven by plans and schedules, not by customers.

It is the third category, corrective maintenance, that reveals that the classification of repair and maintenance work is not always straightforward. "Corrective work is like a bucket," explains Thomas, a corrective team supervisor. He elaborates,

> PM [the preventive maintenance team] do scheduled work and any issues they discover they put in the corrective bucket. Then [the reactive maintenance team] transfers everything that is longer than a few hours to complete to the corrective bucket. Inside that corrective bucket—what's what—you then need to dissect it.

Corrective maintenance is meant to serve as a buffer zone between reactive and preventive maintenance. Because reactive teams should be kept available for repair and preventive teams for scheduled work, work that is too lengthy or complex is transferred to one of the corrective teams.

For supervisors and repair workers alike, following the classification scheme requires the constant work of fitting problems into a classificatory system and determining where tasks belong (Bowker and Star 2000; Denis and Pontille 2010; Pine and Mazmanian 2017). The classification of maintenance work into temporal categories thus requires not only the knowledge and expertise of creating the classificatory system, but also the practical, on-the-ground determination and judgment required to identify problems, classify them, and inscribe them as data. Repair and maintenance workers become experts in funneling problems through a classificatory system, finding the appropriate time for each problem.

Moving "Problems" Through the Classification Scheme

Before material repair takes place, the problem needs to be spotted, allocated to the correct time (and team), documented in the work order system, and assigned to a repair worker. Problems do not stay the same throughout this triage process. An unexpected issue for a preventive team is not a problem to be resolved,

but a problem to be transferred. Repair and maintenance workers and team supervisors count on their organizational and managerial knowledge to articulate problems and channel them through the system.

The allocation of work at Eastern University hinges on team supervisors and highlights the differences in power and autonomy between supervisors and their team members. Team supervisors meet their team members at 7 a.m. every morning. Supervisors arrive anytime between 5 a.m. and 7 a.m., while repair workers in Eastern, following union rules, start their workday at 7 a.m. sharp. Supervisors use the time before the meeting to study the status of existing work orders. While some work orders are familiar, waiting for parts or outside contractors, others are new, allocated to them during the night. Throughout the workday, some work orders will be resolved, others will be postponed or transferred, and a few will be created to capture new issues. During the 7 a.m. meeting, supervisors have a brief conversation with their team members, after which they allocate the daily tasks. While team members are assigned specific tasks, team supervisors have leeway to accompany a specific team member, visit a building administrator, or do administrative work.

Maintenance problems and issues are both flexible, in that they change as they move through the process of repair, and stable, in that they have to be recorded and inscribed in order to be acted upon. Andrew, a reactive team supervisor, provides an example of how problems are spotted and assigned to repair and maintenance workers.

> Just the other day, an HVAC mechanic was doing PM [preventive maintenance] work and saw water on the bottom of one of the electrical units. He sent the picture to my phone. There is no customer in this case, so I needed to create the work order myself.

Only after creating the digital work order Andrew radioed Lucas, the plumber on his team. Seated at his desk, Andrew directed Lucas to the location of the electrical unit. About an hour later, Lucas came into Andrew's office, reporting that the problem was solved. "The drainage is always a little slow there," he added.

From start to finish, this is an example of how one problem was transformed as it was spotted, transferred, recorded, assigned, and resolved. The repair and maintenance worker who spotted the accumulated water at the bottom of an electrical unit saw a problem, and he classified it as a problem that was not his to solve. Since he was doing preventive work, and the accumulated water was classified as an issue requiring immediate attention, he decided to transfer the problem. He contacted a team supervisor for a reactive team— Andrew—and provided the details, location, and a photo of the problem. Once Andrew received his message, the problem moved to Andrew's domain. To resolve the problem, Andrew needed to first record it—to transform an "issue" into a work order. In the process, water where it did not belong became an assignment—it was assigned to a team, recorded in the digital system, and accounted for. Once Andrew had a work order to resolve, he characterized it as a plumbing problem and dispatched a plumber, Lucas, to solve it. It was then Lucas' role to inspect the electrical unit and figure out the cause. When Lucas reported back, saying that "the drainage is slow," the problem was redefined one last time. The problem has been transformed from "an issue requiring action," to "not a preventive maintenance issue," to "a reactive issue," to "a plumbing issue," and finally to a "drainage issue" (which might require further attention later). Repair and maintenance work required both classification and inscription to move labor and responsibility

from one worker to another. The process of moving between categories required inscription in words: labor was funneled through text.

Although previous studies of repair workers have demonstrated that diagnosis and repair are not separate, but rather intertwined practices (Orr 1996; Dant 2010; Houston 2019; Fürst 2019), they largely have focused on the process of searching for a particular cause. Categories used to group objects together as part of diagnosing a specific problem show that the repaired object is both a singular object and a representative of its type (Orr 1996; Fürst 2019). In this case, classification is not used to diagnose a specific problem, but rather to allocate resources and labor. When a repair worker is looking at water accumulated in the bottom of an electrical unit, he looks at it through a classificatory schema of labor, determining whether it is within his work jurisdiction.

Classification and triage are used to allocate work orders not only between teams but also within teams. For team supervisors, allocating work goes hand in hand with divvying up repair work. For example, one team supervisor explained that "some people are good in troubleshooting but not good in repair." Affirming the distinction, another team supervisor explained that the work of finding the cause of the malfunction and repairing it are distinct tasks. Team supervisors take it upon themselves to formulate rules of thumb for the constant work of matching people with problems. In the process of matching, the problem itself is transformed. A "problem" is not the same singular thing for the customer, the mechanic, and the team supervisor.

Repair and maintenance workers, responding to the competing pressures of time, develop and use a ternary classification schema to allocate maintenance work. Classification is practice: it is not merely a logical schema but an overall structure that requires constant work to fit problems into temporal categories. An organizational agenda to make maintenance more cost-efficient translates into organizational structures that allocate slices of maintenance work to various teams. It is then up to the supervisors and repair workers to operationalize the classification scheme. The process deeply transforms repair and maintenance practice. In addition to diagnosing the material problem, workers and supervisors now diagnose the timeliness and correct category of work as part of their troubleshooting process. The organizational scheme translates into a different way of seeing and attending to maintenance issues.

Arbitration and Balancing in Repair and Maintenance Work

Repair and maintenance work is described by both managers and workers as "customer service." Although repair workers and faculty, students, and administrative staff are all employed by the university, treating repair and maintenance as customer service turns some into service providers and others into service receivers. Formally, work orders are created by customers in one of two ways: by placing a phone call to the customer service center or by filling out an electronic form on Eastern's website. Customers can then track the work order and, once complete, rate the service they received and provide feedback. Informally, however, work orders are created in additional ways. Supervisors receive service requests from building managers or representatives of academic departments with whom they maintain a close working relationship. Sometimes, as the previous section demonstrates, it is the supervisors themselves who create work orders, momentarily assuming the role of customers.

Despite the depiction of repair and maintenance as customer service, repair and maintenance work does not only consist of responding or reacting to individual requests for service. Supervisors in repair and maintenance consistently weigh these requests against what they perceive as larger organizational interests like safety, sustainability, or efficiency. In this section, I examine three cases in which repair and maintenance supervisors chose to override customers' requests in the name of other interests. I argue that repair and maintenance workers constantly weigh the perceived interests of the organization as a whole against the formal demands of customers. Playing the role of organizational arbitrators, supervisors formulate the conditions under which it would be acceptable, and even desirable, to override customers' requests, even though these conditions are never made explicit by their managers or the organization.

To do this organizational work, supervisors construct a unique realm of expertise through reliance on what are, to them, objective forms of knowledge (building code, mechanical knowledge, sensor data). They do so by positioning an objective or collective interest against individual complaints, wishes, or needs. Rather than treating temperature, noise, and light as essential conditions for Eastern University's mission, maintenance workers view them as issues of personal accommodation and comfort. Classifying faculty, students, and staff as customers, ironically, strips them from any collectivity, emphasizing instead individual comfort and convenience. Service requests are then assessed against larger organizational priorities. Finally, supervisors justify overriding customers' requests based on what they perceive as objective knowledge. Repair and maintenance workers take it upon themselves to do the organizational work of preserving safety, sustainability, and efficiency.

The Cold Office Problem[2]

Early in my fieldwork, Matthew, a senior director in the Department of Facilities, takes me on a tour of the repair and maintenance main office building. Our first stop is in the operations center, just across from Matthew's office. Although the operations center is a large room, it is not designed for visitors. There is no reception area or chairs. The only employees in the room, two system operators, sit behind a high divider. Only the very tops of their heads are visible from the entrance. The walls are bare but for a 3 x 3 array of flat monitors, displaying a live feed from security cameras around campus. Matthew leads me behind the high divider, and we stand behind the swivel chairs of the two system operators, who are in turn seated in front of multiple computer screens. Seen from this vantage point, repair and maintenance work seems sophisticated, highly technological, and impressive.

Steve, a young and energetic system operator, describes the operations center as "the head of the lizard," the brain of the facilities department. He prides himself on controlling a vast array of sensors, tracking systems, and workers without leaving his chair at the operations center. Steve oversees some of the largest and most crucial systems at Eastern—temperature control, ventilation, and heating. While one computer is used for email and accessing the work order system, the others display information from

[2] I borrow the term "Cold Office Problem" from Henke and Sims (2020).

automated systems across campus. Electronic sensors in offices, basements, and mechanical rooms measure temperature and moisture. The sensor data allows Steve to track temperature and humidity on a highly granular level. "I can tell," says Steve, "if someone was in a particular room within the past 30 minutes without ever being there."

Steve relies on the automated system of sensors to minimize unnecessary trips for repair and maintenance workers. He takes pride in resolving problems remotely. To do so, he distinguishes "matters of preference" from mechanical issues. A matter of preference is a matter of subjective and individual sensation that does not necessarily require physical repair. "It is when somebody gets a new office, and the temperature is set to too high or too low," Steve elaborates. He follows with an example. A few hours earlier, an administrator in the chemistry building complained that the heating system was not working in her room. It is a particularly cold February day and so the complaint was immediately transferred to the operations center. The first thing that Steve did was to look at the data coming from the sensors on her floor.

> I immediately saw that the temperature in that room was 72 degrees while the "preference" for that room was set to 70 degrees. Because the room was warm enough, what was working was the ventilation, not the heating. The people in the room felt cold air coming from the vents and concluded that the heating system was not working. From a mechanical standpoint, there was no problem—the temperature in the room was higher than the preference. I was able to tell all of this without sending someone down there.

What Steve refers to as the "preference" for a room is a centrally managed setting for the desired temperature. The "preference" setting cannot be changed from within the room, only through the centralized system that Steve controls from the operations center. In this case, because the preference was set to 70 degrees, the heating, cooling, and ventilation systems in the room kept trying to reach 70 degrees. When the room was warm enough, the heating system switched to ventilation mode to maintain air circulation.

Christopher R. Henke and Benjamin Sims (2020) use the term "the cold office problem" to describe a similar situation, provoked by an administrator's complaint about her cold office. For them, the cold office problem illustrates that repair and maintenance workers are called not only to right a material malfunction but also to repair a social breakdown. The mechanic's serious attention to the administrator's complaint and a visible attempt to rectify the problem are aimed at validating the administrator's sensation. The mechanic is able to address her feeling of not being cared for properly. Repair is aimed at restoring social order in addition to the material one (Henke 2000).

In the case described above, the cold office problem is not only a social and material problem. The cold office problem is perceived by Steve as a resource management problem, an organizational problem. By separating matters of preference from mechanical issues, Steve is creating an opposition between subjective sensations and objective metrics. The remote sensor system generates an "objective" data point, based on machine, not human, sensing. The "preference" setting inhibits office inhabitants from controlling their offices' temperature. Both are based on the idea that optimal thermal comfort in office spaces is not a matter of individual sensation (Murphy 2006; Henke and Sims 2020).

The electronic system of sensors that tracks temperature and moisture allows Steve to assess the situation from a supposedly objective perspective. As opposed to repair workers, who rely on sensory

information and their embodied knowledge for repair work (ibid.; Henke 2000; Harper 1987), Steve, who is operating at a distance, draws on mechanic indicators to assess individual and subjective impressions. These indicators are used by Steve to bridge distance and construct a realm of expert knowledge. When Steve is engaging in boundary work (Gieryn 1983) between matters of preferences and mechanical issues, he is taking an active role in renegotiating the delicate balance between maintaining social order (and a sense of being cared for) and deploying organizational resources.

Functioning as an organizational arbitrator, Steve justifies overriding a customer's complaint by drawing on what he perceives as objective knowledge—a combination of mechanical knowledge and sensor data. His "objective" knowledge joins organizational knowledge, knowledge of what others in the organization value, to guide Steve's judgment as he assesses customers' requests. These decisions are not publicized and do not trickle down to customers, who are not aware of these set "preferences." They continue to complain that offices are too cold or too hot, turning on knobs and dials, desperate to adjust the room's temperature to their comfort level.

The Dark Room Problem

Sensors are used in Eastern not only for measuring temperature and humidity but also as part of an automated system meant to conserve energy. Newer campus buildings, constructed with more stringent environmental protocols, often use motion sensors with a system that automatically switches lights off when no movement is detected. Not everyone is satisfied with the automatic control of lighting. "Some faculty members," explains Steve, "prefer to keep the lights on at all times and repeatedly ask us to turn the automated system off." Steve and other system operators do not simply grant these faculty members their wishes. "It is about balancing their wishes and needs with parameters we have in place to deal with environmental concerns," he adds. Here, too, Steve sees his role as that of an arbitrator: he assesses the request and balances it against what he perceives as the interests of the organization as a whole.

In this case, Steve relies on the LEED certification of the newer buildings to justify his refusal to disable the automatic lighting control system. LEED, standing for Leadership in Energy and Environmental Design, is an international "green" building certification program that rates buildings according to their environmental responsibility and efficient use of resources. LEED certification is obtained through LEED credits that are allocated for implementing control systems for lighting, HVAC, and/or the entire building structure and materials (Cooperman et al. 2012; Henke 2017). Steve uses the concrete guidelines on energy management set in LEED certificates to justify his refusal to disable the automated lighting control system. He takes it upon himself to play an active role in Eastern's compliance with LEED standards.

"Green" best practices are often not adopted in organizations because their costs are immediate while their benefits are delayed (Lyneis and Sherman 2009). A bias towards servicing customers and reactive maintenance work tends to reinforce the delay in implementing sustainable policies within organizations, even when, in the long-term, these policies are cost-reducing and more efficient. In this instance, however, the internal organizational tension between the short-term (the satisfaction of faculty members) and the long-term (energy conservation and cost reduction) is dealt with through an external standard that allows maintenance workers to transfer the responsibility for the balancing work, thus relieving themselves from customers' pressures without bearing the results of direct refusal.

Finally, in this example, as in the previous case described, repair and maintenance supervisors frame the two positions that require balancing as individual versus collective: the needs, wishes, and convenience of individual faculty members are pitted against collective concerns such as energy conservation. The same tension is also present between the short- and long-term commitments of Eastern as an organization. Committing to an external standard means that Eastern University bolsters its commitment to the long term, which repair and maintenance workers then prioritize in their constant arbitration work.

The Emergency Stairway Problem

Sitting in a shared office space on the basement level in one of Eastern's new buildings, I observe two team supervisors, Andrew and Thomas, hunched over a computer screen, as they are composing an email. At issue is an emergency stairway with restricted access in the same building. One of Andrew's repair workers came across a stairway marked with an "emergency exit" sign. When the worker tried to use the stairway, he discovered that the gate leading to the stairway was barred and locked. While the repair worker was taking pictures of the stairway using his tablet, Andrew recounts, a secretary from one of the adjacent offices came out and asked him to leave. One of the professors on this floor, she explained, is bothered by people passing through. Based on that comment, Andrew concluded that the lock was placed there to limit traffic. As Andrew is talking, he is shaking his head, becoming more and more agitated:

> There is a possible stamped problem here. This is an oxymoron and unsafe. If this is not an emergency exit, then remove the sign. If this is an emergency exit—then remove the lock. Stairways shouldn't have locks on them. That's building code.

Andrew received the photographs a few days ago and immediately sent an email to the building manager, alerting him of the situation. Today, he received a response. The building manager wrote back that the building's architect defined this stairway as a "convenience stairway" (as opposed to an emergency exit). Andrew is not satisfied with this answer. "They should take off the emergency exit sign then," he says. The email that Thomas and Andrew are working on is addressed to the Department of Health and Safety at Eastern. After they finish editing the email and attaching the photos, Thomas calls their manager, Patrick, to read the email. Finally, the email is sent. "We will let them take care of this," concludes Andrew.

While Andrew and Thomas are team supervisors in charge of repair and maintenance work, in this case, they are engaging in organizational work, not repair work. Andrew is upset at what he perceives as a total disregard for safety protocols. In Andrew's view, the convenience in the "convenience stairway" is the professor's convenience, and it should retreat in the face of bigger organizational goals like ensuring safety. In this case, Andrew is not serving a customer. On the contrary, he seems to be going out of his way to go against one of the customers, a faculty member. Even though ensuring safety is not within his realm of "jurisdiction" at Eastern—health and safety are taken care of by a separate office—Andrew is making sure that this issue will not go unnoticed. He takes it upon himself to represent the long-term and collective interest of ensuring safety in the face of individual preferences.

Andrew is using building code and common sense to justify his position and explain why he is not content with the building manager's decision. Like Steve, he constructs an opposition: convenience on the

one hand and safety on the other. While convenience is presented as subjective and individual, safety is aligned with objectivity and collectivity. Andrew's use of building code as a form of expert knowledge positions him as the guardian of Eastern's organizational interests. While the professor has many representatives, starting with the secretary and extending to the building manager and the architect, Andrew alone pushes back, representing the organizational counter-interest.

These cases show that repair and maintenance work is often the site where managerial decisions come to bear on the lived experience of campus inhabitants. Although team supervisors in repair and maintenance are not tasked with ensuring sustainability, safety, or resolving social issues, they interpret their role as encompassing the overall well-being of buildings, people, and the organizational fabric. However, since they lack the institutional authority to override customers' requests, they classify some customers' requests as matters of individual comfort and justify overriding them by relying on what they perceive as an objective body of knowledge. Objectivity is used to legitimize the decisions of supervisors, who have little authority of their own, particularly in the face of customers' complaints (Porter 1995). Drawing on specialized knowledge, either mechanical, standard, or regulatory, managers construct a realm of expertise that is at once based on their repair and maintenance knowledge and on their knowledge of the organization.

Crafting Organizational Solutions Through Repair and Maintenance Routines

On a chilly March day, I meet Michael, a supervisor of a team of electricians at Eastern University. Like many team supervisors in Eastern, Michael holds half a dozen trade licenses in addition to his electrical license. Michael and I escape the frigid weather by heading into one of the underground tunnels that connects the basement levels of Eastern's campus buildings. Repair workers and supervisors alike prefer moving through the tunnels and basement levels. Lower traffic and wide hallways facilitate swift movement, either on foot or on maintenance buggies, as workers respond to service requests.

This particular basement level is home to Michael's team breakroom. Pointing to a door on our right, Michael says, "Let me show you where the guys hide." "The guys" are his team of seven electricians, who, as it turns out, are all out on work assignments. The windowless room is sparsely furnished, having only a few chairs, a table, and a refrigerator. The left wall is entirely occupied by a neatly organized shelving unit with an assortment of spare parts. Catching my gaze, Michael explains:

> We are not supposed to do this, you know, management doesn't like it. Customers want things fixed fast. Ordering a part sometimes takes a month. The customer doesn't understand that. They want things to be fixed today.

Faculty, students, and staff at Eastern University urge Michael to complete repairs quickly. Parts are in short supply, however, and Michael and his team must adhere to Eastern's rules and procedures for obtaining necessary parts. As a workaround, Michael's electricians keep key spare parts in their breakroom. As soon as one of the parts is needed for repair work, they place the appropriate order and charge it to the customer. Then, without waiting for the part to arrive, they use the spare parts from their shelves for repair. Once the new part arrives, they place it on their shelves, restocking their inventory. Eastern's management does not support this practice formally, insisting that parts should be handled by the dedicated stock room.

Sociologist Julian Orr described similar practices among Xerox technicians, who kept a trunk inventory and utilized a variety of strategies to obtain rare parts (Orr 1996, 99–101). However, Orr's analysis was limited to the triangular relationships between technicians, machines, and customers. In essence, he argued that the missing parts were a challenge in the face of technicians' attempts to gain control over the machines and to establish themselves as competent professionals. Michael's story suggests that spare parts are an arena where the competing pressures in a large organization play out between customers, machines, repair workers, and their managers. In this case, Michael perceives managerial demands as twofold: fiscal accountability and customer satisfaction. Although these pressures might seem contradictory, they are both aimed at gaining greater control over repair and maintenance workers. The managerial strategy of forcing a structure (and paperwork) on inventory is a way to gain control over repair practices, which are often seen as unruly and unpredictable (Dubois 1981). Framing repair and maintenance work as customer service, particularly through the emphasis on customer satisfaction surveys that follow work completion, is also meant to gain greater control over repair and maintenance practice.

Michael's team's workaround reclaims a measure of control over their work by creating a protocol of action that diverges from official policy. Their devised solution works to convert a reoccurring organizational problem, competing pressures on Michael's team, into a routine procedure. Addressing both customer satisfaction and bureaucratic demands, workers repeatedly invoke a protocol of action rather than resorting to ad hoc solutions. Maintenance work is a heavily routinized practice, even in reactive teams. Repair workers and supervisors alike rely on routine procedures that structure future action.

The routinization of maintenance work is a meeting point of several temporal regimes, enmeshing together machine time, social time, and organizational time. Neither fully objective (determined by a set schedule of "machine time") nor fully subjective (completely determined by workers and supervisors), repair and maintenance supervisors experience time through practice (Orlikowski and Yates 2002). Time is experienced differently depending on one's organizational position: while managers at Eastern do not mind the wait, prioritizing centralization over speed, faculty, students, and administrators in Eastern want to return to their routine as quickly as possible. Through their routinized protocol for dealing with parts, Michael and his team craft a new temporal structure: parts seem to arrive immediately from the perspective of customers and in normal time from the perspective of management. The routine relieves the pressure on repair and maintenance workers by both dealing with competing pressures and regaining a measure of control over work.

Routine is a key way in which repair and maintenance supervisors deal with the unpredictability of maintenance work. Michael does a walk around every Friday to check equipment that he knows is prone to breakdown. He does this to avoid being called to campus over the weekend. In anticipation of mechanic failure—but also ruined weekend plans—Michael makes sure everything is operating smoothly before leaving. The frequency of equipment checkups, in addition to being anticipatory (preventive and not reactive), is social in nature.

Maintenance "rounds," the frequent check-ups of equipment, are also used to address overarching organizational tensions like the tension between Eastern University's research mission and economic constraints. Robert, the reactive team supervisor we met in the introduction, is a man of routine. He is the first one to arrive in the morning. He starts every day the same—he gets his coffee at exactly 5 a.m. when the

nearby coffee shop opens its doors. He then heads to his office, where he glances at the work order system and checks his email while sipping his coffee. Immediately after, he makes his rounds. He walks fast. In each building, he heads straight to the basement level, and, once there, straight to a large tank of water attached to several pumps. These tanks and pumps are part of Eastern's pH neutralization system. Robert examines them daily, checking both the monitors and the handwritten logs that document previous inspections. He explains:

> Some of the water used at Eastern cannot be discarded through the sewage system because their pH is too high or too low. The pH neutralization system is meant to neutralize the pH, so that the water can be discarded. It is a legal requirement . . . [Eastern] has a permit. They need to report every problem. If there are too many problems, the permit can be taken away.

Robert describes his rounds as an uncomplicated but crucial task: "It's simple but it's gotta be done." He completes his rounds daily by 7 a.m., when his team members arrive. Looking at the equipment and logs daily makes him a trained observer of the pH neutralization system:

> My eyes are really trained to see anomalies. So, even though it looks like I'm not doing much, I'm looking at all the equipment and making sure everything is okay.

It is exactly because he does this every day that he knows what to look for. Robert relies on his senses and embodied knowledge to identify anomalies quickly. The body remains a tool for both gathering the necessary information and troubleshooting repair (Henke 2000; Denis and Pontille 2015; Henke and Sims 2020). Robert and I do not see in the same way: while his vision is skilled, the result of training, education, and daily practice, mine is blind to most, if not all, "anomalies." There is nothing straightforward about seeing anomalies. It requires formal training and cultivating a way of looking through daily practice (Grasseni 2004).

Robert's rounds are a curious anomaly in Eastern's classification scheme. Robert is a reactive team supervisor. His main job is to react to customers' calls. His daily rounds, however, are meant to inspect, not repair, a system in perfect operating condition. In an interview, he elaborates on how this routine developed:

> [It] was decided between myself and upper management that we will look at it on a daily basis when I am here because of a single incident that happened. It was an operator error by one of our contractors . . . so basically, it got around that I'll go around and make sure that they are doing their job right. It's something I always did, but now I do it on a regular basis because of that.

The pH neutralization system at Eastern is crucial for discarding liquid waste from laboratories. It is a site where research interests, regulatory compliance, and maintenance issues overlap (Huising and Silbey 2011). Despite its critical function, it is inspected and maintained by outside contractors. Eastern's management, concerned about possible laboratory downtime, pushed for another layer of scrutiny. Inspecting the pH neutralization system daily by an Eastern employee allows for spotting anomalies and malfunctions quicker.

Robert's rounds mend an organizational rather than a mechanical problem. He is not inspecting the pH neutralization system as a reactive team supervisor but as a trusted employee with trained vision. His routine addresses structural tensions at Eastern: managers at Eastern wish to cut the costs of maintenance

work but worry about laboratory downtime. The devised solution includes using a salaried repair worker (at no extra cost) to supervise outside contractors, thus increasing the frequency of inspections.

What determines the rate of inspections is not the manufacturer's schedule (i.e. machine time), nor the availability of resources. Robert follows a timetable set by organizational priorities, checking the equipment more than necessary for its physical maintenance. In this case, a routine cements a solution to a reoccurring organizational problem. It is also a matter of obtaining control over one's schedule and time. Time in organizations is produced through routines, practices, and continuous interpretations of workers within the organizations, who might have different and even conflicting senses of time (Orlikowski and Yates 2002; Reinecke and Ansari 2015). In other words, it is the adopted routines that structure the day-in and day-out of repair and maintenance work, not merely machine schedules or top-down resource management.

Anticipating possible trouble, malfunction, and tension, team supervisors act to reduce uncertainty by heavily routinizing their schedules. They concoct routine solutions to solve reoccurring problems such as outsourcing and intraorganizational competing pressures. Through routine, they regain a measure of control over an unruly material environment and over competing organizational pressures in which they are enmeshed. Their work is shaped not only by interactions with customers, machines, and repair workers but also by their repeated attempts to organize and order maintenance work to fit their interpretation of the organizational good.

Conclusion

Team supervisors, who are both repair workers and managers, populate the gap between top-down organizational policies and repair and maintenance practice. This gap is a productive space. Team supervisors rely on their discretion and autonomy to unpack and order organizational priorities while also taking care of the people, machines, and materials on Eastern's campus. To translate policy into practice, they engage in organizational work, the constant articulation and negotiation of organizational interests, as an inseparable part of repair work.

In each of the sections in the article, team supervisors are trying to carve out a domain of practice and expertise. In the first section, I show that official policies and rules do not relieve repair and maintenance workers from the classification and triage work in large organizations. As problems flow through repair and maintenance teams, they are defined and classified repeatedly. Detailed data collection and managerial schemes of classifications do not erase the discretion and intellectual work embedded in repair and maintenance work. To successfully complete work orders, team members and supervisors must rely on their organizational knowledge for direction on the optimal allocation of resources.

The second section deals with a specific domain of expertise—assessing and responding to customer requests. Repair and maintenance work at Eastern University is described as customer service. This does not mean, however, that every customer request is granted. Without clear guidance on how to assess customer requests, team supervisors craft a domain in which individual requests are weighed against organizational priorities. Supervisors use what they perceive as objective knowledge, standards, regulations, and common sense to justify overriding a customer request.

The third section focuses on how supervisors use routinization to regain control over their work. Supervisors attempt to gain control over unanticipated events, malfunctions, and breakdowns. They also respond to managerial attempts to restrict their work and gain control over their discretion. Routines are deployed to curb both.

Although the article focuses on large organizations, where team supervisors are needed to organize and coordinate work, its findings point to a productive lens to study repair and maintenance work in a variety of settings. Repair and maintenance workers are also employees. As such, they constantly interpret workplace policies, managerial agendas, and the intentions of their managers. While the triangular relationship between customers, repair workers, and machines has been extensively documented, this article invites scholars to widen the scope of analysis and incorporate the organizational work that repair and maintenance workers do into the study of repair and maintenance work. Repair and maintenance do not simply abide by agendas and policies set from the top, but take an active role in interpreting, developing, and enforcing these agendas and policies. It is through their work that abstract managerial agendas are made concrete.

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