Wage Theft and Technology in the Home Care Context

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Home care workers (HCWs) are professionals who provide care to older adults and people with disabilities at home. However, HCWs are vulnerable and especially susceptible to wage theft, or not being paid their legally-entitled wages in full by their employers. Prior work has examined other low-wage work settings to show how technology is designed and deployed has the potential to both cause and address wage theft. We extend this work by examining the relationship between technology and wage theft in the home care context. We collaborated closely with a local grassroots organization to conduct interviews with workers and labor, legal, and payroll experts. We uncovered how the complex, volatile, and diverse nature of home care complicates the errors in time-tracking systems. Through design provocations and focus groups with workers and experts, we also investigated the potential of technology as a part of broader efforts to curb wage theft through educating and empowering isolated HCWs. While we found that approachable design could reduce errors in existing systems, make employer processes more transparent, and help workers exchange knowledge to build collective power, we also discuss concerns around burden, privacy, and accountability when designing technologies for HCWs and other low-wage workers.

CCS Concepts: • **Human-centered computing → Empirical studies in HCI**.

Additional Key Words and Phrases: worker advocacy, design probes, activism, frontline health

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1 INTRODUCTION

Home care workers (HCWs) provide care for older adults and people with disabilities in their homes by assisting their clients with daily tasks, providing social support, and monitoring clinical symptoms. Despite their role in empowering clients to thrive in their communities and avoid institutionalization, HCWs themselves are vulnerable, marginalized workers. Home care has been historically undervalued and associated with unpaid, reproductive labor [36]. The work is seen as "*jobs of last resort*" [40] left primarily to women (85% of HCWs), people of color (63%), and

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immigrants (31%) [87]. Historic and current discriminatory attitudes towards home care work and workers has continuously excluded this area of essential work from same rights and protections afforded to other workers [67]. For example, HCWs have been reported as being especially at risk of not being paid their legally entitled wages by their employers, or "*wage theft*." A 2008 survey in New York City demonstrated that HCWs face the highest levels of wage theft among low-wage workers, with 83% reporting not being paid overtime premiums, 90% reporting working while not clocked in, and 18% reporting average hourly wages less than the minimum [15]. These wage and hour violations compound the financial precarity of already low wages, and a quarter of home care workers living below the federal poverty line [87].

Several HCI and CSCW scholars have explored the relationship between wage theft and technology in other low-wage work contexts [32, 104, 111]. Tippett et al. [104] show that time-tracking technology has wage theft embedded in its design when it allows employers to freely modify reported hours without record. Some time-tracking technologies also enforce default number rounding rules that shaves time off paychecks. On the other hand, Dombrowski et al. [32] suggest that worker-centered technology could potentially help challenge unfair wage practices by helping low-wage workers identify and document wage violations to collectively organize. In their assessment of the design of applications that address wage theft, Wolf et al. [111] note that a focus on both urgent, tactical needs and fostering strategic conditions for social change could produce technology that can combat the negative impacts of the broader structure of capitalism and neoliberalism.

Given the high prevalence and large impact of wage theft on HCWs, we take inspiration from prior work to investigate the sociotechnical context of wage theft among this workforce. In particular, we ask: ***How could technology design cause and address wage theft for HCWs?*** To answer our research question, we partnered with a local, union-affiliated grassroots organization in Upstate New York, United States. We developed an IRB-approved study with two phases. In Phase I, we conducted semi-structured individual interviews with workers and labor, legal, and payroll experts to understand why wage theft happens, what existing methods HCWs currently employ, and the challenges to addressing wage theft. Then, in Phase II, we synthesized the interview data and developed low-fidelity design provocations as conversation starters about different technological futures where HCWs could identify wage theft and act on wage information. We presented these designs to groups of workers and experts to engage in conversations around the feasibility and concerns of the role of technology in the fight against wage theft.

Through the two phases, we found that in some cases, issues with technology design, access, and usability exacerbated the complicated sociopolitical factors that contributed to wage theft in the home care context, including amplifying unequal worker-employer power dynamics, perpetuating noninclusive policies set at the agency and legislative level, and further devaluing the autonomy and voice of marginalized workers. However, we also found that certain technology interventions had the potential to unify worker advocacy efforts and work towards reducing some of these structural barriers. Our research highlights the importance of considering the sociopolitical context of workers in developing technology solutions, given that existing technologies prioritize employer-driven compliance, lack sufficient training and support, and result in costs that fall on the workers.

Our findings aim to support tangible changes for the HCWs we worked with as well as broader designs of appropriate and equitable technology for other HCWs and low-wage workers. We make the following three contributions to CSCW. Firstly, our research explores how technology design of employer-mandated time-tracking software currently complicates wage theft in the home care context. Furthermore, we also explore how technology design could mitigate problems through changes in time-tracking systems, employer-worker dynamics, and collective action for HCWs. Finally, we discuss how these changes requires careful consideration of the added to workers, accountability of employers, and sensitivity of information.

2 BACKGROUND AND RELATED WORK

Our work builds on literature in worker-centered technology and activism. We first discuss prior work on how technology can both cause and mitigate the effects of wage theft in other low-wage work contexts. Then, we provide background on the home care context, including what HCWs do, how they receive their wages, and how wage theft affects them.

2.1 Wage Theft and Technology

2.1.1 Oppressive Workplace Technologies. Prior work has demonstrated how employer-mandated technology used to report hours could actually exacerbate wage theft. Tippett et al. [104] reported different ways that the electronic systems used to track time codify wage theft, allowing employers to make changes to workers' reported times without the workers or auditors being aware. Employers could also set defaults that disadvantage the worker. For example, maintaining the historic practice of rounding clock-in and out times up or down to the nearest 15 minutes could cumulatively favor the employer because workers will consistently show up a few minutes early to avoid being marked tardy—and that extra time before the start of their shift would be rounded off. This potential for time-tracking technology to cause wage theft is becoming more relevant in the home care context specifically as electronic visit verification (EVV) applications are being increasingly mandated [4]. EVV apps note when a provider visit occurs by capturing the date and time of the visit, the location of the visit, the person who received the services, and the person who provided the services. Prior work has investigated how these EVV applications could disadvantage workers, including by categorically excluding contributions that are beyond the specified times or tasks [47]. Additionally, these applications are invasive, ultimately surveilling the workers and, in turn, the vulnerable clients to whom they give care [69], as seen in other low-wage workplaces [63].

Our study bridges these two threads of investigating systemized wage theft and the negative externalities of EVV by looking at how the technologies HCWs use could exacerbate unequal power dynamics between them and their employers. We contribute to a growing body of CSCW and HCI literature that examines how most workplace technologies are designed to benefit the employer [42] and how worker-centered tools could be designed in opposition to this tradition [56]. Worker-centered tools have been shown to bridge information gaps and support the coordination of other marginalized workers in healthcare, including community health workers [52], porters [17] and orderlies [101]. Worker-centered tracking technologies have been shown to help workers better understand their contributions [79], be more productive [48], and improve their well-being [113]. Our investigation into technology and wage theft for HCWs contributes to the discussion on how worker-centered design could establish accountability, representation, and responsibility in the relationship between workplace technology and workers [37].

2.1.2 Technology for Addressing Wage Theft. Based on the documentation of sociotechnical practices that low-wage workers undertook to identify and act on wage theft, Dombrowski et al. [33] highlight three potential goals for technology to address wage theft that are also reflected in other literature. The first goal is educating and connecting workers, which could look like creating more tailored advice about work rights and specific situations. Prior work, such as Poon et al. [88], has explored the use of computer-mediated communication to develop communities of practice for geographically distributed HCWs, though it has not been extended to topics about wage theft specifically. The second goal is identifying and documenting wage violations, such as generating clear, complete, and consistent automated and semi-automated reports. This approach has been taken by various self-tracking tools, but have been intended for high-tech users (e.g., desktop applications for freelancers like Toggl [7] or Harvest [5]) or not easily adapted to the fluctuating schedules and unique calculations associated with home care (e.g., the U.S. Department of Labor's

timesheet [8], online calculators [3, 6]). The final goal is to support collective organizing and coalition building with advocacy organizations and specialized legal experts. There have been some efforts to achieve this goal for some low-wage workers. For example, Journalero [91] also notifies other day laborers when wage theft occurs and WeClock [9] guides worker collectives to "*collect insights and advocate for change that's needed*." However, some of these tools have been since discontinued or are not yet widely adopted.

There have also been critical analyses looking at broader structural factors that influence why technologies aimed at improving low-wage workers' conditions have not been as effective as promised. Wolf et al. [111]'s analysis showed that such projects faced challenges on three different levels. Firstly, the projects faced challenges due to a lack of individual technological adoption, discussed as "*gaps*" to usage in self-tracking literature [105]. Then, on the relational level, Wolf et al. [111] found issues of an anti-labor political and economic climate, emphasizing the importance of stakeholder alliances to build enough power to challenge larger structural mechanisms. This reflects the importance of "*broad-based organizing*" [24] or cooperative activism [71] that brings various stakeholders to the table to build mutually and collectively beneficial efforts. Lastly, the projects analyzed by Wolf et al. [111] were limited by large-scale, pervading institutions that reinforced capitalism and neoliberalism. This speaks to the existing literature on the role of technology in handling "*wicked problems*" [90] that have complex causes, goals, and implications. Despite the failures they witnessed, Wolf et al. [111] still have hope for pro-labor projects as "*capitalism's varied multiplicities means that failures at one juncture do not preclude successes at others*."

Our study builds upon these two bodies of literature, expanding on the capabilities of technology to address problems related to wage theft while also heeding the warnings of sociotechnical forces that curtail its impact in other low-wage work settings. Prior work has shown that technology has the power to work towards just conditions by reporting issues (e.g., employer practices [50], social programs [110], extortionary corruption [93]), telling stories (e.g., building community through encouragement and discussion [60], developing shared narratives about harassment [31] or abortion rights [73]), and mobilizing action (e.g., finding volunteers [94], donating money [62], performing everyday philanthropy [44]). Our project learns from these examples of social justice technology in how data about individuals can be used to hold institutions accountable through external accounting, building a shared connection across otherwise alienated individuals, and activating a response together.

2.2 Research Context

2.2.1 About HCWs. There are currently 3.5 million home care workers in the United States [108]. An estimated one million more home care workers (HCWs) will be needed by 2029 to address the demand resulting from an increasing aging population, growing desire to live at home due to the pandemic, and decreasing availability of family and friend caregivers [92]. HCWs are direct care workers who assist more than 9.3 million older adults and people with disabilities living at home with daily tasks, such as eating, dressing, and bathing [87]. In this study, we consider two main types of HCWs: personal care aides (PCAs) and home health aides (HHAs). In addition to assisting with daily activities, PCAs also provide other household assistance and social support to help individuals remain engaged in their communities. HHAs perform certain clinical tasks (e.g., monitoring vital signs, distributing medication) under the remote or intermittent onsite supervision of a licensed professional [108]. However, despite these differences in job scope, both PCAs and HHAs have similar backgrounds and deal with similar types of problems. HCWs are a marginalized group of frontline workers: predominantly women, people of color, and immigrants [96]. The COVID-19 pandemic highlighted their essential but precarious role [43, 100]—they were on the frontlines but reported feeling invisible, unsupported, overworked, and undervalued. They work

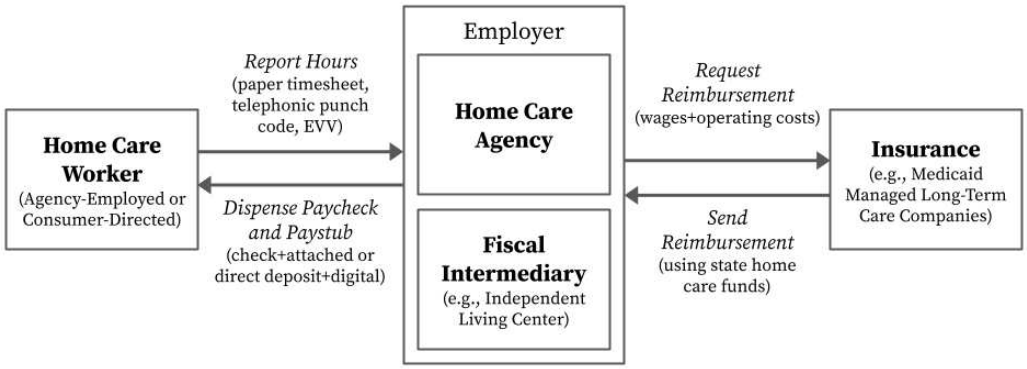


Fig. 1. Overview of wage processes for HCWs paid with public funding

long shifts that can be physically draining and also perform "*invisible*" emotional labor that draws from the close, personal bonds they form with their clients [38, 39]. Additionally, they fill in on crucial health-related tasks that are outside of their job scope and for which they are not trained [89, 99]. Due to their low hourly wage (a median pay of USD$14.15 per hour [108]) and inconsistent hours, many HCWs themselves are on welfare or living below the federal poverty level [86].

2.2.2 Wage Processes. An overview of this process can be seen in Figure 1. Some home care services are funded privately via out-of-pocket client expenditures and private insurance, but approximately three-quarters of home care expenses are funded publicly via Medicaid, Medicare, Department of Veterans Affairs, workers compensation, or individual state programs [61]. This public funding can be distributed to HCWs in one of two ways: through a home care agency provider or a consumer-directed/self-directed program [57]. HCWs who are employed by home care agencies receive client and shift assignments from them. HCWs who are employed by the client directly either find their client on their own (e.g., self-referral via a family member or friend who needs care) or through a state registry and receive their payments through a fiscal intermediary (e.g., an independent living center [2]). In both agency-employed and independent cases, the HCWs report the number of hours they worked as well as which tasks they completed by using a paper timesheet, telephonic punch codes, or an electronic visit verification (EVV) application [84]. After receiving the report of hours worked, the employer (i.e., agency or fiscal intermediary) would calculate how much the HCWs should be paid based on how many hours they worked and with which clients, as some clients are reimbursed at different rates. Then, the employer would pay the HCWs and be reimbursed for the HCW's hourly rates as well as any additional costs (e.g., workers compensation, disability, operating costs) through an insurance company that dispenses state home care funds (e.g., Medicaid Managed Long-Term Care Company). When HCWs receive their payments (i.e., paycheck) either through a physical check or direct deposit, they also receive a wage statement (i.e., paystub) which should detail gross wages, deductions, and net wages. Traditionally, this wage statement used to be delivered as an attachment to a physical check, but employers have recently moved to digital paystubs accessed through a portal or smartphone application.

2.2.3 HCWs and Wage Theft. The marginalization of HCWs and their work in turn influences the prevalence and impact of wage theft. Care work, like the work HCWs perform, has long been seen as separate from paid, productive labor [36]. One ramification of this is that work done in the

home has been historically excluded from legal protection. Domestic workers and HCWs did not have their minimum wage and overtime protected under the 1938 Fair Labor and Standards Act until a legal loophole was resolved in 2015 [1]. In the case of New York State, recent successes in advocacy led to not only promises of higher wages, but also more ambiguity in how these raises would be deployed [81]. The key wage and hour violations HCWs experience include minimum wage violations (not being paid at or above the federal or state minimum wage, whichever is higher), overtime violations (not being paid at 1.5x their usual hourly rate when working over 40 hours), and off-the-clock violations (doing work while clocked out and not being paid for it) [15]. As wage theft occurs when the costs of compliance are greater than the costs of a violation [58], the lack of regulation led to lower costs of violations and the frequent changes led to higher costs of compliance. Moreover, the expected cost of violations is also low because, even with laws in place, the probability of a violation being recognized and reported is low. As the work is done in clients' homes, HCWs are more likely to face violations hidden from public view and are too isolated from each other to effectively act together [27]. An survey of low-wage, frontline workers in three U.S. cities in 2014 showed that for bottom-up, worker-driven enforcement of labor laws, "*the least politically, economically, and socially powerful and secure workers*" like HCWs were the "*least likely to make claims, the most likely to experience retaliation, and the least likely to have accurate substantive and procedural legal knowledge*" [12]. Moreover, independently contracted HCWs also face increased costs of representation without a clear employer to rally against [67]. Our research explores how technology design could support the "*oversight, enforcement, and worker organizing*" [27] required to address wage theft for HCWs.

3 PHASE I: UNDERSTANDING THE CAUSES AND EFFECTS OF WAGE THEFT

For the first phase of our study, we built a background understanding of wage theft for HCWs through individual, semi-structured interviews with workers and labor, legal, and payroll experts. Through this phase, we explored why wage theft happens and what current approaches or challenges there are to addressing it. This analysis of the context laid the groundwork for the design of provocations in Phase II, which would be used to discuss the benefits and drawbacks of potential technological futures aimed at addressing the problem.

3.1 Individual Interviews

Interviewees. We conducted semi-structured interviews with five experts and four HCWs in order to better understand the causes of wage theft for HCWs. We worked closely with our partner, a union-affiliated, grassroots organization that hosts trainings and organizes advocacy activities for more fair and consistent pay, better health and safety, and fairer schedules for HCWs in Upstate New York. Interviewees were recruited through these activities and snowball sampling through the organization's networks and were thus all located in New York in the United States. For the experts (E), we spoke to three organizers who helped host events and guide HCWs through concerns at the partner organization (E1, E2, E3), a lawyer who had worked with the partner organization on a class action case related to wage theft (E4), and a bookkeeper who handled the payroll for a fiscal intermediary for self-directed clients (E5). For the workers (W), we spoke to one retired home health aide (HHA) (W1), one personal care aide (PCA) (W2), and two who identified as both HHAs and PCAs (W3, W4). These HCWs were not union-affiliated and were agency-employed. More information can be found at Table 1.

Procedure. The interviews lasted approximately 30-60 minutes and were conducted remotely over Zoom or phone, recorded with the interviewees' consent, and transcribed. During the interviews, interviewees were read the informed consent and asked about their experiences identifying and

Table 1. Interviewee self-reported demographics for interviews in Phase I (including job role/position, gender, race/ethnicity, education level, and years of experience)

ID	Position	Gender	Race/Ethnicity	Education Level	Years of Exp.
E1	Organizer	Woman	White or Caucasian	Graduated from College	15
E2	Organizer	Woman	Black or African American	Some college	5
E3	Organizer	Woman	Black or African American	Some College	6
E4	Lawyer	Man	White or Caucasian	Completed Graduate School	50
E5	Bookkeeper	Woman	White or Caucasian	Graduated from College	20
W1	Retired HHA	Woman	Hispanic or Latinx	Master's degree	40
W2	PCA	Woman	White or Caucasian	Some college	25+
W3	PCA/HHA	Woman	Black or African American	High school	8
W4	PCA/HHA	Woman	Black or African American	Associate's degree	30

reporting wage theft, as appropriate for their position. They discussed, among other topics, how hours were tracked and reported, how issues with wages were resolved, reasons why wage issues occur, some challenges to addressing wage issues, what they wished the process would look like, and how technological systems could help or harm HCWs in addressing wage theft. At the end of the interview, workers were reimbursed with a USD$25 gift card, an amount not considered coercive by the IRB.

Analysis. We conducted reflexive thematic analysis [18] using professional transcriptions of the interviews. First, three researchers coded each interview separately and came together to reconcile the codes. The first five interviews were coded by all three coders and the next four interviews were coded by only two (one of whom was the first author). The codes were created using gerunds (i.e., verbs with -ing endings) [25] and started with an initial codebook of 53 codes. The coders added codes as they arose in the transcripts and the final codebook was 106 codes (e.g., "*attributing pay issues to worker error*," "*working around app constraints*"). Then, using memos of the interviews, we identified three broader topics (i.e., "*causes of wage theft*," "*current approaches*," "*challenges and concerns*") and organized the codes into 15 subthemes (e.g., "*home care is unpredictable*," "*agency making it harder*") presented in the findings.

Positionality. Our research team included six people, five of whom identified as women, four as people of color, and five as immigrants or children of immigrants. We have more than a decade of experience designing technologies with underserved communities in a way that "*centers the voices of those directly impacted*" [28] and aimed for an equity-driven, collaborative approach by working closely with our partner organization.

3.2 Findings

The interviewees delineated how wage issues resulted from a confluence of errors and ill-intent. Moreover, they spoke about how this impacts the way HCWs currently identify wage issues and resolve problems. Finally, the interviewees discussed some of the system-level challenges that upheld this broken status quo. In doing so, they isolated some of the opportunities for technology to reduce mistakes, bridge gaps between people, and change the system.

3.2.1 Causes of Wage Theft. The interviewees described the sociopolitical context that enabled wage theft. They mentioned errors due to complicated calculations, fluctuating schedules, and unreliable technology driven by inconsistent policies and unequal power dynamics. Some felt that the wage concerns were actually due to intentional noncompliance from the employers wanting

to take advantage of the workers, which was furthered by complicated relationships between the workers and their employers.

Human and System-Level Errors. Both the experts and workers pointed to errors that resulted from the complexity of the wage calculation for HCWs. E1 shared a long, dense summary of special clauses that apply to HCWs, including payment for travel, split shifts (if the next shift does not start immediately at the conclusion of the previous shift), spread-of-hours (when there's a greater than 10 hour difference between the start and end time for a single day), or uniform cleaning. Moreover, E1 spoke about how confusion increased with the recent legislation passed by New York State to increase the budget for all HCWs by $1 per hour across the state [81]. Some employers misunderstood the clause and only increased the wage for HCWs being paid minimum wage and others did not raise wages at all because they did not receive increased reimbursements from the insurance companies.

In addition to the complicated amalgamation of HCW-specific laws, the unpredictability and heterogeneity of home care work also factored into the litany of errors. For example, one common refrain was that "*things happen*" (W4) on the job that may force workers to stay overtime, such as when the next caregiver showed up late or their client had an accident at the last minute. Even though HCWs were instructed to inform their agencies about such unexpected circumstances, E3 explained that sometimes these updates were not well tracked:

> "*[The agencies] can ask you to pick up hours, but when it comes time for them to pay you for those hours, then they are not on your paystub . . . As far as I know, there's nothing written down. . . . Basically it's their [the workers'] words against theirs [the agency's].*"

This was further complicated by the heterogeneity of experiences HCWs had when they cared for multiple clients and work for multiple agencies.

There were other instances where the technological system HCWs used to report their hours failed and resulted in errors. When they faced a "*glitch with technology . . . things get confusing and the rules get bent*" (W3). W2 explained that the GPS reading required to clock in and out with the EVV system would fail and result in a mismatch of information between herself and her agency:

> "*Well the thing is, if the GPS is not working, it's not going to go to the system. Because everything is done in the system, it goes from my phone to their system and a lot of the times it does not go from my phone to their system.*"

E5, a bookkeeper, mentioned taking at least an hour each day to reach out to HCWs and clients to reconcile errors due to gaps in information, whether it was because the HCWs forgot to clock out or the system did not register the clock out.

Error or Ill-Intent?. Even with the complexity of the wage calculations, many attributed the wage issues to ill-intent on part of the employers. E4, a lawyer who specializes in wage and hour violation cases, was skeptical of error as the primary driver of wage theft:

> "*[Agencies] have their own lawyers. They know what they are required to do. It's just that they are used to taking advantage of low-wage workers who have limited education, who have little to no contact with lawyers, [or] may have immigration problems.*"

Several experts and workers echoed this sentiment. E2 referred to the agencies as "*top-dog scammers*" and E1 said that agencies were "*money-hungry, borderline criminals.*"

The workers pointed to examples where even if their agency was not necessarily acting maliciously, their agency did little to support them. For example, W2 spoke about how she had to wait two weeks to get paid back because her agency did not inform her that there was an issue with her timesheet and payment would be withheld until she submitted a corrected one. She was frustrated,

wondering "*how am I supposed to know there is a note in your computer without somebody calling me?*" E2 stated that if workers did not speak up about wage issues they were facing, "*it just gets swept under the rug*." Interviewees also noted that the issues got forgotten about or took a long time to fix due to a lack of response from the agency.

The interviewees emphasized that the feelings of ill-intent and additional complications were due in part to the inherent disconnect between workers and their agencies in terms of goals. The workers felt that their agencies could sometimes forget that tracking hours was not always the first thing on their minds. As W2 summarized:

> "*The office is about getting the client a person to work with and getting that funding. They're all about getting the money, OK? Where we are about getting that person to a better situation or to a comfortable situation. We work with the human side. They work with the bureaucracy of it all.*"

W1 furthered elaborated on this dichotomy of priorities between the bureaucratic and the human sides, noting that "*I get it, I'm sure you know it's important to collect data . . . but when you're at the frontline level you're trying to work.*"

3.2.2 Current Approaches to Addressing Wage Theft. The interviewees described how HCWs would track their hours, compare them against their paychecks, raise issues to their employers, and, if necessary, bring their employers to court. However, the interviewees also brought up some of the challenges they faced with difficult-to-navigate systems and employer-driven complications.

Verifying Hours. Workers used different practices to identify wage theft. Some workers like W4 verified their reported clock-in and clock-out times per day to ensure that their times were being recorded properly. Others, like W2, took screenshots of their hours every week to keep track. Additionally, workers supplemented existing systems with their own records. W1 described how she used a separate calendar booklet to keep track of her own notes across the clients and agencies that she worked for, making sure to note the mileage to and from clients as well as any additional out-of-pocket expenses.

After keeping track of their hours, workers compared their notes to their paychecks to make sure they were paid the right amount. One complication was that many of the agencies switched to digital paystubs and many HCWs did not know about this switch. Others had issues accessing the paystubs because they did not have access to a computer or did not know their login information. Even when looking at the paystubs, HCWs lacked clear delineation of which hours were associated with a given pay rate (i.e., for different clients or for overtime) or what types of deductions were being taken out. This became especially complicated because the "*tax rates are not always the same*" (W2)—different amounts would be withheld based on varying weekly hours or delayed compensatory payments.

Reporting and Escalating. E2 noted that most workers were "*getting the situation rectified*" and getting paid after they raised wage issues to their agencies. E5, the bookkeeper, spoke about being open to fixing wage issues, except for cases when she could not make the change (e.g., the issue was reported after she had already requested reimbursement). Both experts and workers spoke about the importance of keeping valid notes of the hours HCWs worked because reporting wage issues required submission of some kind of proof (i.e., filling out a supplementary timesheet, sending emails of screenshots of the hours logged that week, calling their client to confirm their hours). Additionally, interviewees spoke about the importance of also logging these interactions with the agency, with E2 and W2 encouraging workers to communicate with their employers through email to maintain a paper trail that could be referred to in the future.

While some workers and experts were proponents of resolving issues with the employer directly, E4 elaborated on the other options workers have, including filing a claim through either the State or Federal Department of Labor or bringing the case to state or federal court. While filing a claim does not require a lawyer, state and federal agencies faced an overwhelming number of such cases that they did not have enough resources to provide a "*reasonable settlement*" (E4). E4 further explained how wage theft cases are not necessarily attractive to lawyers because the potential attorney fees are only "*a relatively modest amount of money*" unless it was a class (state) or collective (federal) action group case. Moreover, the cases themselves were invariably dragged on for many years, meaning good records of the hours worked that go back 5-6 years ago were vital and some workers ended up taking settlements to get cash earlier and walk away from the case.

3.2.3 Challenges and Concerns around Addressing Wage Theft. The interviewees elaborated on some of the obstacles in the broader system to addressing wage theft. The HCWs felt isolated from each other, which made it difficult to reduce the information asymmetry and act. In order to address wage issues, HCWs had to do a lot of extra, invisible work on top of their already large set of responsibilities. Moreover, they felt limited in what they could do to improve their circumstances because of the broader system.

Divided and Conquered. One underlying sentiment from the interviewees was the lack of education and awareness around wage theft. E2 and W1 noted that knowing how to handle wage discrepancies relied on experience, but this experience was not being shared with newer HCWs. There was a lack of mentorship and standardization because HCWs are often isolated from each other and "*rarely see anybody . . . one person comes in, the next person goes out*" (W3). E2 speculated on a future where workers could be connected and share their experiences with each other:

> "*I would definitely love to see home care workers on the same page so they can teach others. If there's a standard, new people in the industry have something to look up to . . . Someone who's been doing it longer can say, 'Hey, this is what it's supposed to look like.'*"

The alienation of workers from each other also made it difficult for HCWs to identify and act on systemic issues. E3 noted that it was only through multiple workers bringing up similar issues that the partner organization was able to "*do a deeper dive into it and . . . see that there [was] something wrong*." However, the organizers reported that the workers were hesitant to share sensitive information like their pay stub when asking for help because, as E2 put it, "*it's hard to give people that kind of trust*." If they were able to share this information, they could build a better legal case that would be more appealing for an attorney to take on. E4 believed that "*if the employer knew the employees had the ability to keep precise records, it would lead them to comply with the law much more to avoid being sued*."

Added Workload and Burden. Identifying and preventing wage theft added extra work for the HCWs who already "*have a lot going on in their lives*" (E4) and just wanted to do their job to take care of their clients. Several HCWs reported the onus of handling wage issues was put on the workers. W2 was so frustrated with the fight for her wages that she submitted an extra paper timesheet in addition to her regular reporting channels "*to cover [her] ass*" (W2). Moreover, she had to do extra work to handle the ramifications of not being paid, like getting an extension for her phone bill for an extra 72 hours.

The technological systems HCWs have to use also added more burden. W1 shared how needing to make records using technology distracted her from "*trying to remember the many things [needed] to give good care to the person in front of you*." Many workers had to put in extra work to learn how to use the applications in the first place. E3 noted that "*older [HCWs] always have a harder time dealing with the technology*." Additionally, workers had to handle and prevent issues that arose from

application constraints. For example, W2 mentioned how she had to clock out and clock back in at midnight because her application was unable to handle the change in date. Additionally, she mentioned that even though she spent 24 hours giving care to her client, she was only able to get paid for 16 hours, potentially because, as E2 speculated, Medicaid will only cover a certain number of hours of care a week for a client. W2 was frustrated that her employer asked her to "*doctor the books*" and only report 16 hours worked because she felt that she had done her job of taking care of the client and it was her employer's job to handle the book work.

Limitations to Recourse. HCWs often felt limited in what they were able to do to change their circumstances around wage issues. One of the factors limiting their options was the strong emotional bonds HCWs formed with their clients. Their sense of responsibility meant that they were willing to "*take the loss*" for their "*passion work*" (E2). They wanted to ensure the client's well-being, regardless of pay and were less likely to scrutinize their paystubs. As E2 described:

> "*With my experience with home care, . . . clients become family and stuff like that. You get paid. If it remotely looks right . . . it's not a discussion. It's like, 'Oh, I got paid.'*"

Additionally, HCWs felt trapped because they worried raising wage issues with their employers would endanger their relationship with their clients. W1 explained that if HCWs who wanted to continue working with a client would have to convince the client to change agencies. This led to additional overhead to changing agencies and increased hesitancy to speaking up.

Furthermore, the interviewees also spoke about HCWs' options were limited because they were disadvantaged and disrespected by the larger system. E4 noted how the legal system was failing the workers because ultimately "*there's really only a few claims that are available under the wage and hour law.*" Additionally, the workers raised the concern that even if they were paid their full wages, they still felt unappreciated. W2 noted that home care was saving insurance thousands of dollars in medical costs and resources throughout the COVID pandemic, but HCWs were not paid or acknowledged for their efforts.

> "*I got no recognition at all, no thank you for working through the pandemic to keep my dad out of the hospital, nothing. I still get minimum wage—my granddaughter that works at a burger place makes more than I do and I take care of a whole person. . . . I'm not 16, I am 62 years old and I am running a household.*"

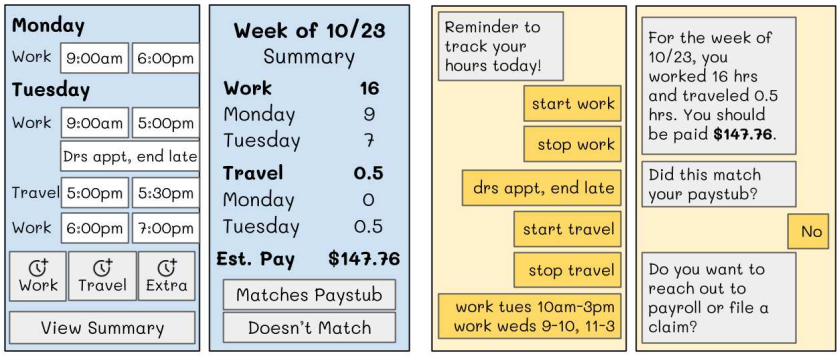
4 PHASE II: EXPLORING TECHNOLOGY ROLES IN ADDRESSING WAGE THEFT

The interviews in Phase I discussed the issues associated with wage theft, including difficult processes, isolation, and limited options. In the second phase of the study, we synthesized these interviews and developed design provocations to generate group conversations around potential future roles technology could take on in broader efforts to address wage theft. We designed seven provocations around how technology could be used to identify wage theft and act on wage information. Then, we presented these provocations in five focus groups with experts and workers to evoke discussions around some of the key questions about reducing burdens, leveraging group power, and establishing trust that arose from the interviews.

4.1 Design Provocations

4.1.1 Approach. Prior work in HCI and CSCW has used technology probes and provocations [16] to propose potential futures and explore participant reactions to them, including in healthcare settings with home health aides [107] and resident physicians [11]. This method has been used with other marginalized health workers, like community health workers [85], to understand local culture and experience [112]. We selected this method to give participants the opportunity to react to concrete examples and reduce the cognitive load of "blue sky" ideation [45]. Additionally, we

Fig. 2. Design provocations of separate, smartphone-based systems for identifying wage theft



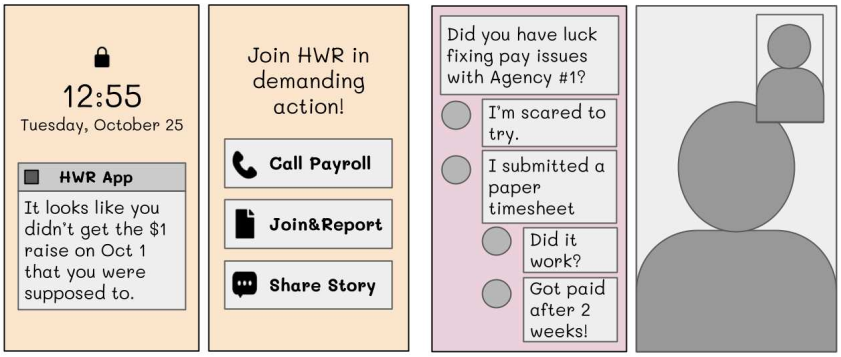
(a) Form-based tracking with weekly summary (b) Conversation-based tracking with reminders)

(c) Timer-based tracking with tax breakdown) (d) Screenshot/file upload-based tracking

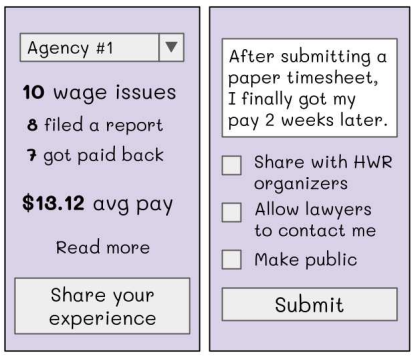
provided the opportunity for participants to generate new ideas without design fixation by using low-fidelity wireframes [54]. We focused on the design of smartphone-based systems to allow participants to be familiar with the basic application interactions and focus on the new ideas.

4.1.2 Areas of Concern. As we found in through the interviews (Section 3.2.2), there were two main parts to the current approaches to addressing wage theft: verifying hours and reporting and escalating. These reflect and extend prior work, including the Dombrowski et al. [32]'s main sociotechnical practices low-wage workers engage in to address wage theft (i.e., identifying wage and payment discrepancies, tracking and documenting work, and pursuing wage claims), Wolf et al. [111]'s main features of the wage theft computing interventions (i.e., track and document work hours; educate on workers' rights; and/or submit wage claims), and Li et al. [64]'s stages of tracking (i.e., preparation, collection, integration, reflection, and action). Therefore, we designed around these two main areas of concern. First, we wanted to explore different ways technology could help HCWs identify wage theft by tracking their working hours and travel time as well as simplifying the process of calculating and comparing their estimated wages with their actual wages (Figure 2). Second, we designed three different provocations that could give the workers confidence to resolve the issues on their own as well as encourage others to do the same so that the prevalence of wage theft would decrease (Figure 3).

Fig. 3. Designs of separate, smartphone-based provocations for acting on wage discrepancies



(a) Alerts of issues and potential actions (b) Sharing experiences in a community forum



(c) Summary of issues for given employer

4.1.3 Design Questions. We hoped to design provocations that would more deeply explore the following key questions that arose from our interviews and prior work.

Minimizing Additional Workload. One key question we focused on was: "How might we design processes for workers to identify wage theft while minimally increasing their workload?" As many participants mentioned, HCWs already "*have a lot going on in their lives*" (E4) and just wanted to do their job of taking care of their client. We wanted to avoid cases of low adoption due to a mismatch between the proposed design and workers' routines, or "*practice misalignment*," [111] and, instead, design something that can be seamlessly integrated into the workers' day-to-day. We also wanted to have a range of options to account for the varying lived experiences of the workers (i.e., different clients, agencies, and job roles) and levels of tech literacy and accessibility.

In order to spark conversation about the workload of wage theft tracking options, we presented four different types of input methods. In the blue design (Figure 3(a)), workers would enter work and travel time sessions into a form, and receive a weekly summary of their total work hours and estimated pay. This design draws from basic online wage calculators [3], but accounts for the home care context of working multiple shifts per day with travel time in-between. As participants reported in the interviews, some older HCWs had low digital literacy. We leveraged findings from systems designed to be accessible to communities with low digital literacy, like SMS-based

mHealth medication reminders [13], in the yellow design (Figure 3(b)). Workers would receive a text reminder and be able to use unstructured, conversational language to report their hours and be walked through the verification process. Building on the start/stop mechanisms many HCWs were already using in employer-mandated time-tracking apps, the green design (Figure 3(c)) used a stopwatch-style input (similar to the Department of Labor's app [8] and WeClock [9]). However, we also added a breakdown of potential tax withholdings in the wage summary (similar to ADP's online calculator [6]) to address concerns about the confusing setup of paystubs. Finally, as the HCWs reported that they were already taking screenshots of their time-tracking applications, the red design included an option for workers to upload these screenshots or take photos of their physical timesheets and paystubs, inspired by paper-to-digital pipelines like ODK Scan [30]). To increase transparency, the design also incorporated tracking the progress of the workers' actions to address wage theft, an element drawn from Marathe et al. [66]'s guidance on designing grievance redressal systems for citizens making reports of governmental failures.

To evaluate the added workload of these wage tracking methods, we asked the participants to compare and contrast the designs as well as suggest any additional methods that were not presented (i.e., automatic location tracking, voice input). Moreover, during the comparison of these methods, we discussed modalities (i.e., paper or digital) and how frequently they would use these systems (i.e., per shift, per pay period). We also presented participants with options of how much information they would want to track (i.e., additional notes or expenses) to identify exactly what information was the most useful for the workers to minimize extraneous effort.

Bottom-Up Accountability. Another key question was: "How might we leverage the strength of the group to discourage employers from taking advantage of their workers?" Combining the participant concerns that HCWs "*rarely see anybody*" (W3) and that the workers' isolation from each other would make it hard to collectively hold employers "*accountable*" (E3), we wanted to explore how the aggregated strength of workers could increase the "*costs of a violation*" [58] so that employers are incentivized to change. Prior work has explored the strengths of the camaraderie of home care workers [75] and the potential for technology-mediated building of community [88].

We explored these ideas of collective action further through different approaches to alleviate the isolation workers faced, so they could work together to change their circumstances. In the orange design (Figure 4(a)), workers were shown a wage-related alert and asked to elaborate on what other alerts might be helpful. Then, they were presented with a list of different follow-up actions, including calling their agency or sharing their story, in order for us to probe the actions they would be open to pursuing. Additionally, we were interested in learning about any concerns or past experiences workers had connecting with others as a group or one-on-one. The pink design (Figure 4(b)) presented an option for workers to connect with each others in a forum-like setting and follow-up with specific people via video chat (inspired by Facebook Groups for specific types of workers and support groups for HCWs [88]). Lastly, we were interested in learning more about what type of information workers would be willing to share and see. This was implemented in the purple design (Figure 4(c)), which showed an aggregation of statistics about wage issues in order for workers to see others' experiences (inspired by rating systems like Turkopticon [50]).

Our designs explore different ways technology could mediate this collective action (i.e., collecting statistics, identifying common concerns, facilitating connections, guiding to specific forms of action). Moreover, they reflect the tenets of the social identity model of collective action, one of the theories of motivation for individuals to engage in collective action [109]. The design provocations aimed to increase awareness of wage issues and "*perceived injustice*" (i.e., alerts in Figure 4(a), group discussions in Figure 4(b) and 4(c)). Moreover, the group discussions also helped build "*social identity*" together, exchanging experiences and building a unified voice through shared concerns.

Table 2. Participant self-reported demographics for focus groups in Phase II (including group, job role/position, gender, race/ethnicity, education level, and years of experience)

Group	ID	Position	Gender	Race/Ethnicity	Education Level	Years of Exp.
1	E1*	Organizer	Woman	White or Caucasian	Graduated from College	15
	E2*	Organizer	Woman	Black or African American	Some college	5
	E3*	Organizer	Woman	Black or African American	Some College	6
2	W5	HHA	Woman	Black or African American	Some college	30+
	W6	PCA	Woman	Black or African American	Some college	30+
	W7	PCA	Woman	Black or African American	Some college	10+
3	W8	HHA	Woman	Black or African American	Some college	35+
	W9	PCA	Woman	Black or African American	Associate's degree	30+
4	W2*	PCA	Woman	White or Caucasian	Some college	25+
	W10	PCA/HHA	Woman	Hispanic or Latinx	Some high school	5
5	W1*	Retired HHA	Woman	Hispanic or Latinx	Master's degree	40

* Also participated in Phase I individual interviews

Finally, there were also features to present the "*efficacy*" of acting on wage theft (i.e., statistics of successful resolutions for each agency in Figure 4(c), testimonies to how others have resolved their issues in Figure 4(b)).

Trust and Privacy. Finally, we wanted to explore the question of: "How might we establish trust when dealing with issues as sensitive as wages?" E2 noted that as an organizer, it was difficult to build enough trust for a worker to hand over their paystub. However, many interviewees did express the potential for the power of data and experience shared across the broader community of home care workers. Thus, we wanted to explore the expectations they had for the flow of their personal information [82] and establish what information the workers want to share and with whom as well as any potential implications of the tracking.

In order to investigate the workers' expectations for information-sharing, we used Figure 4(c) as a springboard to discuss different levels of disclosure to other stakeholders (i.e., other HCWs, the partner organization, lawyers, the broader public) of different types of information (i.e., aggregate wage statistics, experiences resolving issues). We also investigated the workers' perceptions of the trust of potential technological tools by discussing the potential implications of different interactions (i.e., location tracking in Figure 3(c), uploading information in Figure 3(d), conversing with a chatbot in Figure 3(b)).

4.2 Focus Groups

Participants. In total, we had 11 participants (8 workers (W) and three experts (E)) in our five focus groups. All of the participants were based in Upstate New York in the United States Most groups had two to three participants, except for one that had only one participant due to last minute cancellations. Workers were recruited through the partner organization and included home health aides and personal care aides. These workers were not union-affiliated and were agency-employed. We invited all of the participants who had participated in the individual interviews to join these focus groups and expand on our conversations and E1, E2, E3, W1, and W2 were available and willing to do so. While in most groups the participants did not know each other previously, they were aware that they had each participated in training sessions and monthly meetings with the partner organization. More information can be found in Table 2.

Procedure. We used focus groups to elicit varied perspectives on the topic as well as learn from the way the participants interacted with each other [78]. The focus groups occurred remotely over Zoom and lasted for approximately 60-90 minutes. The groups were facilitated by one researcher with another present taking notes and adding additional questions at the end. Before the focus groups, participants were asked to read the informed consent and fill out a survey regarding their demographics. During the focus groups, participants were asked to share their own experiences, respond to the design provocations, and discuss any potential challenges. At the end of the focus group, participants were each reimbursed with a USD$20 gift card, an amount not considered coercive by the IRB.

The first 5-10 minutes were spent introducing the participants to the project and to each other. The next 20-40 minutes was spent discussing the four provocations related to identifying wage theft (Figure 2). We showed the participants each of the provocations as a slideshow using Zoom screen-sharing, asking them to share their reactions and answer some design-specific questions (e.g., for Figure 3(a), how often would you be tracking?). Then, the participants were asked to compare the different designs, suggest potential combinations of features, explore what using the technology in their day-to-day might look like, and discuss higher-level questions (e.g., sensitivity of information). In the next 20-40 minutes, we discussed the three designs related to using technology for acting on wage discrepancies (Figure 3), using a similar process. Finally, in the last 5-10 minutes, participants gave reflections on the process or general feedback.

Analysis. We utilized an adaptation of constant comparison analysis specifically for focus group discussions [34] to examine the transcriptions of the groups, focusing on the topics that were brought up as well as the interactions between the participants. In the open coding stage, we built upon the codebook of 106 codes generated from the analysis of Phase I. We used 84 of the original codes and added 38 new codes as they arose (e.g., "*wanting the information to be presentable*," "*worrying about knowing what to say*"). Each of the focus groups was coded by two of the three coders (one of whom was the first author). In axial coding, we grouped the codes into 12 categories (e.g., "*support/guidance*," "*simplicity/directness*," "*sharing info/helping others*"). Finally, in selective coding, we selected five larger themes to describe the categories that we present in the findings.

4.3 Findings

The experts and workers discussed the potential for technology to play a role in addressing wage theft for HCWs. However, the participants balanced the futures the provocations presented with concerns they had around the features and technology in general. They spoke about how the proposed futures could help them gain and share more knowledge and power, but were cautious about how this knowledge and power should be used. Moreover, they were excited that the technology could help them reduce complexity in identifying and acting on wage theft, but were concerned about how much additional burden doing so might add to their day-to-day. The participants saw the potential for technology to simplify the existing wage processes, but wanted for it to do so in a way that accommodated the heterogeneity of their experiences. Ultimately, the participants raised the importance of ensuring the difficulty of transitioning to a new technological system would be worth it and proposed different features that would guide HCWs to reduce the cost to adopting a new technology.

Knowledge as Power. The participants recognized the potential for technology to help them gain more knowledge about their work and their worth. Participants expressed that the different input methods for tracking in Figure 2 would give them access to legible information and could empower

them to prevent wage theft. Moreover, W1 said features like the weekly summaries in Figures 3(a) and 3(c) would allow workers to "*see the value of [their] own work and be able to represent the value of [their] own work*" to current or future employers to advocate for their wages. Additionally, features that aggregated data across the group of workers, such as the summary of wage infractions per employer in Figure 4(c), could help shift the tide by giving the workers and organizers more information. Even during the focus groups, W8 and W9 exchanged stories about the challenges they had with a shared employer.

The participants discussed at length how individual and aggregated information about employers could best be used. Some wanted to follow the "*chain of command*" (W1 and W9). But W2 noted that she was having trouble getting heard by her agency, saying "*it's getting to the point where my agency refuses to talk to me about my wages.*" Others like W8 also faced difficulty when reaching out to her agency, saying "*they act as though it's so difficult and hard for them . . . to help us.*" Thus, many spoke about using the information among themselves. W6 felt that "*these agencies need to be put on blast*" and sharing information through forums like Figures 4(b) and 4(c) would warn other HCWs of the potential issues. Even though W1 felt that giving HCWs more information could make the employers more accountable to their workers to stay competitive in the market, she warned against being too punitive, saying "*you really shouldn't be sharing the story to try to cancel your employer, because that's just going to come back on you.*"

Group Exchanges and Issues. The participants were excited about the provocation that enabled workers to connect with each other through an online forum or video call (Figure 4(b)) or through reporting their experiences with a specific agency (Figure 4(c)). W1 pointed out the importance of the technology because it would "*give people who are disconnected from group representation . . . support and education.*" Despite the challenges in building community, the participants appreciated the potential sense of camaraderie among HCWs and hoped to make sure their challenges did not befall anyone else. W6 especially liked the phrasing of "Share your experience" in Figure 4(c), saying "*maybe someone else is going through the same thing you are.*"

The groups discussed examples demonstrating the benefit of connecting isolated HCWs with each other using technology. The focus groups themselves served as a forum for HCWs to exchange experiences and support each other in their endeavors. For example, when W8 was confused about when her raise would go into effect, W9 told her when it should have started and instructed her on how to call her employer and escalate the issue. Additionally, the participants spoke about their own experiences with online groups that were managed by the partner organization for HCWs. They spoke about a monthly Zoom gathering where caregivers and organizers discussed "*different things that are going on, like has everyone gotten their raise*" (W8) as well as a WhatsApp discussion group for HCWs to stay connected after the meeting. W9 really appreciated these chats, saying that "*we get a lot of information and some things that we don't know that other people know.*" She even found private duty jobs on the WhatsApp group.

The participants had different ideas for how the technology-enabled group spaces would look. Between the group forum and individual video chat options in Figure 4(b), some preferred direct connections while others wanted to "*get more input, more advice from different people*" (W7). E1, who organized the WhatsApp group, felt that a smaller group size would balance the depth of connection and breadth of knowledge as well as alleviate some of the challenges they faced regarding low and hesitant engagement. She also proposed more planning and moderation from the organizers, attributing the lack of activity to the fact that "*people didn't know what to do with that group . . . the organizers themselves in each of the groups didn't know.*" Another concern around engagement was the mode of communication. Some of the HCWs were not aware of the WhatsApp group because they did not themselves use WhatsApp. Others discussed the merits of meeting wider audiences

online versus using technology to organize meetings that were face-to-face after the social isolation due to the pandemic.

Speaking Up Cautiously. Another concern participants had around group interactions was how their contributions would be perceived and used by other group members. W10 noted she felt uncomfortable in group settings such as the monthly Zoom meeting because she "*might not know what to say*"—worried her words might be misconstrued and cause offense to the others in the group. W7 emphasized the importance of having the option for anonymity when talking about the possibility of workers posting about their experiences with a specific agency in Figures 4(b) and 4(c). E2 was "*pessimistic*" that HCWs might tell on each other to their clients or agencies. Others spoke of ways employers could retaliate if they knew which individual workers had spoken up against them. The participants discussed different examples of "*backlash*" (W6) or "*jeopardy*" (W5) they might face if they spoke out publicly, including losing their job (W6) or making clients who want to continue being cared for by them switch agencies (W7). E1 said it was possible that workers who diligently track and ask for travel time may be "*taken off cases that are farther away [and those cases] given to somebody who doesn't track their hours.*"

However, others saw the group as a way to collect their voices and speak up together in a way that was more protected. E1 supported the idea of having a "Join and Report" button in Figure 4(a) because it meant the workers would join together to act and were thus "*protected with collective action . . . if people are standing up by themselves, it's always a little more concerning.*" W10 pointed to an experience where she felt less alone during a group lawsuit against a previous employer:

> "*It was so many brains going against them and so many people going against them that action was taken. If it was just me or another person by ourselves, it would have been way harder for actions to get taken care of.*"

Overall, the participants saw the options to band together and speak up as potentially positive for the HCWs. W7 discussed the potentials for the "Share Story" button in Figure 4(a) or "Make public" option in Figure 4(c) to raise consciousness of wage issues for HCWs and create change:

> "*I believe that this is something that will benefit us all . . . we can find out . . . why we're not being paid properly and the reason for so many mishaps and issues when it comes to pay for home health care workers . . . Something is bound to arise when you take things in this nature to a public setting. it awakens a lot more people that's been asleep.*"

Reducing or Increasing Complexity. The participants noted that technology could reduce the confusion currently associated with wage issues by taking on some of the complexity. As previously discussed, one of the difficulties of identifying wage theft is the lack of transparency around paystubs. W7 said that she was pleased by the delineation of the specific tax withholdings in Figure 3(c) because she "*want[ed] to know where the money is going . . . [to] compare and contrast and see exactly where they [the employers] are stealing money.*" However, E1 noted the complication that different people might have different "*garnishments*" taken in their taxes like child support. She noted that the "*backside*" (potentially referring to the backend) of the application would have to be able to sort through this complexity to maintain simplicity on the side of the worker.

Another area of complexity discussed was around being able to accommodate diverse employer experiences in a simple manner. With regards to a feature that might summarize information regarding specific employers (Figure 4(c)), E2 noted that there were "*so many agencies*" which was further complicated by the fact that "*they [(the agencies)] change names, people change agencies.*" She suggested making sure there was enough space for the different names beyond an extremely long list. Moreover, W8 noted that because she worked for four different companies, she preferred having the dropdown options to toggle between different agencies seen in Figure 3(c). Without

this option, she felt like "*would have to do everything all over again and would have to have different sheets for each one of the jobs.*"

Reducing the Cost of Transition. Noting that the realization of any of the futures presented by the provocations would require adoption of new technology-based processes, the participants brought up many concerns around the difficulty of making a transition between their existing paper processes to digital ones. One of the main concerns was around the digital literacy of HCWs. E1 mentioned that the HCWs she worked with often faced phone issues and that their information "*doesn't transfer from phone to phone . . . they'll sign up for a new email because they got a new phone.*" In discussing the possibility of realizing one of the futures presented by the provocations, W8 described her hesitance to try a new process due to her being used to the status quo:

> "*It's just maybe for someone now that's just starting out... but for us, I mean... We've been in it so long...We're conditioned in doing it how we do it.*"

W1 emphasized the importance of demonstrating a distinct improvement with the new future that would make the cost of transition worth it, saying that "*no, I'm not going to learn a new app for you unless I can see how it is really going to benefit me.*"

While some participants noted the importance of having marked differences in the new technological futures in order to make any switch worth it, others argued the importance of making sure the changes were less disruptive and closer to their current patterns. W2 expressed that Figure 3(c) "*seems more simpler*" because it matched how she was already clocking in and out of work. W10 liked the features in Figure 3(b), saying "*it would fit right in my day because I'm normally texting through the day.*" However, both W7 and W9 noted that the texting interactions in the examples presented by that provocation could be even simpler, saying they would "*use less words.*" W5 espoused the importance of simplicity of the few options seen in Figure 4(a) saying, "*sometimes extra stuff just complicate me.*" Other participants mentioned the importance of having things clear, "*uniformed and in place*" (W9), more organized (W2), and searchable (W10).

Another way of lowering the cost of transition was through guidance. Some believed the guidance should come in the form of training. Others saw the technology itself as guiding the workers through the process of identifying wage theft and acting on wage information. W1 saw the options presented by Figure 4(a) as "*giving you a schematic on most of the decision-making and how you're going to manage it.*" W7 felt that even with specified options in Figure 4(c), she still retained agency because "*it's up to your discretion which way you would like to go with it.*" The alerts in Figure 4(a) were also seen as a guiding intervention to make sure workers remember to clock out, check their paystubs, or use vacation. Others spoke about getting more directed and two-way guidance such as the option to "*call a coach*" (E2) and "*ask questions and stuff*" (W6) in Figure 4(a) and Figure 3(b).

5 DISCUSSION

Through the two phases of our study, we explored the relationship between wage theft and technology for HCWs, examining the context around wage theft and conversing about the potential roles of technology in addressing this problem (see Table 3 for a summary of the findings). As wage theft is a "*wicked problem*" that deeply intertwined with other societal problems [90], we discuss both the potential opportunities to leverage the strengths of information and communications technology (ICTs) to address specific aspects of wage theft and the potential challenges of impact, workload, and privacy in doing so (see Table 4 for a summary of opportunities and challenges). In this discussion, we also consider the limitations of our study and some of the changes need beyond technology to address the sociopolitical context that enables wage theft in the home care context.

Table 3. Summary of findings across the two phases of the study.

Phase Description	Findings
Phase I (Section 3) Individual interviews with 5 experts and 4 workers to understand the causes, current approaches, and challenges related to wage theft.	*3.2.1 Causes of Wage Theft.* Some see wage theft as caused by the conflation of human and technological error with the unique complexity, volatility, and diversity of home care work (**Human and System-Level Errors**). Others see it as a misalignment of incentives between the HCWs and their agencies (**Error or Ill-Intent?**).
	3.2.2 Current Approaches to Addressing Wage Theft. Currently, HCWs will keep track of their hours and calculate their expected pay, but sometimes their paystubs are not easily accessible or readable (**Verifying Hours**). After noting discrepancies in wages, HCWs will reach out to their agencies to resolve it or, in some rare cases where they are able to find and attract a lawyer, escalate to legal actions (**Reporting and Escalating**).
	5.2 Challenges and Concerns around Addressing Wage Theft. Addressing wage theft is difficult for HCWs because they are isolated from each other (**Divided and Conquered**), already overburdened beyond keeping an eye on their wages (**Added Workload and Burden**), and face limitations to what they can do (**Limitations to Recourse**).
Phase II (Section 4) Designing 7 provocations and exploring the role of technology in the fight against wage theft in 5 focus group interviews with 3 experts and 8 workers.	*4.1 Design Provocations* We designed 4 different types of input for hour tracking to identify wage theft (Figure 2) and 3 different ways HCWs could act on wage information (Figure 3), exploring questions around worker responsibility (**Minimizing Additional Workload**), collective action (**Bottom-Up Accountability**), and the sensitivity of the issue (**Trust and Privacy**).
	4.3 Findings. Technology had the promise of sharing and aggregating knowledge that could be used by HCWs to develop more confidence and agency (**Knowledge as Power**), and provide a way for workers to connect with each other and speak up with each other (**Group Exchanges and Issues**). However, the participants had different ideas of how this knowledge and power should be wielded, worrying about how it might lead to a cycle of retaliation (**Speaking Up Cautiously**). Considering the benefits of the potential technological futures, the participants also had concerns around the potential added heterogeneity across experiences (**Reducing or Increasing Complexity**) and steep cost of adopting new technology (**Reducing the Cost of Transition**).

5.1 Roles for Technology in Addressing Wage Theft

Our findings highlighted the key affordances of information and communication technologies (ICTs) that could be applied to supporting the larger fight against wage theft for HCWs at the employer and worker/advocate levels. First, we discuss the ability of ICTs to collect accurate and precise information in more robust time-tracking systems to serve both the employers as well as the workers and advocates. Then, we discuss the capability of ICTs to facilitate communication to promote transparency and solidarity across groups, contributing to the exchange of more open feedback to allow employers to address concerns in a timely manner or more tacit knowledge that can help workers act together. However, we acknowledge that these opportunities for leveraging technology would not address wage theft on their own and require careful consideration of additional sociopolitical forces.

Table 4. Summary of roles and challenges for technology design to address wage theft.

	Employer	Workers/Advocates
5.1 Roles		
5.1.1 Collecting & Analyzing Info	**Improving Time-Tracking** to have less errors and more accuracy, saving time/effort for workers/employers	**Aggregating Evidence** of wage violations and invisible work across the larger group of workers
5.1.2 Facilitating Communication	**Employer-Worker Feedback** for monitoring and acting on concerns to ensure worker well-being	**Communities of Practice** for exchanging experiences and building shared solidarity
5.2 Challenges		
5.2.1 Spreading the Workload	Incentivizing employers to take responsibility by identifying alignments with worker interests and promoting legislation that protects workers and enables employers to act	Spearheading solutions that fit existing practices/systems and reimagining the care system to improve worker conditions through more compensation and support
5.2.2 Avoiding Retaliation/Surveillance	Providing timely and necessary information for employers to not feel "*cancelled*," with restrictions that protect worker autonomy	Anonymity and quality of contributions through the numbers and worker control of their own data, adapted to fit the home care context
5.2.3 Collectively Maintaining Impact	Putting in checks through worker information, advocate enforcement, and protective legislation to ensure violations do not keep happening	Balancing individual/short-term and group/long-term goals through highlighting effectiveness, aligning incentives, and changing norms

5.1.1 Collecting and Analyzing Information. **Improving Time-Tracking.** At the moment, electronic visit verification (EVV) and other employer-mandated time-tracking technologies are unable to realize their highest potential in collecting information because they are unreliable. Improvements in the technology HCWs use to report their hours could reduce some of the errors that cause wage theft. Some of these errors, such as the system not being able to handle changeovers at 12:01 a.m. or the application recording the wrong time due to a break in connectivity, could be fixed by more robust architecture like offline syncing [35]. Other issues might require changes in worker behavior through intelligent nudges [20] or multisystem infrastructure [77] and integration with scheduling software. Many of the issues could be ameliorated by having the employers provide technological resources like phones or internet hotspots to ensure a uniform experience along with better training. Across all of the different human and system errors, having a more robust way of repairing information (i.e., addressing gaps [105] or maintaining systems [53]) could enable workers and their employers to track and report more accurately.

Aggregating Evidence. Additionally, these time-tracking technologies could expand beyond ensuring compliance for employers to gathering even more information that could empower workers. For example, comparing hours to wage information could help identify and establish proof of wage theft for individual workers, reflecting W9's emphasis on making the tracked information presentable to arbitrators. Additionally, analysis across more workers could identify trends of employer violations, similar to examples of technology as a "*diagnostic*" [10] of widespread injustice in literature [93, 110]. Examples of community self-survey [21] have demonstrated that aggregating information about employer missteps could potentially put pressure on employers to change their

actions by increasing the "*costs of a violation*" [58]. The organizers we interviewed spoke about how tracking of the specific conditions workers faced (i.e., staying late because of a doctors appointment) could more clearly establish both the paid and unpaid activities the workers engaged in, providing evidence for the invisible work that HCWs perform [74].

5.1.2 Facilitating Communication. **Employer-Worker Feedback.** Better communication could reduce errors and make the process of resolving errors more transparent. This communication could be extended to track and monitor wage issues to reduce the incidence of missing (i.e., W2 not being notified there was an issue with her timesheet) or laborious communication (i.e., E5 spending over an hour each day calling individual workers about timesheet issues). Literature on quantified workplaces [68] has shown that employers have incentives to implement such systems to monitor the health of their dispersed workforce, such as improving productivity [98] and worker well-being [106]. Doing so would also allow HCWs to check the progress of their concerns [66], building on systems that meaningfully disclose information to key stakeholders [83] and bridging the gaps in the partial knowledges of multiple stakeholders in large, sociotechnical systems [51].

Communities of Practice. In addition, technology could provide spaces for isolated HCWs to develop connections and share knowledge. Poon et al. [88] explored the potential for computer-mediated support groups for HCWs to serve as communities of practice [22] where workers could share some of the "*tacit knowledge*" [80] they developed. The online forums and video chats presented by our provocations could allow HCWs to exchange ideas on how they approached the shortcomings of the software (i.e., setting their own alarms as reminders to clock out) and communication processes with the employers (i.e., using email to have a paper trail). While the partner organization tried out Zoom meetings and WhatsApp groups as a means of fostering community, these could be more effective by utilizing more familiar platforms, having more directed conversations, or working in smaller groups, guided by unplatformed design of coordinating participation [59]. Moreover, Poon et al. [88] also noted the importance of communities of practice to build a shared narrative across alienated HCWs, which could then be activated as "*framing*" [41] for social movements and collective action [31].

5.2 Challenges in Technology Design for HCWs and Low-Wage Workers

While our findings pointed to the potential roles of technology in addressing wage theft, simply collecting information or facilitating the communication is not enough—there are challenges to how information can be collected and how communications may be received. Following up on the key questions highlighted in the design of the provocations, we discuss how our findings and recommendations relate to questions about minimizing workload, ensuring privacy in technological tools, and increasing accountability. We build on the discussion Wolf et al. [111] initiated about the structural challenges that surround technological interventions—how the technology fits into the day-to-day of individuals; the relational impacts of the technology on stakeholders; and the institutional and system-level changes that result from collective action.

5.2.1 Spreading the Workload. One of the questions we wanted to explore through the design provocations was: "How might we design processes for workers to identify wage theft while minimally increasing their workload?" On the individual/adoption level, one way of reducing burden for workers we explored was designing solutions that seamlessly integrated into the workers' day-to-day lives but did not contribute more invisible work to the already heavy burden HCWs face [75]. The workers were open to investing some time into learning new technology, especially if it matched the texting they already do every day, aligned with the start/stop they have to do for time-tracking applications already, or utilized the screenshots they already took on their

own. Future explorations could potentially even look into integration with existing time-tracking applications or passive location tracking in the background.

However, regardless of how tightly coupled these new technologies were, these solutions all required additional action from the worker. Thus, on the relational level, we encounter the problem Silberman and Irani [95] recounted in their implementation of the employer reputation system Turkopticon—the balance between "*independent*" systems that give the workers more control and responsibility versus "*integrated*" systems run by the employers who are in a better technical and organizational position. In cases where the worker and employer priorities are aligned, changes are appealing, because fixing errors could save time not only for workers but also for bookkepers like E5. However, in other cases, such as W2's situation where she said her agency would not even talk to her about her wages, it is not in the employer's interest to disturb the status quo.

Therefore, institution/macro level changes are required. Legislation could nudge employers to act on worker feedback or encourage software companies to fix errors in time-tracking applications [104]. However, as we saw through the delays in the recent wage increases in New York State, new legislation also requires careful consideration on how it would be enacted. With such considerations, additional structural-level changes could even address why HCWs are so overloaded and exploited in the first place—changing the broader system of care and better distributing the responsibilities of care across workers could provide better working and living conditions for the workers.

5.2.2 Avoiding Retaliation and Surveillance. While effective collective action requires sharing information with other HCWs and organizers, doing so also raises questions about how sensitive data is collected and handled, especially given questions around surveillance [70] and workers' data rights [26]. As we explored the question of: "How might we establish trust when dealing with issues as sensitive as wages?", we found that, on the individual level, workers were especially concerned about protecting themselves from employer retaliation. To counter this, two participants mentioned that aggregating the information could offer a layer of protection and develop trust, building on examples of "*information escrow*," employed by sexual harassment reporting applications [65] or k-anonymity [103] as seen in cases of worker incident reporting [46]. Another option would be to allow the HCWs to have more control over their own information, as seen in examples such as self-presentation [11] or data sovereignty [23].

On the relational level, there are questions of how information collected by technological solutions could be used by other stakeholders and how to prevent misuse of that information. One of the concerns brought up by the participants was whether the information might be incendiary. Creating feedback loops where the employer is informed in a timely and privacy-sensitive way, could help give them more opportunities to change their behavior and not feel as attacked. Additionally, having a third-party "*social audit*" [14] or other formalized verification processes of concerns raised by workers [65] could alleviate some of the potential blame on individual workers.

In addition to overt retaliation for individual negative feedback or nonaction on the concerns raised by workers, there is also the potential for unintended consequences on the institutional level [72]. While a worker-driven system could subvert the dynamic of compliance and collect more useful information by identifying violations or making the contributions of workers legible and visible [102], the visibility could also lead to surveillance and increased scrutiny of practices that were informally allowed [97]. Therefore, it is necessary to carefully assess what information is being shared, potentially through participatory mechanisms [76], as well as ensure there are legal measures to ensure minimum protection for worker autonomy.

5.2.3 Collectively Maintaining Impact. Another question our design provocations explored was: "How might we leverage the strength of the group to discourage employers from taking advantage of their workers?" On the individual and relational level, one of the challenges we faced was

the balance between short-term, individual outcomes and long-term, collective outcomes. Many interviewees expressed concerns about additional worker efforts due to lengthy legal processes and low chances of a payout in individual cases of wage theft. This dilemma of individual interests and collective action has long been discussed in social movement theory, noting the importance of highlighting the effectiveness of collective action [49], aligning individual interests with the group [19], and changing the social norms to encourage group action [29]. Some features of our design provocations explored the potential of documenting and communicating efficacy. However, institution-level changes beyond technology might be needed in order to increase incentives for workers, potentially by enable short-term payouts for workers to track wage theft.

Thus, another question that arises is how solutions can shift the sociopolitical context so wage theft does not continue to happen. On the individual level, one way of doing this is by creating an ecosystem that reduces information asymmetry, allowing workers to best act in their interests, like Amazon Mechanical Turk workers who check the reputation of a potential employer on Turkopticon before deciding whether to take the job [50]. However, there were challenges maintaining this impact when subsisting mainly on academic funding and resources. On the relational level, worker advocates may be able to gather support for systems like Turkopticon and use the data to "*predict instances of misbehavior*" to employers accountable, similar to how data from sexual harassment applications are being used for perpetrators [65]. Moreover, on the institutional level, these predictions might be able to highlight patterns of misbehavior that advocates could propose legislation against, such as prohibiting obscure language and calculations on paystubs. In all of these cases, the technology can help aggregate the data that underpins the initial shifts, but additional efforts are required to maintain the potential impact.

5.3 Limitations and Future Work

Our research is just the beginning of further, in-depth explorations of technology as a part of efforts opposing wage theft. Working with the partner organization helped us ground our exploration in a tangible, actionable manner that leverages the foundation the organization has built. But, like all qualitative research, our study focused on a small sample size with specific characteristics. The workers were all fairly involved with the partner organization, which meant that they were likely better connected and less isolated than most HCWs. Moreover, the partner organization was focused on certain areas in Upstate New York, United States (i.e., Rochester, Buffalo), which meant these workers were all subject to New York State laws (i.e., the recent wage increase [81]) but faced different challenges from other workers downstate and in New York City [55]. Many were more experienced in their field, with 7 out of 10 workers having 25+ years of experience, meaning they had witnessed a lot of change in the industry but also were much more accustomed to the status quo. Future studies are needed to understand how the findings may apply to HCWs from a variety of employment arrangements (i.e., agency employed, unionized) and across a number of states given the state-level variation in wages in wage policy.

However, our work has the potential for real-world implications. Our detailed accounting of the homecare-specific issues (i.e., last minute changes to schedules) could lead to explorations of how new processes could account for these issues by home care agencies, software developers for time-tracking applications, and advocates for HCWs. Additionally, our findings could also have implications and inspire more research on larger questions about wage theft and employer accountability for other frontline health workers and low-wage workers. Future work could explore how specific software features could account for these issues and understand how they apply to other contexts as well.

6 CONCLUSION

Through foundational interviews, we identified some of the causes, current practices, and challenges in addressing wage theft in the home care context. This allowed us to not only further understand of how technology could exacerbate the sociopolitical impacts of wage theft, but also guide us in developing design provocations that utilize technology to help mitigate some of these impacts—empowering HCWs collectively through aggregated knowledge, experience, and power. Finally, we also contribute discussion around important considerations of how to thoughtfully design technology that respects workers' time and experience as well as pushes for the most impactful change. While we note that technology would not be able to eradicate wage theft on its own, these findings can help designers develop technology that can reduce error, enable transparency, share narratives, and enforce accountability to contribute to broader efforts. We hope that our research will be able to enact tangible change for our partner organization and influence future technologies for other essential but vulnerable frontline health workers and low-wage workers.

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REFERENCES

[1] 2015. Federal minimum wage & overtime protections for home care workers. https://s27147.pcdn.co/wp-content/uploads/NELP-Fact-Sheet-Companionship-Rules-Reform.pdf.
[2] 2015. Independent Living Centers. http://www.acces.nysed.gov/vr/independent-living-centers. Accessed: 2022-12-13.
[3] 2019. Free Time Card Calculator. https://www.redcort.com/free-timecard-calculator. Accessed: 2022-12-13.
[4] 2022. Electronic Visit Verification (EVV) Resource Library. https://www.health.ny.gov/health_care/medicaid/redesign/evv/faqs.htm. Accessed: 2022-12-13.
[5] 2022. Harvest: Time Tracking Software With Invoicing. https://www.getharvest.com/. Accessed: 2022-12-13.
[6] 2022. Hourly Paycheck Calculator. https://www.adp.com/resources/tools/calculators/hourly-paycheck-calculator.aspx. Accessed: 2022-12-13.
[7] 2022. Toggl: Time Tracking Software, Project Planning & Hiring Tools. https://toggl.com/. Accessed: 2022-12-13.
[8] 2022. Track Your Hours: Just Tap the App. https://www.dol.gov/agencies/whd/timesheet-app. Accessed: 2022-12-13.
[9] 2022. WeClock. https://weclock.it/. Accessed: 2022-12-13.
[10] Rediet Abebe, Solon Barocas, Jon Kleinberg, Karen Levy, Manish Raghavan, and David G Robinson. 2020. Roles for computing in social change. In *Proceedings of the 2020 Conference on Fairness, Accountability, and Transparency* (Barcelona, Spain) *(FAT* '20)*. Association for Computing Machinery, New York, NY, USA, 252–260.
[11] Daniel A Adler, Emily Tseng, Khatiya C Moon, John Q Young, John M Kane, Emanuel Moss, David C Mohr, and Tanzeem Choudhury. 2022. Burnout and the Quantified Workplace: Tensions around Personal Sensing Interventions for Stress in Resident Physicians. *Proc. ACM Hum.-Comput. Interact.* 6, CSCW2 (Nov. 2022), 1–48.
[12] Alexander and Prasad. 2014. Bottom-up workplace law enforcement: An empirical analysis. *Ind. LJ* (2014).
[13] H Anglada-Martinez, G Riu-Viladoms, M Martin-Conde, M Rovira-Illamola, J M Sotoca-Momblona, and C Codina-Jane. 2015. Does mHealth increase adherence to medication? Results of a systematic review. *Int. J. Clin. Pract.* 69, 1 (Jan. 2015), 9–32.
[14] Laurie Berg, Bassina Farbenblum, and Angela Kintominas. 2020. Addressing Exploitation in Supply Chains: Is Technology a Game Changer for Worker Voice? (April 2020).
[15] Annette Bernhardt, Diana Polson, and James DeFilippis. 2010. *Working Without Laws: A Survey of Employment and Labor Law Violations in New York City.* Technical Report. National Employment Law Project.
[16] Kirsten Boehner, Janet Vertesi, Phoebe Sengers, and Paul Dourish. 2007. How HCI interprets the probes. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (San Jose, California, USA) *(CHI '07)*. Association for Computing Machinery, New York, NY, USA, 1077–1086.
[17] Claus Bossen and Martin Foss. 2016. The Collaborative work of Hospital Porters: Accountability, Visibility and Configurations of Work. In *Proceedings of the 19th ACM Conference on Computer-Supported Cooperative Work & Social Computing* (San Francisco, California, USA) *(CSCW '16)*. Association for Computing Machinery, New York, NY, USA, 965–979.

[18] V Braun and V Clarke. 2006. Using thematic analysis in psychology. *Qual. Res. Psychol.* (2006).

[19] Jason Brennan, William English, John Hasnas, and Peter Jaworski. 2021. The Effect of Incentives: The Problem of Collective Action. (Aug. 2021).

[20] R N Brewer, M R Morris, and S E Lindley. 2017. How to Remember What to Remember: Exploring Possibilities for Digital Reminder Systems. *Proc. ACM Interact. Mob. Wearable Ubiquitous Technol.* 1, 3 (Sept. 2017), 1–20.

[21] Leonard Broom, Margot Haas Wormser, and Claire Selltiz. 1952. How to conduct a community self-survey of civil rights. *Am. Sociol. Rev.* 17, 3 (June 1952), 381.

[22] John Seely Brown and Paul Duguid. 1991. Organizational Learning and Communities-of-Practice: Toward a Unified View of Working, Learning, and Innovation. *Organization Science* 2, 1 (Feb. 1991), 40–57.

[23] Stephanie Russo Carroll, Ibrahim Garba, Oscar L Figueroa-Rodríguez, Jarita Holbrook, Raymond Lovett, Simeon Materechera, Mark Parsons, Kay Raseroka, Desi Rodriguez-Lonebear, Robyn Rowe, Rodrigo Sara, Jennifer D Walker, Jane Anderson, and Maui Hudson. 2020. The CARE principles for indigenous data governance. *Data Sci. J.* 19 (Nov. 2020).

[24] Edward T Chambers and Michael A Cowan. 2003. *Roots for Radicals: Organizing for Power, Action, and Justice* (first edition ed.). Continuum International Publishing Group, 15 East 26th Street, New York, NY 10010.

[25] Kathy Charmaz. 2011. Grounded Theory Methods in Social Justice Research. In *The SAGE Handbook of Qualitative Research*, Norman K Denzin Yvonna (Ed.). SAGE Publications, 359–380.

[26] Christina J Colclough. 2022. Righting the Wrong: Putting Workers' Data Rights Firmly on the Table. In *Digital Work in the Planetary Market*, Mark Graham and Fabian Ferrari (Eds.). The MIT Press, 291.

[27] Caitlin Connolly. 2016. Home Care Workers Call for End to Wage Theft. https://www.nelp.org/blog/home-care-workers-call-for-end-to-wage-theft/. Accessed: 2022-10-24.

[28] Sasha Costanza-Chock. 2020. *Design Justice: Community-Led Practices to Build the Worlds We Need (Information Policy)*. The MIT Press.

[29] Matthew A Crenson. 1987. The Private Stake in Public Goods: Overcoming the Illogic of Collective Action. *Policy Sci.* 20, 3 (1987), 259–276.

[30] Nicola Dell, Jessica Crawford, Nathan Breit, Timóteo Chaluco, Aida Coelho, Joseph McCord, and Gaetano Borriello. 2013. Integrating ODK Scan into the community health worker supply chain in Mozambique. In *Proceedings of the Sixth International Conference on Information and Communication Technologies and Development: Full Papers - Volume 1* (Cape Town, South Africa) *(ICTD '13)*. Association for Computing Machinery, New York, NY, USA, 228–237.

[31] Jill P Dimond, Michaelanne Dye, Daphne Larose, and Amy S Bruckman. 2013. Hollaback! the role of storytelling online in a social movement organization. In *Proceedings of the 2013 conference on Computer supported cooperative work* (San Antonio, Texas, USA) *(CSCW '13)*. Association for Computing Machinery, New York, NY, USA, 477–490.

[32] Lynn Dombrowski, Adriana Alvarado Garcia, and Jessica Despard. 2017. Low-Wage Precarious Workers' Sociotechnical Practices Working Towards Addressing Wage Theft. In *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems*. Association for Computing Machinery, New York, NY, USA, 4585–4598.

[33] Lynn Dombrowski, Ellie Harmon, and Sarah Fox. 2016. Social Justice-Oriented Interaction Design: Outlining Key Design Strategies and Commitments. In *Proceedings of the 2016 ACM Conference on Designing Interactive Systems* (Brisbane, QLD, Australia) *(DIS '16)*. Association for Computing Machinery, New York, NY, USA, 656–671.

[34] Owen Doody, Eamonn Slevin, and Laurence Taggart. 2013. Focus group interviews part 3: analysis. *Br. J. Nurs.* 22, 5 (2013), 266–269.

[35] Jörg Dörflinger and Tom Gross. 2010. Bottom billion architecture: an extensible software architecture for ICT access in the rural developing world. In *Proceedings of the 4th ACM/IEEE International Conference on Information and Communication Technologies and Development* (London, United Kingdom) *(ICTD '10, Article 9)*. Association for Computing Machinery, New York, NY, USA, 1–10.

[36] Silvia Federici. 2004. *Caliban and the Witch: Women, the Body, and Primitive Accumulation.* Autonomedia.

[37] Sarah E Fox, Vera Khovanskaya, Clara Crivellaro, Niloufar Salehi, Lynn Dombrowski, Chinmay Kulkarni, Lilly Irani, and Jodi Forlizzi. 2020. Worker-Centered Design: Expanding HCI Methods for Supporting Labor. In *Extended Abstracts of the 2020 CHI Conference on Human Factors in Computing Systems* (Honolulu, HI, USA) *(CHI EA '20)*. Association for Computing Machinery, New York, NY, USA, 1–8.

[38] Emily Franzosa, Emma K Tsui, and Sherry Baron. 2019. "Who's Caring for Us?": Understanding and Addressing the Effects of Emotional Labor on Home Health Aides' Well-being. *Gerontologist* 59, 6 (Nov. 2019), 1055–1064.

[39] Emily Franzosa, Tamar Wyte-Lake, Emma K Tsui, Jennifer M Reckrey, and Madeline R Sterling. 2022. Essential but Excluded: Building Disaster Preparedness Capacity for Home Health Care Workers and Home Care Agencies. *J. Am. Med. Dir. Assoc.* 23, 12 (Dec. 2022), 1990–1996.

[40] Evelyn Nakano Glenn. 2010. *Forced to Care: Coercion and Caregiving in America.* Harvard University Press.

[41] Erving Goffman. 1974. Frame analysis: An essay on the organization of experience. 586 (1974).

[42] Judith Gregory. 2003. Scandinavian approaches to participatory design. *International Journal of Engineering Education* 19, 1 (2003), 62–74.
[43] Lourdes R Guerrero, Ariel C Avgar, Erica Phillips, and Madeline R Sterling. 2020. They are Essential Workers Now, and Should Continue to Be: Social Workers and Home Health Care Workers during COVID-19 and Beyond. *J. Gerontol. Soc. Work* 63, 6-7 (June 2020), 574–576.
[44] Ellie Harmon, Matthias Korn, and Amy Voida. 2017. Supporting Everyday Philanthropy: Care Work In Situ and at Scale. In *Proceedings of the 2017 ACM Conference on Computer Supported Cooperative Work and Social Computing* (Portland, Oregon, USA) *(CSCW '17)*. Association for Computing Machinery, New York, NY, USA, 1631–1645.
[45] Christina Harrington, Sheena Erete, and Anne Marie Piper. 2019. Deconstructing community-based collaborative design: Towards more equitable participatory design engagements. *Proc. ACM Hum.-Comput. Interact.* 3, CSCW (Nov. 2019), 1–25.
[46] Tahsina Hashem, Tanzima Hashem, and Anindya Iqbal. 2016. Ensuring Feedback Data Privacy in the Context of Developing Countries. In *Proceedings of the 7th Annual Symposium on Computing for Development* (Nairobi, Kenya) *(ACM DEV '16, Article 18)*. Association for Computing Machinery, New York, NY, USA, 1–4.
[47] L J B Hayes and Sian Moore. 2017. Care in a time of austerity: The electronic monitoring of homecare workers' time. *Gend. Work Organ.* 24, 4 (July 2017), 329–344.
[48] Päivi Heikkilä, Anita Honka, and Eija Kaasinen. 2018. Quantified factory worker: designing a worker feedback dashboard. In *Proceedings of the 10th Nordic Conference on Human-Computer Interaction* (Oslo, Norway) *(NordiCHI '18)*. Association for Computing Machinery, New York, NY, USA, 515–523.
[49] Matthew J Hornsey, Leda Blackwood, Winnifred Louis, Kelly Fielding, Ken Mavor, Thomas Morton, Anne O'Brien, Karl-Erik Paasonen, Joanne Smith, and Katherine M White. 2006. Why do people engage in collective action? Revisiting the role of perceived effectiveness. *J. Appl. Soc. Psychol.* 36, 7 (July 2006), 1701–1722.
[50] Lilly C Irani and M Six Silberman. 2013. Turkopticon: Interrupting worker invisibility in amazon mechanical turk. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (Paris, France) *(CHI '13)*. Association for Computing Machinery, New York, NY, USA, 611–620.
[51] Azra Ismail, Naveena Karusala, and Neha Kumar. 2018. Bridging Disconnected Knowledges for Community Health. *Proc. ACM Hum.-Comput. Interact.* 2, CSCW (Nov. 2018), 1–27.
[52] Azra Ismail and Neha Kumar. 2018. Engaging Solidarity in Data Collection Practices for Community Health. *Proc. ACM Hum.-Comput. Interact.* 2, CSCW (Nov. 2018), 1–24.
[53] Steven J Jackson. 2014. Rethinking Repair. In *Media Technologies: Essays on Communication, Materiality and Society*, Tarleton Gillespie, Pablo Boczkowski, and Kirsten Foot (Eds.). MIT Press, Cambridge, MA.
[54] David G Jansson and Steven M Smith. 1991. Design fixation. *Design Studies* 12, 1 (Jan. 1991), 3–11.
[55] John Kallas, Madeline R Sterling, Olay Ajayi, Ethan Mulroy, Elizabeth Kuo, Joy Ming, Nicola Dell, and Ariel C Avgar. 2022. Making a Bad Situation Worse: Examining the Challenges Facing Rural Home Care Workers. *J. Appl. Gerontol.* (Dec. 2022), 7334648221134793.
[56] Vera D Khovanskaya. 2021. *The Tools of Management: Data Practices for Worker Advocacy*. Ph. D. Dissertation. Cornell University, Ann Arbor, United States.
[57] Joy Jeounghee Kim. 2022. Personal Care Aides as Household Employees and Independent Contractors: Estimating the Size and Job Characteristics of the Workforce. *Innov Aging* 6, 1 (2022), igab049.
[58] Joy Jeounghee Kim and Skye Allmang. 2021. Wage theft in the United States: Towards new research agendas. *The Economic and Labour Relations Review* 32, 4 (Dec. 2021), 534–551.
[59] Daniel Lambton-Howard, Patrick Olivier, Vasilis Vlachokyriakos, Hanna Celina, and Ahmed Kharrufa. 2020. Unplatformed Design: A Model for Appropriating Social Media Technologies for Coordinated Participation. In *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems* (Honolulu, HI, USA) *(CHI '20)*. Association for Computing Machinery, New York, NY, USA, 1–13.
[60] Daniel Le Compte and Daniel Klug. 2021. "It's Viral!" - A Study of the Behaviors, Practices, and Motivations of TikTok Users and Social Activism. In *Companion Publication of the 2021 Conference on Computer Supported Cooperative Work and Social Computing* (Virtual Event, USA) *(CSCW '21)*. Association for Computing Machinery, New York, NY, USA, 108–111.
[61] Sarah Leberstein, Irene Tung, and Caitlin Connolly. 2015. *Upholding Labor Standards in Home Care: How to Build Employer Accountability Into America's Fastest-Growing Jobs*. Technical Report. National Employment Law Project.
[62] Yu-Hao Lee and Gary Hsieh. 2013. Does slacktivism hurt activism? the effects of moral balancing and consistency in online activism. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (Paris, France) *(CHI '13)*. Association for Computing Machinery, New York, NY, USA, 811–820.
[63] Karen E C Levy. 2015. The Contexts of Control: Information, Power, and Truck-Driving Work. *The Information Society* 31, 2 (March 2015), 160–174.

[64] Ian Li, Anind Dey, and Jodi Forlizzi. 2010. A stage-based model of personal informatics systems. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (Atlanta, Georgia, USA) *(CHI '10)*. Association for Computing Machinery, New York, NY, USA, 557–566.
[65] Heidi Liu. 2017. When Whispers Enter the Cloud: Evaluating Technology to Prevent and Report Sexual Assault Notes. *Harv. J. Law Technol.* 31, 2 (2017), 939–964.
[66] M Marathe, J O'Neill, P Pain, and W Thies. 2016. ICT-enabled grievance redressal in Central India: A comparative analysis. *Proceedings of the Eighth* (2016).
[67] Patrice M Mareschal. 2006. Innovation and Adaptation: Contrasting Efforts to Organize Home Care Workers in Four States. *Labor Studies Journal* 31, 1 (March 2006), 25–49.
[68] Gloria Mark, Shamsi Iqbal, Mary Czerwinski, and Paul Johns. 2014. Capturing the mood: facebook and face-to-face encounters in the workplace. In *Proceedings of the 17th ACM conference on Computer supported cooperative work & social computing* (Baltimore, Maryland, USA) *(CSCW '14)*. Association for Computing Machinery, New York, NY, USA, 1082–1094.
[69] Alexandra Mateescu. 2021. *Electronic Visit Verification: The Weight of Surveillance and the Fracturing of Care.* Technical Report. Data & Society.
[70] Alexandra Mateescu and Julia Ticona. 2020. Invisible Work, Visible Workers. *Beyond the Algorithm: Qualitative Insights for Gig Work Regulation* (2020), 57.
[71] Maria Menendez-Blanco, Pernille Bjorn, and Antonella De Angeli. 2017. Fostering Cooperative Activism through Critical Design. In *Proceedings of the 2017 ACM Conference on Computer Supported Cooperative Work and Social Computing* (Portland, Oregon, USA) *(CSCW '17)*. Association for Computing Machinery, New York, NY, USA, 618–629.
[72] Robert K Merton. 1936. The Unanticipated Consequences of Purposive Social Action. *Am. Sociol. Rev.* 1, 6 (1936), 894–904.
[73] Lydia Michie, Madeline Balaam, John McCarthy, Timur Osadchiy, and Kellie Morrissey. 2018. From Her Story, to Our Story: Digital Storytelling as Public Engagement around Abortion Rights Advocacy in Ireland. In *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems* (Montreal QC, Canada) *(CHI '18, Paper 357)*. Association for Computing Machinery, New York, NY, USA, 1–15.
[74] Joy Ming, Srujana Kamath, Elizabeth Kuo, Madeline Sterling, Nicola Dell, and Aditya Vashistha. 2022. Invisible Work in Two Frontline Health Contexts. In *ACM SIGCAS Conference on Computing and Sustainable Societies (COMPASS)*.
[75] Joy Ming, Elizabeth F Kuo, Katie Go, Emily Tseng, John Kallas, Aditya Vashistha, Madeline Sterling, and Nicola Dell. 2023. "I Go Beyond and Beyond": Examining the Invisible Work of Home Health Aides. In *ACM Conference on Computer-Supported Cooperative Work and Social Computing (CSCW)*.
[76] Darakhshan J Mir, Madelyn Rose Sanfilippo, Brett M Frischmann, and Katherine J Strandburg. 2021. Designing for the Privacy Commons. In *Governing Privacy in Knowledge Commons*. Cambridge University Press, 245–267.
[77] Eric Monteiro, Neil Pollock, Ole Hanseth, and Robin Williams. 2013. From Artefacts to Infrastructures. *Comput. Support. Coop. Work* 22, 4 (Aug. 2013), 575–607.
[78] David L Morgan. 1996. *Focus Groups as Qualitative Research.* SAGE Publications.
[79] Dawn Nafus and Rajiv Mehta. 2016. *Atlas of Caregiving Pilot Study Report.* Technical Report. Family Caregiver Alliance.
[80] Bonnie A Nardi and Yrjö Engeström. 1999. A web on the wind: The structure of invisible work. *Comput. Support. Coop. Work* 8, 1-2 (1999), 1–8.
[81] New York State Department of Labor. 2022. Home Care Aide: Minimum Wage. https://dol.ny.gov/system/files/documents/2022/10/p105-home-health-aide-10-5-22.pdf.
[82] Helen Nissenbaum. 2009. *Privacy in context: Technology, policy, and the integrity of social life.* Stanford University Press, Palo Alto, CA.
[83] Chris Norval, Kristin Cornelius, Jennifer Cobbe, and Jatinder Singh. 2022. Disclosure by Design: Designing information disclosures to support meaningful transparency and accountability. In *2022 ACM Conference on Fairness, Accountability, and Transparency* (Seoul, Republic of Korea) *(FAccT '22)*. Association for Computing Machinery, New York, NY, USA, 679–690.
[84] Fabian Okeke, Emily Tseng, Benedetta Piantella, Mikaela Brown, Harveen Kaur, Madeline R Sterling, and Nicola Dell. 2019. Technology, home health care, and heart failure: a qualitative analysis with multiple stakeholders. In *Proceedings of the 2nd ACM SIGCAS Conference on Computing and Sustainable Societies* (Accra, Ghana) *(COMPASS '19)*. Association for Computing Machinery, New York, NY, USA, 122–133.
[85] Chinasa T Okolo and Srujana Kamath. 2021. "It cannot do all of my work": Community Health Worker Perceptions of AI-Enabled Mobile Health Applications in Rural India. *CHI '21* (2021).
[86] PHI. 2020. Caring for the Future: The Power and Potential of America's Direct Care Workforce. https://phinational.org/wp-content/uploads/2021/01/Caring-for-the-Future-2021-PHI.pdf.

[87] PHI. 2022. Direct Care Workers in the United States: Key Facts. https://www.phinational.org/resource/direct-care-workers-in-the-united-states-key-facts-3/. Accessed: 2022-10-24.
[88] Anthony Poon, Vaidehi Hussain, Julia Loughman, Ariel C Avgar, Madeline Sterling, and Nicola Dell. 2021. Computer-Mediated Peer Support Needs of Home Care Workers: Emotional Labor & the Politics of Professionalism. *Proc. ACM Hum.-Comput. Interact.* 5, CSCW2 (Oct. 2021), 1–32.
[89] Jennifer M Reckrey, Emma K Tsui, R Sean Morrison, Emma T Geduldig, Robyn I Stone, Katherine A Ornstein, and Alex D Federman. 2019. Beyond Functional Support: The Range Of Health-Related Tasks Performed In The Home By Paid Caregivers In New York. *Health Aff.* 38, 6 (June 2019), 927–933.
[90] Horst W J Rittel and Melvin M Webber. 1973. Dilemmas in a general theory of planning. *Policy Sci.* 4, 2 (June 1973), 155–169.
[91] Liz Robbins. 2016. New Weapon in Day Laborers' Fight Against Wage Theft: A Smartphone App. *The New York Times* (March 2016).
[92] Cassandra Robertson, Marokey Sawo, and David Cooper. 2022. All states must set higher wage benchmarks for home health care workers. https://www.epi.org/publication/state-home-health-care-wages/. Accessed: 2022-12-20.
[93] Dmitry Ryvkin, Danila Serra, and James Tremewan. 2017. I paid a bribe: An experiment on information sharing and extortionary corruption. *Eur. Econ. Rev.* 94 (May 2017), 1–22.
[94] Saiph Savage, Andres Monroy-Hernandez, and Tobias Höllerer. 2016. Botivist: Calling Volunteers to Action using Online Bots. In *Proceedings of the 19th ACM Conference on Computer-Supported Cooperative Work & Social Computing* (San Francisco, California, USA) *(CSCW '16)*. Association for Computing Machinery, New York, NY, USA, 813–822.
[95] M Six Silberman and Lilly Irani. 2016. Operating an Employer Reputation System: Lessons from Turkopticon, 2008-2015. (Feb. 2016).
[96] Clare L Stacey. 2011. The Caring Self. In *The Caring Self*. Cornell University Press.
[97] Susan Leigh Star and Anselm Strauss. 1999. Layers of Silence, Arenas of Voice: The Ecology of Visible and Invisible Work. *Comput. Support. Coop. Work* 8, 1 (March 1999), 9–30.
[98] Charles W Steinfield. 1986. Computer-Mediated Communication in an Organizational Setting: Explaining Task-Related and Socioemotional Uses. *Annals of the International Communication Association* 9, 1 (Jan. 1986), 777–804.
[99] Madeline R Sterling, Ariel F Silva, Peggy B K Leung, Amy L Shaw, Emma K Tsui, Christine D Jones, Laura Robbins, Yanira Escamilla, Ann Lee, Faith Wiggins, Frances Sadler, Martin F Shapiro, Mary E Charlson, Lisa M Kern, and Monika M Safford. 2018. "It's Like They Forget That the Word 'Health' Is in 'Home Health Aide'": Understanding the Perspectives of Home Care Workers Who Care for Adults With Heart Failure. *Journal of the American Heart Association* 7, 23 (Nov. 2018), e010134.
[100] Madeline R Sterling, Emily Tseng, Anthony Poon, Jacklyn Cho, Ariel C Avgar, Lisa M Kern, Claire K Ankuda, and Nicola Dell. 2020. Experiences of Home Health Care Workers in New York City During the Coronavirus Disease 2019 Pandemic: A Qualitative Analysis. *JAMA Intern. Med.* (Aug. 2020).
[101] Allan Stisen, Nervo Verdezoto, Henrik Blunck, Mikkel Baun Kjærgaard, and Kaj Grønbæk. 2016. Accounting for the Invisible Work of Hospital Orderlies: Designing for Local and Global Coordination. In *Proceedings of the 19th ACM Conference on Computer-Supported Cooperative Work & Social Computing* (San Francisco, California, USA) *(CSCW '16)*. Association for Computing Machinery, New York, NY, USA, 980–992.
[102] Lucy Suchman. 1995. Making Work Visible. *Commun. ACM* 38, 9 (Sept. 1995), 56–64.
[103] Latanya Sweeney. 2002. ACHIEVING k-ANONYMITY PRIVACY PROTECTION USING GENERALIZATION AND SUPPRESSION. *Int. J. Uncertainty Fuzziness Knowledge Based Syst.* 10, 05 (Oct. 2002), 571–588.
[104] Elizabeth Tippett, Charlotte S Alexander, and Zev J Eigen. 2017. When timekeeping software undermines compliance. *The Yale Journal of Law & Technology* 19, 1 (2017).
[105] Ciaran B Trace and Yan Zhang. 2019. Towards a Typology of Self-Tracking Gaps. In *Extended Abstracts of the 2019 CHI Conference on Human Factors in Computing Systems* (Glasgow, Scotland Uk) *(CHI EA '19, Paper LBW2515)*. Association for Computing Machinery, New York, NY, USA, 1–6.
[106] Tuan Luu Trong. 2021. Employer event communication and hospitality workers' resilience during the COVID-19 crisis: the role of core beliefs examination and family support. *International Journal of Contemporary Hospitality Management* 33, 5 (Jan. 2021), 1593–1619.
[107] Emily Tseng, Fabian Okeke, Madeline Sterling, and Nicola Dell. 2020. "We can learn. Why not?": Designing Technologies to Engender Equity for Home Health Aides. In *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems* (Honolulu, HI, USA) *(CHI '20)*. Association for Computing Machinery, New York, NY, USA, 1–14.
[108] U.S. Bureau of Labor Statistics. 2022. Home Health and Personal Care Aides. https://www.bls.gov/ooh/healthcare/home-health-aides-and-personal-care-aides.htm. Accessed: 2022-10-24.
[109] Martijn van Zomeren, Tom Postmes, and Russell Spears. 2008. Toward an integrative social identity model of collective action: a quantitative research synthesis of three socio-psychological perspectives. *Psychol. Bull.* 134, 4 (July 2008), 504–535.

[110] Rajesh Veeraraghavan. 2021. *Patching Development: Information Politics and Social Change in India (Modern South Asia).* Oxford University Press.

[111] Christine T Wolf, Mariam Asad, and Lynn S Dombrowski. 2022. Designing within Capitalism. In *Designing Interactive Systems Conference* (Virtual Event, Australia) *(DIS '22).* Association for Computing Machinery, New York, NY, USA, 439–453.

[112] Susan Wyche. 2019. Using Cultural Probes In New Contexts: Exploring the Benefits of Probes in HCI4D/ICTD. In *Conference Companion Publication of the 2019 on Computer Supported Cooperative Work and Social Computing* (Austin, TX, USA) *(CSCW '19).* Association for Computing Machinery, New York, NY, USA, 423–427.

[113] Angie Zhang, Alexander Boltz, Chun Wei Wang, and Min Kyung Lee. 2022. Algorithmic Management Reimagined For Workers and By Workers: Centering Worker Well-Being in Gig Work. In *Proceedings of the 2022 CHI Conference on Human Factors in Computing Systems* (New Orleans, LA, USA) *(CHI '22, Article 14).* Association for Computing Machinery, New York, NY, USA, 1–20.

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