

Discarded Labor:

Countervisualities for Representing AI Integration in Essential Work

Franchesca Spektor
Carnegie Mellon University
Pittsburgh, PA, USA
fspektor@cmu.edu

Estefania Rodriguez
University of Texas at Austin
Austin, Texas, USA
estefaniarodrz@gmail.com

Samantha Shorey
University of Texas at Austin
Austin, Texas, USA
sshorey@utexas.edu

Sarah E. Fox
Carnegie Mellon University
Pittsburgh, PA, USA
sarahfox@cmu.edu

ABSTRACT

This pictorial critically explores the role of visual media representations in the deployment of automated and artificially intelligent (AI) technologies within essential work sectors. We draw on an exhaustive review of local and national newspaper articles about automation in two waste labor industries (cleaning and recycling) over the last five years. We highlight a set of common visual tropes and move to challenge these representations by taking up the lens of countervisuality. Our analysis reveals that press photographs tend to focus on machines and the decision-makers who champion them, overlooking the work that it takes to integrate technology on the ground. Through our countervisuals,

we depict the extensive efforts of waste workers to maintain AI technologies, and their potential for surveillance. Through visualizing under-recognized forms of labor that come after the design process ends, we highlight how an outsized emphasis on invention ignores waste workers' expertise and needs over time.

Authors Keywords

Invisible work; countervisuality; waste labor, AI, automation.

CSS Concepts

Human-centered computing

OPENING VIGNETTE

A white machine gleams against neon-streaked darkness. Its edges are smooth and luminous, its body carved like a racecar's. The machine pulses with lights and sensors, a single starburst of lens-flare breaking the slope of its profile. Even through the still image, its motor emits the suggestion of a low hum — the sound of perfect, effortless efficiency.

This image is a digital rendering of a self-driving, floor-cleaning "robot janitor," developed by a California-based startup. The robot's image is one of a singular hero, the pinnacle of innovation on an empty black background. But, this robot janitor is hardly without context.

Published in an area newspaper, the article surrounding the image enthusiastically profiles a local business deploying cutting-edge technologies. A quote from the Vice President of Innovation explains the engineering challenge of building a robot janitor for retail — a complicated problem, as they'll work alongside forklift drivers, shelf-restockers and customers in the bustling, 24-hour environment of super stores. Should we strip away the rendered lights and edge-glow, we may instead begin to envision the robot as it would live in the world: the backdrop of grocery store shelves, under harsh fluorescent lights. And it would certainly not appear alone. Ask now, where are the people who must drive the robot to its daily route? Where are those who clean the robot, maintain its fragile circuits? Where are those who continue to perform the janitorial duties this robot is not deft enough to master?

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system made by *Brain Corp.* allow the floor scrubber to detect
maneuver around them automatically. (Brain Corp.)

which recently nearly tripled its orders
self-driving, floor-scrubbing robots, is now
into Europe by opening a satellite office in

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Who will fix
it when it breaks?

Who will do the
tasks it can't?

Who will lose their
job — or take on
an extra load?

Where are
worker voices
?

Intro

This pictorial interrogates media representations circulating alongside the rapid and widespread deployment of artificial intelligence (AI) technologies within waste labor contexts, such as the “robot janitor” that opened this piece. Drawing on an exhaustive review of US news reporting about AI and automation in the essential work sectors of recycling and cleaning over the last five years (2015-2020), we offer a visual analysis of the press photography that accompanied these articles. We highlight common patterns and visual tropes across articles including disembodied hands, portraits of executives, and stylized depictions of robots absent of people. Building on the critical examination of existing representations, we consider what is missing from these depictions of essential labor and AI — insights that are informed by a series of interviews and observations in recycling and cleaning field sites.

Rather than focusing on discrete moments of invention or deployment, we take up the lens of counter-visibility to expand the purview of the pictorial format and represent the work of those who are tasked with negotiating AI on the ground [27]. Through a series of countervisual illustrations, we depict recycling sorters and janitorial staff tasked with integrating automation technologies through calibrating, maintaining, and repairing the devices as they are made to adapt to the physical environments and social contexts of waste management. In pairing illustrated renderings of existing news imagery with alternative representations of AI infused waste labor, we use countervisuality to invite HCI and design researchers to consider the under-recognized or invisible work that comes after the design process ends, and how an outsized emphasis on invention within news media elides the expertise of waste labor workers and their needs over time.

Related Work

By drawing out countervisualities that focus not on those who build technology, but instead those whose work of integrating, reconfiguring, and repairing AI goes unacknowledged in current accounts.



Invisible Labor of AI

Design researchers have long-examined how emergent technologies interact with cultures and practices of work. Although much of this research is dedicated to improving the features and procedures of workplace technologies, critical scholarship brings specific attention to the unseen forms of labor that contribute to technological systems. As a theoretical perspective the lens of “invisible labor” illuminates how workplace activities or workers themselves may be hidden through obscurity or abstraction [32]. In these situations, the products of labor may be visible, but those who perform them remain hidden or reduced to numerical data. For example, Gray and Suri reveal how seemingly automated systems like content moderation on social media rely on the (unseen) human labor of tagging, rating and reviewing border cases [16]. These “hidden layers of data work” underpin the celebrated labor of designers and engineers, but are often performed by contract workers who don’t have access to the same pay or perks as other tech indus-

try employees [18:36]. This obscurity limits the ability of workers to guide processes of technology adoption and adaption, even as they’re tasked with handling the problems that arise because of them.

Recovering Buried Accounts of Innovation

An emerging body of HCI research has begun to investigate how interdisciplinary design methods might be used to highlight overlooked contributions to technological processes. At the heart of this work is a commitment to rewriting narratives as part of design justice: “attribution and attention are important benefits of design processes and they should be equitably distributed” [8:26]. For example, Rosner, Shorey and colleagues knit together archival research and design inquiry to expand well-tread histories of engineering genius to include the gendered and racialized handwork that made the Apollo moon missions possible [29,31]. Nooney and Brain similarly pair historical and speculative design methods to engage students in writing fictional pasts that intervene in social, political and

technical contexts [28]. Archival traces have been used within the pictorial format, specifically, to document worker-centered histories of industrial developments, such as human-factors engineering. Khovanskaya et al. [22] chart the practices of labor unionists of the mid-20th century who strategically leveraged the techniques of scientific management to advocate for better working conditions. Taking up techniques of counter-storytelling in the present, Bennett et al. [4] develop a corpus of design stories that prioritize the contributions of disabled people to design practice, grappling with the tensions that lie between necessity and recognition.

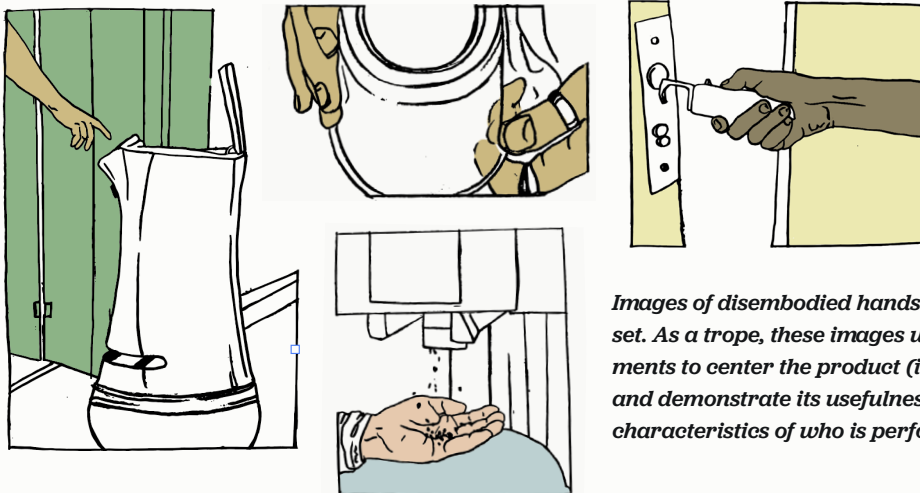
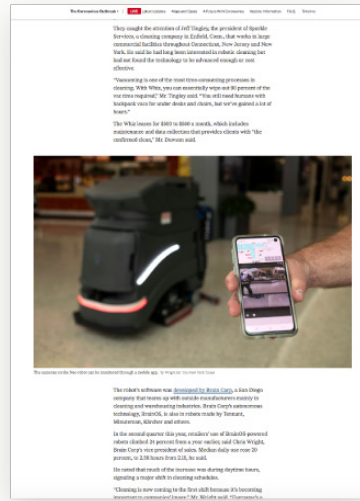
Contemporary media reports about innovation often reinforce technical labor hierarchies, casting accomplishments as the product of design professionals exclusively. Irani and Silberman [19] reflexively analyze the reporting about their project Turkopticon, a plugin for Amazon Mechanical Turk workers to publish reviews and rate interactions with employers on the platform. Journalists depicted the designers as “saving” AMT workers through innovation, subsequently

devaluing workers’ contributions and creative acts of maintenance and repair. Pushing back, the authors argue for designers and technologists to “tell stories about design that do not implicitly value our labor more than others’ [...] and counter discourses of innovation that legitimize inequality” [19:4582]. In the pages that follow, we attend to this call by drawing out countervisualities that focus not on those who build technology, but instead those whose work of integrating, reconfiguring, and repairing AI goes unacknowledged in current accounts. Amid the COVID-19 pandemic, waste labor workers have been positioned by governments and industry alike as “essential” in slowing virus spread, yet such designations often do not come with corresponding gains in the form of protective equipment or discretion over the technical interventions introduced into their workplaces. By figuring waste labor as central in this pictorial, we seek to more than simply show the presence of this work, but promote its value [32].

Interrogating Dominant Representations

In an effort to examine existing representations of waste labor and AI, we sourced images from an exhaustive list of news articles published in the United States about airport sanitation and recycling sorting technologies during the COVID-19 pandemic and in the 5 years prior (September 2015 to September 2020). Identifying visual tropes across this set of imagery allowed us to question the recurring “units of metaphor” that reflect shared cultural attitudes or values [6]. Within HCI literature, Desjardins, Wakkery and Odom [9] perform a similar method of “pattern analysis” to examine how smart home technologies are represented within computing

scholarship. Through analyzing the images that accompany publications, they identify seven recurring visual positions taken by researchers (or “observers”) that reflect their corresponding epistemological commitments. In this pictorial, we acknowledge the ways in which press photographs play an important role in molding public conceptions of issues and events, with particular interest in how such representations may distract from the realities of conditions on the ground.



Images of disembodied hands appeared several times in our data set. As a trope, these images use the visual language of advertisements to center the product (in this case, a technological artifact) and demonstrate its usefulness while eliminating most identifying characteristics of who is performing the action.



Using the LexisNexis Uni database, we assembled a list of English-language newspaper and magazine articles that contained various terms for our industries of interest as well as terms often synonymous with AI (e.g., Robot OR Artificial Intelligence OR Automation). Based on the location of our field sites, we limited articles to those published within the United States. This returned over a thousand results that we then hand-coded for relevance. Excluding those that were off topic and later grouping articles that were republished in multiple publications, we narrowed in on a final set of 80 articles featuring 179 images. These images were then uploaded to a collaborative, private Pinterest board where they were thematically grouped by all members of the research team into a photo collection feature the platform calls “Notes.” The images were grouped based on the shared visual content that repeated across images and groups were non-discrete—a single image could appear in multiple groups.

The text of the news articles often discussed how AI might be used to address complex problems like global waste disposal or improve industry-level profitability (ideas that we interrogate further in [30]). In the sections that follow, we describe the visual patterns that accompanied this reporting. As visual anthropologist Marcus Banks [1] observes, news photographs often rely on visual metaphors to illustrate abstract concepts that extend beyond physical documentation. Although widely held assumptions about photography purport that photographs are direct reproductions of reality, the content and aesthetic qualities of photos are shaped by a series of strategic choices made by photographers [33]. News photographs, in particular,

are the product of an especially “complex network of cultural phenomenon” — the editorial decisions of photo editors, the bottom-line concerns of publishers, and the expectations of audiences [25]. In our collection of news photos, we identified three recurrent and prominent patterns: both images of robots and members of the executive suite featured prominently across articles we analyzed, while workers were often cast as overwhelmed or not at all.

Executive Voices

A common occurrence among the photographs is the presence of executive administrators — managers, directors, and, most frequently, CEOs. These tend to be shot in a portrait style, either close ups or environmental shots where the robots and facilities are utilized as props for their character. Within the photographs, the administrators are sharply dressed in button-down shirts and jeans, and typically inactive as they pose or gesture to something within the shot.

The images of executives stand in sharp contrast to those of workers in action, suited up in protective gear such as gloves, hardhats, and PPE as they sort through trash or sanitize surfaces. Through this style and framing, the administrators are set up as the authorities of the operation — their role and presence uplifted both in the photography and articles.



Commonly the subject of portraits, executives are depicted as overseers. Rather than interacting directly with waste, they instruct or observe. Pictured here is a field operations manager at a janitorial robotics company and three CEOs of companies that produce waste management technologies. The top image is credited to a public relations company, and presumably depicts hypothetical executives.

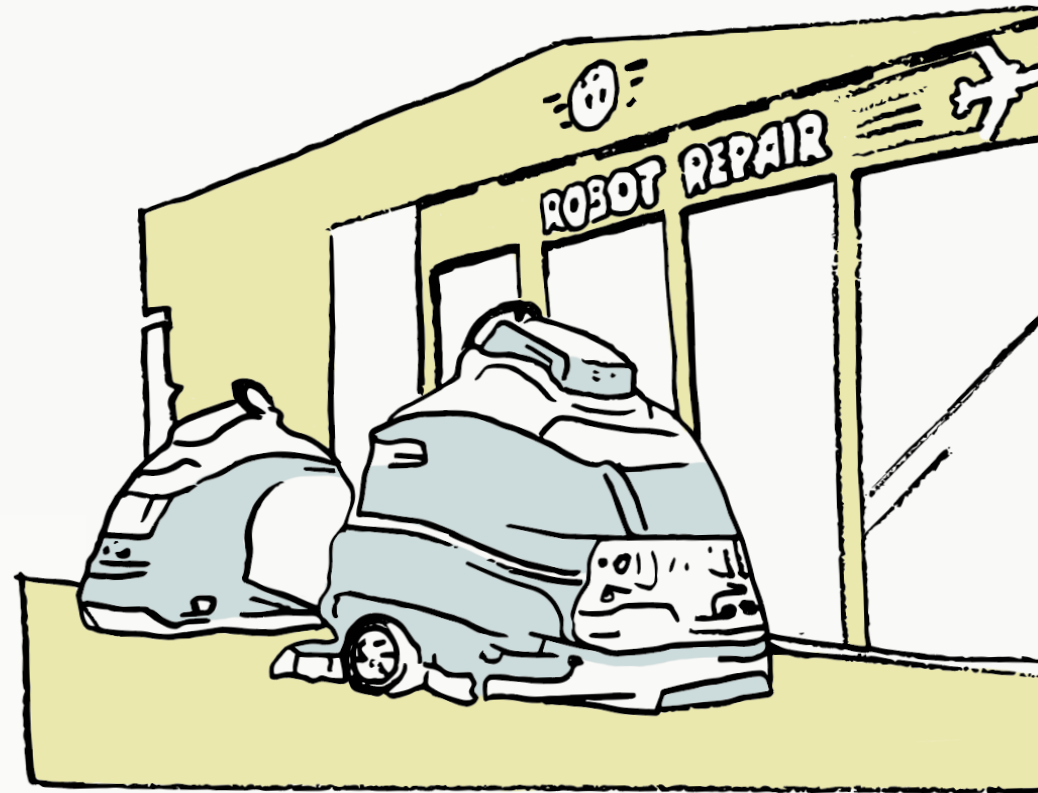
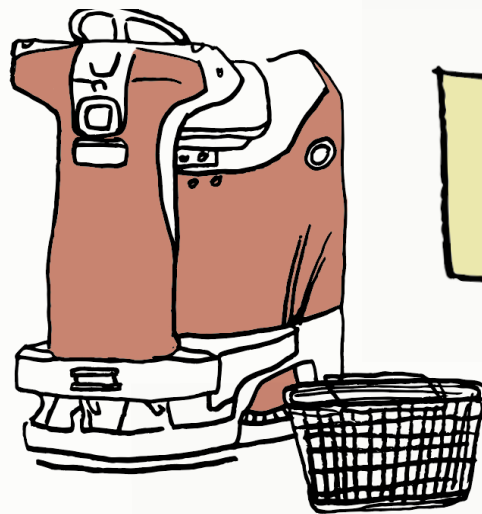


Robots in Profile

One recurring pattern within our data set are photos profiling the machinery and robots that are being implemented. In these photos, machines stand at the central focal point of the image and are absent from humans. Photojournalism customarily shies away from shots where people are not present, as they are often what makes an image visually engaging and can act as stand-in characters for the reader to connect to the story. Therefore, these photographs of the machinery and robots alone are somewhat of an anomaly, as traditional standards would dictate that these be shot with, for example, a worker manning the AMP robotic arm or a customer holding the basket next to the floor cleaner. Thus, shooting the machinery by itself is a deliberate choice — one that serves to present it as the main character of these articles, the one doing the action, and upon which readers should focus.

Positing the robots as the main character, separate from workers or people, pushes the idea that this machinery is independent and autonomous. In a certain manner, it makes the machinery transcend the typical role of an inanimate object into a superhuman of sorts. Within the context of

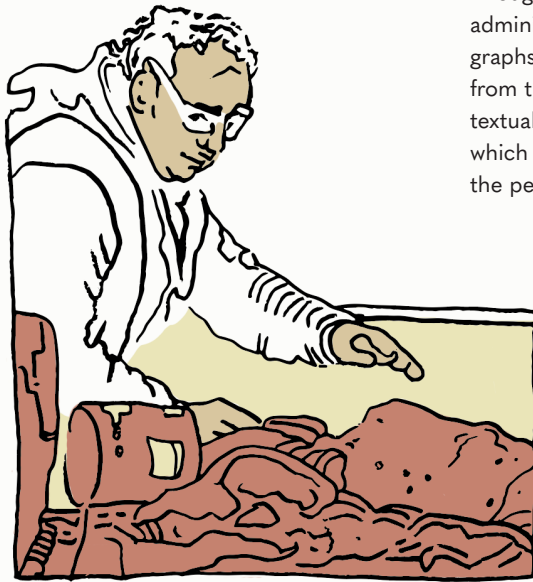
the ongoing pandemic, the absence of people takes on renewed meaning as sterility is centered as means of life or death. Robots that “can’t get the virus” perform service or infrastructural work that keeps the public safe, without putting human workers at risk.



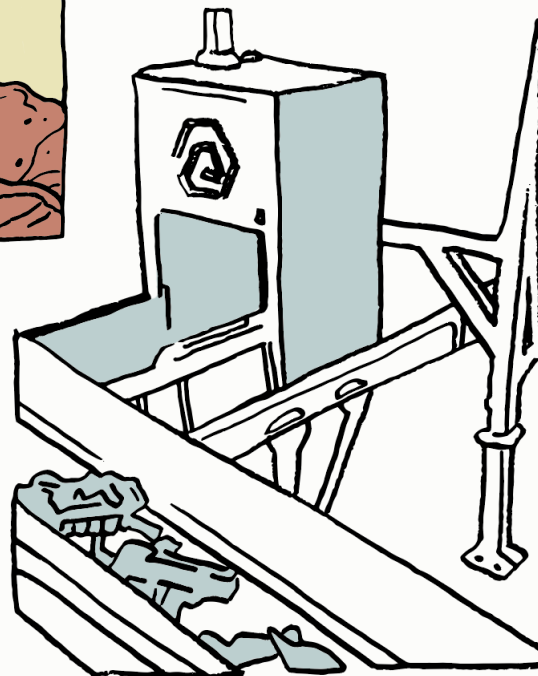
Robot profile images feature machines as the solo, central figure. The machines are either photographed in context (in an airport or recycling facility) or on a sweep, consistent with product photography. At times, these images are shiny, 3D renderings as opposed to actual photographs. Whether or not these innovations come to market, staged photographs and robot renderings in the popular press communicate to corporate consumers that these technologies are crucial to staying with the times. The consequence of such reporting is to drive cyclical hype around products which may ultimately be impractical, useless, or even harmful.

Workers Overwhelmed

Though photographs of the machinery and of administrators were prevalent in press photographs, workers were not completely absent from the narrative. This runs in contrast to the textual elements of the articles we analyzed which featured almost no direct quotes from the perspective of workers. Where workers



In press photographs, workers are almost always depicted mid-action. Their activity is contextualized — and, to some extent, humbled — by expansive spaces waiting to be cleaned and oncoming piles of trash. While these images depict waste work as difficult and waste workers as industrious, workers also appear to fall short of their momentous tasks, requiring the help of automation.



appeared in images, it was under circumstances which served to reinforce the notion of their inferiority to and separation from AI and automation. Typically, these shots depicted one to three workers attempting to sort through large piles of trash on the conveyor belt or in bales. The angle and framing on these photographs emphasizes the amount of trash, while simultaneously diminishing the workers' presence — suggesting that workers are overwhelmed by the amount of material in need of sorting. In one image, a recycling staff member is pictured leaning against a conveyor belt, visibly exhausted. These pictures support the articles' narrative that workers are incapable of handling the large material stream and so AI and automation are needed to finish the job.

This idea is amplified by the fact that workers are frequently absent in any pictures where new AI or automation technologies are present, thus erasing the necessary labor they perform fixing or working alongside the machinery. The exception is in cases where the machinery being implemented is hand-held. For example, in images featuring temperature checking devices or sanitation sprayers, workers were there holding the devices. However, these shots only make up a couple out of the nearly 200 we analyzed.

Counter-visualities

a different realism. In short, the choice is between continuing to move on and authorizing authority or claiming that there is something to see and democratizing democracy" [27:5]. Literary scholar and historian Sadiya Hartman [17], for example, cuts through the pathologized and criminalized depictions of 'wayward' Black women in the cities of New York and Philadelphia at the turn of the 20th century to show how they experimented with agency and personhood. In telling these stories anew, she recuperates histories unaccounted for in the archive and offers a retelling of Black lives in the wake of slavery.

We use countervisualities to complement and extend the methodological repertoire of critical design and design fiction within HCI [2,11,26]. Existing techniques often rely on reimagining current conditions or potential futures through narrative strategies of irony or satire [5,12]. Brown et al.'s [7] "Future IKEA Catalogue," for example, uses the

familiar visual language of a retail magazine to subvert notions of consumer privacy and data-driven marketing. Similarly, Fuchsberger et al. [14] offer a series of "visionary" job descriptions toward prompting discussions around the future of work and workplaces. By contrast, we draw on countervisualities to challenge dominant configurations within AI reporting, and revive narratives that were never accounted for at all.

Without this vital addition, we face narrow or altogether absent alternatives for the future of robotics and automation.

Our own illustrated countervisualities build upon ongoing interviews and observations we've conducted over a 7-month period in two field sites integrating emerging AI technologies in response to COVID-19: an airport in the mid-Atlantic region of the US and a recycling facility in the American south.

In total, we have conducted twenty-two hours of interviews with eleven participants. In this first phase of research, interviews were primarily conducted with managers and administrative personnel about how automated technologies were being integrated in their facilities. The interviews began in June 2020, and were initially conducted remotely as in-person access to facilities was limited at the height of the pandemic. These conversations were supplemented with data produced in ethnographic fieldnotes from fourteen hours of site observation. Across these conversations and observations, we've collected rich information about acts of calibration, repair, and resistance, which run counter to the well-tread narratives we saw in our news media analysis. In presenting these alternative depictions, we both challenge popular representations of AI, and extend the pictorial format — with its careful accounts of process and experimentation — to consider the ongoing work necessary to design.

Challenging the visualized authority of existing representations of AI and essential work, we drew on the lens of countervisuality to develop illustrations depicting accounts left unseen.



Challenging the visualized authority of existing representations of AI and essential work, we later drew on the lens of countervisuality to develop illustrations depicting accounts left unseen. Emerging from the interdisciplinary field of visual culture, sociology, and media studies, countervisualities seek to "reinstate the terms on which reality is to be understood" [27]. In *The Right to Look*, visual culture scholar Nicholas Mirzoeff explains, "it is by no means a simple or mimetic depiction of lived experience, but one that depicts existing realities and counters them with

The Centrality of Maintenance & Repair

Slick photographs and renderings of automated waste labor technologies depict them as functioning seamlessly and autonomously. Yet, AI requires maintenance and repair. Both mechanical technologies (like conveyor belts) and computational technologies (like optical sorters) break down through use. The context of waste labor is especially hard on machinery — occurring in environments that are dirty, damp and unpredictable. Here, technology requires constant attention. For example, repair is so frequent in our recycling fieldsite that the facility runs an average of one additional day

“The algorithm that [the robots] use—with the continuous fill—creates a lot of turns that seem unnecessary and the mechanics of the machine itself are such that the more times the squeegee moves in a circle it loses its tension and leaves water behind, which is a slip and fall hazard. It causes [janitorial staff members] to have to attend to that unnecessarily.”

— Facilities Maintenance Supervisor, Airport

every month in order to account for time when sorting processes are halted in order to address problems with the machines.

At the airport, a dedicated staff member is tasked with following the floor cleaning robots throughout the day, restarting them when they stall out and mopping up the excess trail of water they leave behind.

Underlying a focus on the maintenance of automated technologies is a commitment to thinking about design

as only one moment within a lifecycle of a computational artifact. Innovative technologies are deeply reliant on the maintainers who keep them running, though this work “remains mostly invisible under our normal modes of picturing and theorizing technology” [20:225]. This invisibility constrains public understanding of whose work matters, and funnels attention and resources away from sustaining the infrastructures and services already central [35].



Sequential Work

Our collection of press photographs reveals an either/or approach to human-computer interaction. They depict the efforts of workers or high-tech machines, but rarely both. In the recycling sorting industry, for example, images of workers show them performing difficult manual labor while being constantly inundated with a never-ending stream of waste materials. Alternatively, images of innovative technologies show them operating independently of human intervention. Yet, our interviews with waste labor professionals indicates that a considerable amount of hand work is required to clean waste streams before it reaches robots on sorting lines and collect materials that robots might have miscategorized after.

This material labor resembles other forms of labor required for human-AI collaboration, such as data collection and dataset cleaning. D'Ignazio and Klein argue that failing to give credit to the types of sequential labor involved in scientific projects directly contributes to devaluing this work, as our economic system rewards the products we can see [10:178]. Though we illustrate sequential work here, we argue for broader efforts to recognize and value this labor regardless of its immediate visibility.

"We call them sorters, but they're really more quality-control people. For example, after the paper has run through the system you have a 90% paper stream, but you have people on those lines pulling out bags and flattened containers that act like paper, and are contaminating the stream."

— **General Manager,
Recycling Facility**



Surfacing Surveillance

While repair and sequential labor are made invisible in automated systems, there is also potential to render other aspects of work more visible. Through the tracking of granular customer data, for example, corporate entities seek to infer processes of sales work happening on the ground to externalize and automate retail worker knowledge [24]. As Suchman outlines, efforts to make aspects of work demonstrable can subject workers to new forms of accountability and surveillance [34], demanding a tradeoff between monitoring and retaining discretion or autonomy [13].

Our observations at the airport have shown how AI and robotics technologies generate data about every

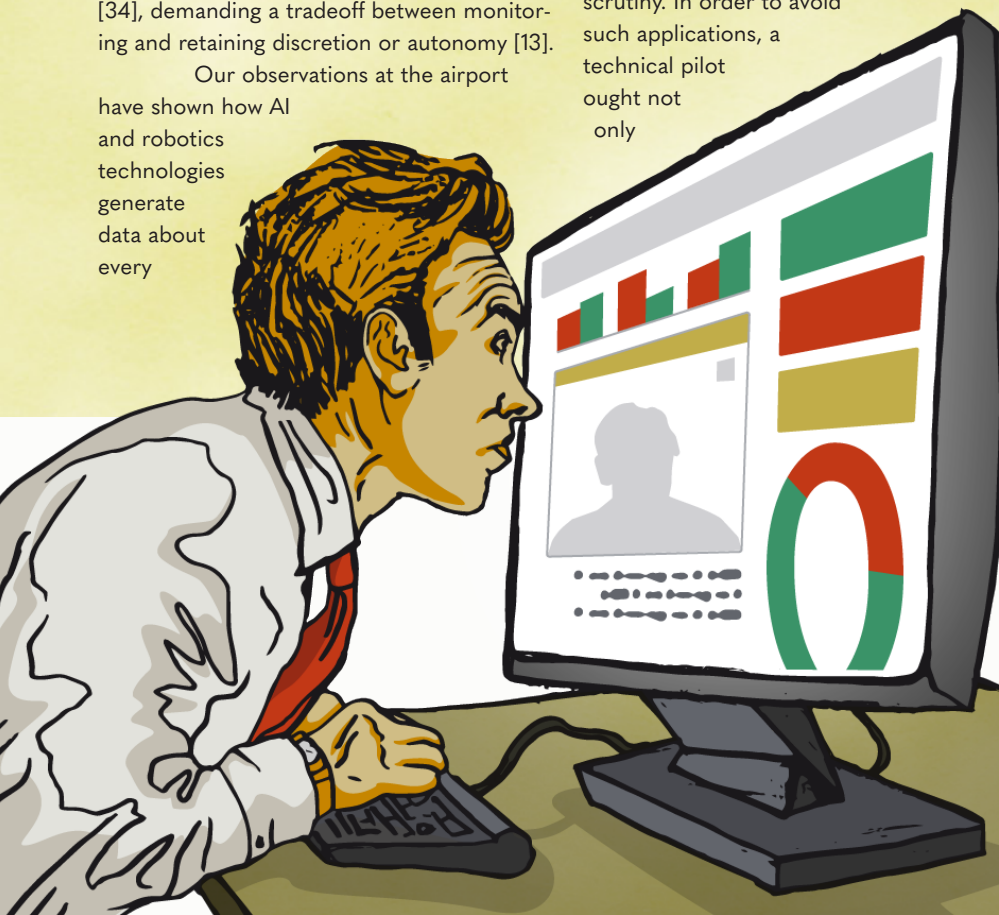
move they make. As the cleaning robots make their way through the space, they produce corresponding maps of their movements and recordings of their interactions within the physical environment. Though this information may be principally used for localization and path planning, this data could also serve as a trace to prove compliance with intensified disinfection procedures (every crevice has been sanitized). Against the backdrop of the ongoing pandemic, management supervision could entwine with wider governance strategies in the name of public safety — subjecting individual workers to further oversight and scrutiny. In order to avoid such applications, a technical pilot ought not only

focus on the capacity of a device to fit within the environmental conditions of a deployment site, but also anticipate potential compromises to workplace privacy and institute policies that protect workers in advance.

Waste Workers Rising

In March 2020, local and national media covered sanitation workers in Pittsburgh who blocked the entrance of the city's Bureau of Environmental Services, demanding personal protective gear and hazard pay [18]. Amazon warehouse workers in Staten Island threatened to walk out over uneven safety precautions and a lack of notice around the spread of the virus within its facilities (as of October, a reported 20,000 employees have contracted Covid-19) [20]. In these acts of refusal, we see an alternate representation of waste labor — one that is not overwhelmed (as depicted in news reporting), but agitated.

Despite numerous accounts in the popular press praising employers for adopting technologies on the cutting edge, we see that workers who experience their fallout are not afforded inexpensive basics: masks, gloves, and consistently enforced safety precautions. It is not a coincidence that the interweaving consequences of workplace technologization, sparse media coverage, and the pandemic fall along clear hierarchies of waged labor.



Conclusion

While underreporting may lead us to imagine that these sharp inequities exist solely in industries associated with low-wage labor, such as sanitation, hierarchies of labor are also evident in technology companies. At Google, for instance, where contract workers wear the red-letter C on their badges for key card access. Projects such as Norman Wilson's "Workers Leaving GooglePlex" have captured the tiered systems of technical work, where scanners on Google's large scale book digitization project enter and exit from a separate building on the campus [11]. However, recent collective action has cut across these hierarchies -- involving collective action by employees and contractors and making demands that apply to both categories of workers [9]. As we present countervisualities of workers agitating and organizing, we surface the importance for class solidarity between traditionally divided industries. With this work, we open space for united workers to exist in their dignity, rather than in their absence, fragmentation, or overwhelm.

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The products of waste workers — clean floors, sanitized tables, objects made from recycled plastics — are evident everywhere. Yet, the activity of waste workers often occurs out of sight. Bathrooms are cleaned behind yellow "wet floor" signs and empty bottles disappear from curbside recycling bins. In news stories meant to explore these processes, workers are again made invisible when the spotlight is put on the development and introduction of waste labor technologies. AI and automation technologies are framed as technological fixes to the problems of dirt and disposal, further obscuring the constituent work required to maintain and operate them.

Machine-centered media representations drive cycles of hype that overvalue the potential of new technology, while simultaneously devaluing workers that will make-up for its shortcomings. As Ruha Benjamin writes, "buzzwords such as 'lower costs' and 'greater efficiency' signal a fundamental tension and paradox -- the indispensable disposability of those whose labor enables innovation" [3:39]. In this pictorial, we've explored what an alternate framework for representation may look like through a series of countervisuals that surface the labor necessary to make AI function and call for justice for waste workers who stand at the front lines (even if behind the scenes).



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