Ludification as a Lens for Algorithmic Management: A Case Study of Gig-Workers' Experiences of Ambiguity in Instacart Work

Divya Ramesh
dramesh@umich.edu
University of Michigan
Ann Arbor, Michigan, USA

Caitlin Henning
caithen@umich.edu
University of Michigan
Ann Arbor, Michigan, USA

Nel Escher
kescher@umich.edu
University of Michigan
Ann Arbor, Michigan, USA

Haiyi Zhu
haiyiz@andrew.cmu.edu
Carnegie Mellon University
Pittsburgh, Pennsylvania, USA

Min Kyung Lee
minkyung.lee@austin.utexas.edu
University of Austin
Austin, Texas, USA

Nikola Banovic
nbanovic@umich.edu
University of Michigan
Ann Arbor, Michigan, USA

ABSTRACT

On-demand work platforms are attractive alternatives to traditional employment arrangements. However, several questions around employment classifcation, compensation, data privacy, and equitable outcomes remain open. The abilities of algorithmic management to structure diferent forms of platform-worker relationships compounds fraught regulatory debates. Understanding the conditions of algorithmic management that result in these variations could point us towards better worker futures. In this work, we studied the platform-worker relationships in Instacart work through the accounts of its workers. From a qualitative analysis of 400 Reddit posts by Instacart's workers, we identifed sources and types of ambiguity that gave rise to open-ended experiences for workers. Ambiguities supplemented gamifcation mechanisms to regulate worker behaviors. Yet, they also generated afective experiences for workers that enabled their playful participation in the Reddit community. We propose the frame of ludifcation to explain these seemingly contradicting fndings and conclude with implications for accountability in on-demand work platforms.

CCS CONCEPTS

• Human-centered computing → Human computer interaction (HCI).

KEYWORDS

algorithmic management, Gig-work, ambiguity, ludic design, ludic engagement, gamifcation, algorithmic resistance

1 INTRODUCTION

Attractive taglines, overnight success stories, and promises of autonomy have enticed numerous workers to enter the on-demand platform economy. As of 2021, 16% of the workforce in the US has participated in the on-demand economy with similar numbers in countries across the globe [2]. However, increasing reports on the conditions of workers in these on-demand jobs provide striking evidence that the grandiose promises of autonomy, fexibility and success in the on-demand economy remain largely contested [34, 50, 59, 69, 73]. Employment classifcation, wage structures, workers' data rights and privacy, and use of deceptive and discriminatory algorithms remain hotly debated topics among companies, workers, regulators, lawyers and academics alike [66, 67].

The use of algorithmic management to structure platform-worker relationships in the on-demand economy intensifes regulatory challenges. Although prior work has attributed negative worker experiences to on-demand platforms' extensive use of algorithmic mechanisms (such as information asymmetry, gamifed incentives, algorithmic surveillance and the datafcation of worker evaluation) [29, 36, 46, 58], recent work reveals a more complex dynamic that is at play between platforms and workers [3, 38, 50, 62, 70]. For example, platforms may use the same algorithmic mechanisms to structure worker relationships in varied and seemingly consentful ways: workers have shown appreciation for gamifed incentive structures [76], workers may develop structure and formality through persistent interactions with opaque platforms [62], and may sometimes take part in counter-activities of algorithmic management to subvert dominant societal narratives [3]. Unfortunately, such complex dynamics also provide opportunities for on-demand platforms to skirt around regulatory pressures [40]. Thus, investigating the conditions under which specifc platform-worker dynamics emerge could inform the design and regulation of fair on-demand work platforms.

Here, we investigated the platform-worker relationships enabled by the algorithmic infrastructure of Instacart, a US-based grocery delivery startup, through the accounts of its workers. From a qualitative content analysis of 400 Reddit posts by Instacart workers

(herein: shoppers[1]), we identifed fve sources of ambiguity that gave rise to open-endedness for shoppers: 1) Instacart's confcting metrics for shopper evaluation posed competency as an open challenge for shoppers to conquer; 2) the subjectivity in platform-mediated social interactions left individual shoppers to decide how they viewed their relationships with Instacart work; 3) the unreliability of Instacart's informational sources allowed for shoppers' unconstrained research of best practices; 4) the lack of platform support challenged shoppers' troubleshooting skills; and 5) inconsistency in algorithmic scheduling opened up the logics of task assignment to shoppers' interpretations. Shoppers responded to these ambiguities with elements of playfulness, which sometimes interfered with utilitarian pursuits. They collectively devised creative exploits and strategies to gain competences, generated arbitrary 'data' and 'evidence' in exploratory pursuits of what they believed
were hidden truths in Instacart, and developed identities and norms to derive meaning and govern themselves in Instacart work.

Borrowing from Gaver et al.'s "Ludic Designs" [22–24, 26] and Raessens' "Ludifcation of Culture" [53], we use the frame of ludifcation to situate our fndings within prior work in algorithmic management. We discuss how ambiguity functions in implicit ways to supplement gamifcation mechanisms and condition shoppers' behaviors. Contrary to the existing framing of gamifcation in algorithmic management [58, 59] (i.e., as exploitative game mechanics introduced in work contexts to induce motivation in otherwise unmotivated work), we discuss how ambiguity generated afective experiences for shoppers (e.g., curiosity, exploration, meaning, refection), and enabled their playful participation in the online Reddit shopper community. Viewed through the lens of ludifcation, shoppers' afective experiences are not tangential to platform work, but the primary components of their interactions with Instacart. We also discuss the contradictions between the ideals of ludic de-sign and "on-the-ground" experiences of shoppers. Here, we follow
Gaver's suggestion [23] to look past whether a design "worked" and instead focus on uncovering "what happened." Instead of assessing if shoppers perceived Instacart's design as ludic and if the platform generated ludic value for them, we center our discussion on what happened when shoppers interacted with Instacart, a platform that exhibited aspects of what designers understand as ludic designs.

Our work contributes empirical knowledge by documenting the layers of ambiguity that Instacart shoppers encounter in their everyday work. We also uncover dual impacts of ambiguity on shoppers: 1) to condition and discipline, and 2) to induce positive afective experiences. We make a theoretical contribution by bringing two distinct threads of HCI (i.e., interaction design and algorithmic management) in conversations with one another to propose a new frame of ludifcation. Through this frame, we explain the contradicting roles of ambiguity in our fndings and resolve tensions in prior work on algorithmic management and ludic design. Our work informs HCI practice by outlining guidelines for platform accountability and enhancing worker well-being in on-demand work.

2 BACKGROUND AND RELATED WORK

We provide a brief overview about technology aspects of algorithmic management in on-demand work and attempt to provide justifcation for why painting algorithmic management with a broad brush is challenging. We also provide background on "ambiguity" in human-computer interaction to contextualize the design orientation of Instacart's algorithmic management.

2.1 Algorithmic Management in On-demand Work

2.1.1 Roles of algorithms in on-demand work. The popularity of on-demand work platforms has been partly due to the scale they aford supported by their algorithmic infrastructure. The algorithmic infrastructure has demonstrated economic value to organizations, and hence plays an important role in several aspects of gig work [41]. Algorithms are perceived as more efcient than human counterparts in decision-making [45, 51] which give credence to their use in making managerial decisions over workers [1, 27, 42]. Such algorithms can be interfaced with humans to coordinate distributed work [32], and can even facilitate organizational learning [55].

Given these organizational benefts, algorithmic infrastructure plays several important roles on on-demand work platforms. Platforms for jobs that have low entry barriers such as ridesharing[46], food and grocery delivery[30], help for physical tasks [68], domestic work employ algorithms [3] for managing workers through automated decisions of work assignments, providing informational support to facilitate coordination between workers and their customers, and evaluations of worker performance [46, 59].

2.1.2 Power and control through algorithmic management. A vast body of literature spanning HCI, organizational theory, economics and fnance, labor theory, and law has documented the ways in which algorithmic management alters the employer-employee relationship. At the heart of the arguments in several of these feld is the notion that use of algorithms provides more control and power to the employer than was previously possible through traditional workplace arrangements.

Algorithmic infrastructure strategically controls and shapes worker behavior through the use of information asymmetry, behavior nudges and surveillance of workers to ensure compliance to platform's objectives, and harsh evaluation techniques [3, 41, 46, 59]. Algorithmic infrastructure is also the basis for gamifed incentives in on-demand work platforms– to help platforms achieve desired worker behaviors. These include challenges to earn badges, points or virtual goods, presenting heat maps of busy locations, and introducing worker gradation through metrics [59].

Prior work has noted how platforms structure these mechanisms to secure their "consent" into gamifed mechanisms of control [3, 15, 70]. For example, Anwar et al [3] document the ways in which beauty workers in India experience control through the platform performing "6R's": 1) recommending, 2) rating, 3) restricting, 4) rewarding, 5) replacing, and 6)recording. Yet, those workers engaged in 'participatory surveillance' to negotiate surrounding patriarchal, casteist, and classist relationships [3]. Similarly, Vasudevan et al. [70] document the counter "work games" played by workers to resist gamifcation. Cameron [15] argues that such

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counter work games produce new meanings, ones un-envisioned by the platform, thereby resisting dominant narratives of platforms. Sehgal and Yatharth note the ways in which design decisions like gamifcation produce categories among workers, impeding their collectivisation eforts [61].

2.1.3 Worker perceptions of algorithmic management.
Even though platforms may gain consent of workers to participate in their gamifed forms of control and surveillance, there is increasing evidence that such participation leads to negative efects of well-being[5, 46, 57]. Lee et al. [46] documented the fnancial, physical and psychological impacts to well-being for rideshare drivers. Platform work introduces additional labors for workers. Raval and Dourish [57] documented the emotional and bodily labors of algorithmic management. Avle et al [5] documented how workers need to keep up by constantly upgrading their knowledge and skills on the platforms they work for.

Prior work has suggested that information asymmetry and opacity of algorithmic management may be at the root of such issues for gig-workers [34, 46, 50]. High levels of uncertainty arising from information asymmetry and opacity could also be a barrier for workers' organizing eforts [75]. Due to uncertainty, gig-workers may not trust one another, may withhold important information from each other, potentially impeding their collective action eforts [75].

While gig-work is extremely exploitative, a recent line of work shows that the worker-platform relationship is more nuanced and complex. Muralidhar et al. [50] trace the ways in which Ola[2], a ridesharing platform in India, creates conditions of auto-rickshaw drivers' dependencies on the platform, that lead to workers' continued use, even against their will. Similarly, while there is growing evidence for providing information visibility along worker-worker and worker-customer dimensions[46, 58, 59], a participatory design study with gig-workers revealed the psychological contracts that workers formed with the platforms gave rise to (surprising) designs including their needs for keeping some information hidden [76].

2.1.4 Accountability in the context of algorithmic management.
Accountability in the context of on-demand platforms has been an extremely difcult challenge. Thebault et al. [33] and Hannak et al. [68] conducted audits on TaskRabbit, Fiverr and Uber platforms to reveal gender and racial biases. However, such external eforts are fairly limited. Platform "afordances" such as API endpoints that can help researchers systematically observe the behavior of algorithms may be missing [65]. Further, the sheer number of platforms exceeds the number of researchers devoting their eforts in this space. Worker-led audits and worker organizing that have sought to expose the underlying discriminatory logics of algorithmic platforms have shown promise for way forward [13, 48]. Some of the resistance to the platform can be through workers fnding ways around algorithmic management. Möhlmann and Zalmanson [49], Cameron et al. [14] and Lee et al. [46] document the ways in which Uber drivers resist algorithmic platform by rejecting rides for low-rated passengers, switching to work with competing platforms, or fnd ways to manipulate and exploit the system [46]. These worker tactics fracture the platforms' dominant narratives.

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[2]https://www.olacabs.com

2.2 Ambiguity in Human-Computer Interaction
Traditionally, questions of minimizing 'frictions'—elements of design that disrupt smooth interaction experiences—has been at the forefront of Human-Computer Interaction (HCI). Thus, reducing frictions was seen as ways to improve functionality, efciency, productivity, and usability of devices [9]. However, over the years, there have been shifts in the feld that have worked to expand the scope of relationships between users and their devices, with affective or emotional engagements as central components [9]. For instance, the Apple iPhone is more than a telephone for users. Users may appropriate an iPhone device as a camera, an editor for poetry, a personal journal, a gaming device, and as means for social engagement [10]. This move towards enabling user appropriation of designs (and devices) has been attributed to designers using 'frictions' generatively; i.e., not as a constraint, but as a resource to be exploited in design [25, 64]. Frictions can include ambiguity and uncertainty, infrastructural seams, and breakdowns. In this subsection, we expand on the various uses of ambiguity in HCI.

2.2.1 Ambiguity as a design resource.
The "third wave" of human-computer interaction has been increasingly concerned with employing and exploiting ambiguity to positively infuence user interactions with digital systems. For instance, prior work has suggested using ambiguity for giving users opportunities for appropriation [16], for making space for user interpretations [4, 25], for encouraging refection [63, 64], for facilitating leisure [6, 7, 26, 35], for producing meaning [71], and for subverting dominant interpretations in design [18]. Ambiguous designs could enable the creation of engaging, thought-provoking and respectful interactions [25].

2.2.2 Tactics for using ambiguity in design.
Hasenzahl and Laschke proposes taking a stance, placing obstacles, creating inferior and non-absolute designs as ways to create and use ambiguity [35]. Similarly, Gaver et al. [25] suggest several tactics to exploit ambiguity for creating engaging designs, such as using imprecise representations, over-interpreting data, exposing inconsistencies to users, casting doubts, implicating incompatible contexts, blocking expected functionality, and using opacity towards these goals. Sengers et al. [64] argue that by specifying usability without constraining use, downplaying system authority, and thwarting consistent interpretations, one could provide "space" for multiple interpretations of a system in a way that undermines the system authority and eventually re-balances the designer-user power relationships.

2.2.3 Ambiguity and uncertainty in algorithmic workplace systems.
Ambiguous designs have also been incorporated into algorithmic workplace systems as desired properties [8, 31, 43, 44, 74]. Langer et al. [43] found that uncertainty can induce suspense and increase users' intrinsic motivation and excitement. Similarly, Law and Yin [44] found that ambiguity induced curiosity and intrinsic incentives for crowdworkers. Further, Woodruf et al. [74] suggest that ambiguity in algorithmic outputs can downplay system authority thereby facilitating easier appeals by users. Grill and Andalibi [31] propose that ambiguity helps to resist oppressive algorithmic systems. Benjamin et al. [8], propose using machine learning uncertainty as a design resource to facilitate "horizontal" relations between users and algorithmic systems.

3 ON INSTACART

Instacart is a platform where customers can order groceries (either through the webiste or through a mobile app) from select retailers in surrounding areas. These requests will be matched to a gig worker, who is also called "personal shopper" (herein: shopper) and be delivered by them to the customers. For shoppers, there is a separate website and application called Instacart Shopper that manages the workfow. Shoppers can create an account at shoppers.instacart.com and download the Shopper app. The sign-up process for shoppers involves a background check. Interested shoppers may often have to wait up to 10 business days to be approved before they can begin work and earning money.

Once the sign-up process is complete, shoppers can open the app at any time to look for batches. Alternatively, shoppers can work on-call and allow the app to send them a notifcation whenever there are new batches in the area. When the shopper opens the app to start work, they must frst click "Go online." This means that the shopper is ready to pick up a "batch" (i.e., a unit of work on Instacart that the shopper takes on). Shoppers can only take one batch at a time, but the batch may contain more than one customer's order, and/or orders from more than one store. Once the shopper is online through the app, a list of available batches nearby is shown. Each batch listed contains details on the amount the batch pays, the number of orders within the batch, the total number of items, the name and location of the store, and the driving distance. The batch pay includes a tip from the customer, but the customer can alter tips post-delivery. The shopper uses this information to decide on a batch to take. Once they accept, they are ready to shop.

The shopping process begins when the shopper selects a batch from the list. The app then provides optional driving directions to the shopping location. Upon arrival, the shopper notifes that they are at the store and have begun shopping. Instacart lists all the items in the batch as well as their locations by aisle number. At this point in time, the shopper and customer can communicate through the app. There are no explicit directions given to shoppers when items are unavailable. However, shoppers often attempt to contact the customer about replacement preferences. The shopper can check out using a card they received from Instacart in the mail, or Apple Pay or Google Pay if they have it set up. When they leave the store, the shopper notifes that they are on their way, and the app provides them driving directions to get to the customer. The customer is given an option to add special delivery requests, with the default set to "Leave at door."

Upon completion of the delivery, the shopper can immediately move on to the next batch. The customer is then prompted on the app to rate the shopper on a fve-star scale based on their own evaluation. This rating is meant to exclude factors such as out-of-stock items, long checkout lines, trafc, and other uncontrollable events, but often these incidents damage a shopper's overall rating, which impacts the frequency of high-paying batches they receive in the future. The customer can also increase or decrease the initial tip amount until two hours after delivery completion. After the two-hour window and up until 24 hours post-delivery, the customer is only able to increase the tip amount.

4 METHOD

4.1 Epistemological Stance

We sought to uncover the design narratives of Instacart platform from the standpoint of the shoppers. We started with a broad focus on adversarial aspects of algorithmic management, instead of specifc research questions guided by a detailed literature review. Some of the questions that prompted this research study include:

- What are the breakdowns in shoppers' interactions with algorithmic management? What forms of repair work (if any) are undertaken by the shoppers?
- What tensions do shoppers experience with the platform, the customers, and with each other through the use of algorithmic management?
- What tactics of resistance do shoppers employ to seek better futures through algorithmically managed gig-work?

We turned to Reddit given that this has been a space where conversations relevant to our research interests often take place [21, 46, 75]. We followed a grounded-theory inspired analysis of the Reddit data, informed by Glaser [28], to identify a single narrative of "what is this data telling us". We sided with Charmaz [17] epistemo-logically, and viewed all codes as constructed through researchers' subjectivities. Further, in line with Charmaz's reasoning, we viewed the role of the researcher as co-creating meaning within the domain they are studying, and providing lenses for analysis rather than developing objectively verifable models or taxonomies [19].

4.2 Selection of Posts for Analysis

We initially sampled 100 posts that were tagged as the "newest" posts on r/InstacartShopper sub-reddit in November 2020, to study the most pressing and current issues of the community. Following the grounded theory method, we then chose subsequent posts for analysis based on the demands of evolving theory; i.e., we did not sample for representativeness, but based on what the additional data brought to the analysis. In all, we sampled 400 posts.

4.3 Analysis

We conducted our analysis in three phases.

4.3.1 Phase 1: Open-Coding. In this phase, the frst author engaged deeply with the data through a line-by-line open-coding of the posts from r/InstacartShoppers November 2020. This line-by-line analysis was accompanied with memo writing that included the frst author's observations of image, video, and other media, redditors' responses to posts and the general dynamics of the Reddit community. The rest of the team discussed the open-codes, memos and observations in weekly team meetings. At the end of the open-coding phase, we generated 538 open-codes staying as close to the data as possible.

4.3.2 Phase 2: Axial and Selective Coding. In this phase, we conducted a workshop to identify axial codes. All members of the research team gathered during a virtual workshop to identify the relationships between open-codes and discuss the initial concepts. Using a method of constant comparison, we selectively coded these into 78 axial codes. We took care to capture capture shoppers' posts verbatim in coming up with the codes. Examples include "Playing the Instacart Game", "Ratings Hell", "Not a big unicorn but", etc.

4.3.3 Phase 3: Theoretical Sampling through Constant Comparison. While Glaser recommended against the use of literature until all data was collected and analyzed, more recent approaches welcome consulting relevant literature through sensitizing concepts [17]. Following the latter tradition, we engaged with relevant literature on ambiguity and ludic design [4, 25, 26, 64], breakdowns and repairs [37, 60], uncertainty [20], contingencies [47], and seams [16]. In this phase, the first author went over the selective codes and identified the sensitizing concept of 'open-endedness'. We generated 20 sub-themes and multiple candidate themes by iteratively going over the data and comparing with existing literature, using them as frames that shaped the analysis. The first author presented candidate themes and emerging theory along with excerpts to the rest of the research team in bi-weekly meetings held over 10 months to generate our final themes and mid-range theory. In this paper, we present the following two higher level themes corresponding to the open-ended experiences of Instacart shoppers: 1) *Sources of Ambiguity in Instacart Work*, and 2) *Shoppers' Responses to Ambiguity in Instacart Work*. The mid-range theory we develop in this work extends Gaver's framework of ludic design [22–24, 26] to suggest ways of facilitating designer accountability.

4.4 Limitations

4.4.1 Atenuated view of the world. Peculiarities of platform (i.e., "hot", "new", "top", moderation of content and community norms on Reddit) shape and influence the way posts are created and shared among shoppers. Due to this, Reddit data can only offer an attenuated view into a much broader set of communicative practices occurring between shoppers on these forums and beyond.

4.4.2 Representativeness of data. 58% of Reddit users are between the ages of 19 and 34, and 57% are men, mostly based in urban geographical locations in wealthier nations [52]. Even though Instacart is only based in the US and Canada, due to the nature of Reddit users only representing a skewed population of Instacart shoppers, we acknowledge that over-reliance on this source of data can lead to skewed understandings of tensions in Instacart work.

We attempted to overcome these epistemological limitations by the altering the scope of our research. We oriented our inquiry to the tensions in Instacart work discussed by the community of shoppers on r/InstacartShoppers and how the community of r/InstacartShoppers navigated these tensions.

4.4.3 Limited perspectives. Although ambiguity in Instacart's designs could blur the lines between work and leisure, we are unable to make any conclusive statements about Instacart designer's intentions to blur those lines, or even their orientation to ludic design. Furthermore, since we are studying shoppers' accounts of Instacart work, our data does not allow us to discuss Instacart designer's awareness of their design impacts, ethics or values. We believe that these are important research questions about Instacart designers and can be directions for future work.

4.4.4 Researcher interpretations. We did not conduct member-checking. Thus, we cannot comment on (nor do we wish to speculate) if shoppers would agree with our interpretations (e.g., if shoppers perceived their experiences as ludic or if they derived ludic value from Instacart).

4.5 Ethical Considerations and Refections

We recognized several ethical challenges in this work. First, we acknowledge that the community of r/InstacartShoppers are a vulnerable population. Even though there is debate about whether workers in the gig-economy identify as an entrepreneurial group, or a low-wage worker group, we saw that several shoppers in the r/InstacartShoppers community were subject to marginalization. Some shoppers' posts were distress calls about low earnings ($200-$300/week), mistreatment by customers, power asymmetry, and lack of expertise to comprehend algorithmic management.

Second, posts on r/InstacartShoppers resembled crisis posts: They consisted of public announcements, pleas for help (personal crisis), and their highs and lows during tasks, which are everyday interactions on gig-work platforms shared on a public forum like Reddit due to the unavailability of dedicated channels from platforms themselves to bring shoppers all in one place. These could be compared to the crisis data on forums like Twitter where individuals send PSAs to their networks, make calls for help to reach wider audiences and update their networks when they are under safety from danger.

Another challenge was brought by the timing of our inquiry, which began in 2020 during a highly uncertain phase of the pandemic. We initially oriented ourselves to audit the discriminatory impacts of the platform on shoppers, but quickly ran into platform opacity challenges. We considered auditing the platform through shoppers' journaling experiences. However, instead of enticing shoppers to participate in a research study that could potentially endanger them during the COVID-19 pandemic, we decided to "lurk" in their online space to capture their story.

Recognizing these challenges allowed us to approach this work with great care. We generated themes carefully to ensure that we were doing justice to shoppers' voices. We also did not include any posts in our analysis that were deleted by shoppers. Further, we attempt to rephrase the quotes of shoppers (while preserving the meaning), in cases where there may be identifable information. We believe our findings have credibility due to that the care with which we approached our work.

5 FINDINGS

Instacart "shoppers" (i.e., the gig-workers) posed a multitude of questions on r/InstacartShoppers sub-reddit, which often invoked a variety of responses. As one shopper put it, being an Instacart shopper meant having layers of questions; from "beating crowds" and finding misplaced grocery items in a busy store to "beating competition", building rapport with customers over text messaging, and receiving high tips:

> "'30 miles? Should I take it?', 'Ugh why are there so many people here it's a TUESDAY morning.' 'XXXX MLK St....thats not too far....Apt. 127895 gate code: look up name on the box. *sighhhhh*' 'Where the F$#K is this f#$king cheese?!' 'hurry up and answer bitch I don't have all day.' 'No TIP??? Yeah right nobody is going to take that... Wow someone took that.' 'What the hell even IS this?' 'Where AM I???' 'Okay so what DO you want? Hurry up!'"

Navigating such open-ended tasks elicited emotional (or afective) responses in shoppers. Instacart shoppers, as gig-workers on other platforms, had few on-boarding processes and instructions for executing tasks. However, on the Instacart platform, smooth completion of tasks required shoppers paying attention to several nuances for which they received vague directions at best. While the lack of rigid guidelines lowered shoppers' barrier to enter Instacart work and provided them with fexibility over such tasks, it also meant that maximizing earnings required skillful navigation of open-endedness (i.e., having seemingly few set ways to accomplish tasks). Therefore, feelings of surprise, confusion, frustration, anger, excitement and ecstasy accompanied Instacart tasks, sometimes all at the same time. Here, we unpack these open-ended experiences of shoppers by tracing the sources of ambiguity (i.e., that of being open to multiple interpretations [25]) in Instacart work, and their responses to such ambiguity.

5.1 Sources of Ambiguity in Instacart Work

We identify 5 sources of ambiguity in Instacart work: 1) Conficting evaluation metrics, 2) Subjective social interactions, 3) Unreliable information sources, 4) Insufcient shopper support, and 5) Inconsistent algorithmic scheduling.

5.1.1 *Conflicting evaluation metrics.* Instacart's exhaustive set of metrics were conficting with one another, which introduced competing goals for shoppers. Shoppers received performance evaluations from customers on a 5-star rating scale, as in most forms of gig-work [46]. In addition, Instacart quantifed several other of their activities, such as their speeds (i.e., time taken for completing orders), their cancellation rates (a measure of the number of times a shopper accepts and cancels an order without fulflling it), and the number of times customers reported issues in their orders [56]. While the metrics seemed to track mutually exclusive activities of shoppers, they introduced competing goals for them. For example, one shopper refected on an instance when customer ratings and shopper speed had them choosing between fulflling an order thoroughly and fulflling an order quickly:

> "What do you do when an item is unavailable and the customer does not respond to your texts about alternative options that are more expensive? Do you substitute the item or leave it out, especially when the app shows that your order is to be delivered soon?"

With a lack of clarity on such conficting metrics, the set of competencies and associated metrics to target on Instacart were open questions for shoppers. Some shoppers, citing patterns between customer ratings and the tasks shown on their screens, believed that improving people-skills could fetch higher paying tasks. Others contested the importance of people-skills; they shared experiences of being "5-star shopper(s)" and only having marginally better incomes. They proposed developing alternative competencies, such speeds and accuracy by upgrading their props and services. These included upgrading wif and phone data plans, buying dashboard phone mounts, owning produce weighing scales to save time in the stores, insulated bags to deliver perishable items at optimal temperatures, and portable chargers for unanticipated battery emergencies.

As a shopper who made a futile investment in an Instacart-endorsed prop shared, such attempts to develop competencies had mixed outcomes for shoppers as they were based on largely arbitrary assessments.

> "I gave in and bought those insulated bags that Instacart sells for $26 during a bad stretch of weeks when I had low ratings. They promote these bags to get more batches, as if having them gives you an abundance of batches that you previously couldn't see. I've now done about 200 batches since getting my bags. Not once have I gotten any type of sign that these insulated bags are necessary."

Thus, discrepancies between shoppers' competencies and Instacart's success metrics for them induced ambiguity for shoppers.

5.1.2 *Subjective social interactions.* Platform-mediated customer-shopper interactions on Instacart were highly subjective and variable, which gave rise to a wavering morale for shoppers. For example, shoppers often did their best to please customers. In return, customers would sometimes respond with kind gestures such as giving them tips, ofering water or snacks, writing them notes, giving them gifts; all which elicited immense gratitude from shoppers.

Even a single positive customer interaction could induce feelings of delight for fnancially struggling shoppers. They would post screenshots of their tips or pictures of their images with ecstatic messages such as "A good day for me :)", "I was blessed today" when they encountered customers who showed empathy and understanding towards them. Shoppers also appreciated small gestures such as customers acknowledging them, making small talk, and expressing a thank you with a smile.

Pleasant social interactions contributed to shoppers perceiving Instacart work positively. In fact, such interactions were not limited to contact with customers. Unique houses, funny signs, customers' pets, cute animals, or unusual customer requests and conversations sparked immense excitement and surprise in shoppers who sometimes made long, narrative posts only to share their feelings of gratitude for Instacart work with their peers:

> "The customer was waiting for me when I arrived. We made some small talk as I unloaded groceries. Not only did they tip well, but they also left some water and snacks for me. Of course not all customer interactions are this great, but oh my, this job is much better than working at the cinemas during a pandemic!"

On the other hand, unpleasant customer interactions left shoppers feeling disgruntled about not just the customers, but Instacart work overall to the extent that some shoppers proclaiming:

"Can you tell I don't care [about Instacart] anymore?". Shoppers who were enraged by difcult customers posted angry and sarcastic messages such as "There should be a 'Thank you' and a 'Fuck you' button after delivery" after their interactions with them.

As a result of variable customer interactions, the question of how shoppers must view their relationships with customers was ambiguous to them. Some Instacart shoppers obsessed over their interactions with customers, often to the extent of worrying that one minor ofending incident in their interactions with customers could negatively impact their overall earnings on Instacart. These shoppers routinely discussed questions about what actions might or might not ofend their customers. Other shoppers built solidarity with one another over negative experiences with "difcult"

customers. They created and classifed their customers on Reddit (difcult customers were "Karens", high-tipping customers were "unicorns"); they shared pictures of orders with low-tips with the community to raise awareness about acceptable amounts for tips; shamed customers among their peers on Reddit with funny memes, screenshots and insults such as 'This has been there since 7. .52 cents?! The nerve of some people," "A solid NO! $2 trap!," "Let's Play! How long will this sit here?," "You can keep that energy to yourself for that tip," etc.

Subjectivity in social interactions also led shoppers to hold diverse attitudes towards Instacart work. Some shoppers shared afrmations to the shopper community for standing up for their rights with messages such as "Shoutout to all the shoppers in my area who have fnally said enough is enough!"; others despised such adversarial attitudes towards customers. They feared that shoppers abusing platform features to deny difcult customers service could result in Instacart implementing algorithmic features to (further) impede their fexibility and autonomy:

> "Instacart isn't going to allow [customer rejections] in instances when you actually **need** to do it such as an irate/threatening customer."

Thus, with such "high highs" and "low lows" that accompanied deeply subjective social interactions, shoppers developed love-hate relationships towards Instacart work.

5.1.3 Unreliable information sources.
Unreliable information such as informational inaccuracies, opacity and imprecise guidelines in both technical and social contexts felt penalizing to shoppers.

Instacart made few attempts to hide the platform's fragility [16], leading shoppers to often do work that one would expect from the algorithmic infrastructure. Shoppers discussed how technical inaccuracies and personal emergencies such as bugs and navigation errors, glitches, phones dying during tasks, cars breaking down could derail their routines entirely. For instance, one shopper found that every time they got to a store to complete a customer's order, the app logged them out and canceled the order when they logged back in. Another shopper found that the app would shufe the items in their order, making them run back and forth in a store to fnd items. Shoppers joked among themselves that app updates meant broken services almost always. Shoppers felt punished by such technical inaccuracies:

> "All of a sudden the app said "you have arrived" at a random spot on the side of the highway. I looked up the address manually and fnd out that I'm 30 MINUTES AWAY. Support told me this batch did not count since I did not complete it. I was compensated partially and my cancellation rate went up."

Customers also introduced social sources of information inaccuracies into the system. For example, shoppers had to deal with what they called "misreports". On Instacart, customers could give fnegrained evaluations of shoppers. They could rate them for each item shopper picked out, indicating the quality of the item and if it was missing. However, shoppers noted that this was the misunderstood and hence misused feature on the Instacart platform:

> "A customer yesterday ordered 4 favors of Propel water. The only favor in stock was kiwi strawberry (which is

one of the favors she wants). For the other 3 I clicked "item not found" and it said the customers choice for replacement was kiwi strawberry so I got all 4 kiwi strawberry. Today I wake up to a 4 star rating from her. She reported 3 of the waters missing. WTF!"

Informational opacity, a characteristic trait of algorithmic management [46, 75, 76], intersected with Instacart platform in unique ways through: a) the physical demands of grocery delivery, b) the excessive metricization of grocery delivery work by Instacart platform, and c) regulatory issues surrounding employment classifcation of grocery delivery workers. Shoppers desired information on how shoppers are matched with customers, how diferent customer orders are lumped together into 'batches', what information about them is used to assign tasks, how Instacart calculates payment, or how diferent metrics are used. In particular, shoppers sought non-algorithmic information to choose tasks appropriate for their well-being. Since grocery delivery came with signifcant physical demands of carrying heavy items, shoppers desired information about the nature of delivery and their locations.

Informational opacity was both exciting and frustrating for shoppers. Due to such opacity, shoppers were unsure about what to expect; what kinds of items were in an order; if they would fnd parking at their delivery locations; if the location was an apartment, a house or a gated community; or if the location contained stairs or elevators before accepting an order. Shoppers took chances with opaque tasks that could be highly rewarding or grossly defeating to them. For instance, one shopper took a chance with a task that yielded a whopping total of $50 on an order which was originally $12 (after the customer increased their tips). On the other hand, shoppers could end up unsuitable tasks for them such as bulky orders that did not ft in their cars or orders that demanded signifcant physical exertion. As this shopper notes, taking chances with orders could impact their cancellation rates and reduce earnings:

> "Between two customers there were 4 cases. I worried about destroying my back to make $46. Plus Instacart HID that there was "heavy pay" included. [I was forced to cancel the order], it wasn't going to ft in my car."

Imprecise guidelines sometimes intersected with opaque regulatory issues and introduced confusion for shoppers. For example, contention in employment classifcation of shoppers made it challenging for shoppers attempting to seek benefts. Shoppers were classifed as business owners or contractors for tax purposes, but found themselves performing tasks that didn't fall squarely within this classifcation. This introduced questions about claiming mileage for taxes, for getting the right type of insurance on their cars, and their eligibility for benefts and subsidies. One concrete example was that imprecise employment classifcation impacted shoppers' COVID-19 vaccine eligibility. Some states in the US prioritized 'front-facing grocery workers' for COVID-19 vaccines. However, In-stacart workers were unsure if their employment status allowed them to claim these benefts. Shoppers posted several questions such as, "Does this mean us?," "Do we need verifcation letters from Instacart to show proof that we can get vaccinated?"

Unreliability of information in Instacart work made shoppers over-scrutinize any informational sources, including internal and external resources. Due to the lack of ofcial informational support,

shoppers scoured multiple platforms for help. They found varied interpretations of rules, directions and guidelines in those external sources (often posted by their peers). Some shoppers doubly verifed all the information they gathered for the fear of being penalized for incorrect interpretations of rules. Shoppers, on the whole, found it difcult to trust any information that they received from and about the platform. Therefore, unreliable information sources led shoppers towards unconstrained individual research on the best practices for Instacart work.

5.1.4 Insuficient shopper support. Shoppers perceived "Shopper Help"—the service designated to log and help with issues faced by shoppers—as merely theatrical. The contact numbers of service representatives were hard to fnd, the service had long wait times, representatives were slow to respond, or completely unhelpful. If shoppers managed to get hold of a representative, they received canned responses such as "issue has been escalated", "uninstall and reinstall the app", "this is not an issue" for their inquiries, leaving shoppers to deal with their issues on their own.

In addition, Instacart often resolved customer-shopper tensions in favor of customers and to the detriment of shoppers. If a customer was dissatisfed with any aspect of Instacart service, they could reduce ratings and tips of shoppers, often with no justifcations. If customers were unhappy with the items that shoppers picked out, they could raise a complaint against the shopper with a 1-click feature and request refunds, potentially deactivating the shopper. If customers decided on a whim that they wanted their order canceled, shoppers were left to deal with returning groceries to the store.

On the contrary, shoppers often had no option to provide evaluations of their customers, even when customers blatantly exploited Instacart's loopholes. One shopper posted "evidence" of Instacart allowing a customer to tactfully avoiding paying extra fee for a heavy weight order by splitting into two orders. Multiple shoppers suspected customers placed "missing item" or "damaged item" complaints through the app's 1-click features to receive free groceries. Unfortunately for the shoppers, such customer exploits were hard to prove or challenge:

> "A customer from a couple days ago reported butternut squash from Costco as a damaged item which is ridiculous. I even remember picking the best looking packaged butternut squash. What should I do about it? Report it as fraud? How would I prove that though? It's so frustrating that customers do that."

Shoppers often attempted to seek help from their peers on Reddit during such moments. For instance, one shopper, whose only source of income was Instacart, and was deactivated by faulty facial recognition algorithms, pleaded for help:

> "My 5yo nephew who plays games on my phones, clicked on a batch notifcation that came up which triggered a selfe-check. I got deactivated because he took a selfe of himself. Whom do I contact to repeal this? Has anyone had this issue before?"

Unfortunately, insufcient shopper support left shoppers to largely troubleshoot and solve their issues on their own.

5.1.5 Inconsistent algorithmic scheduling. Shoppers found Instacart's algorithmic scheduling inconsistent, which introduced anxiety, fear of missing out, and confusion.

For example, pay structures changed routinely and there were new platform policies on assignment limits each day. These uninformed changes introduced randomness in earnings for shoppers, who could be making $500 one week, and just about $200 the fol-lowing week, despite spending the same amount of time ready to fulfll orders. This made it difcult for shoppers to develop and maintain their work schedules.

Shoppers sometimes reported interactions, which we recognize as dark patterns [11], that aggravated the confusion and caused a fear of missing out. For example, one shopper found a bait and switch mechanism where Instacart would lure the shopper with high paying batches when they were logged out of the apps. Another shopper noticed that the way the information presentation created a fear of missing out. These inconsistencies contributed to shoppers experiences of anticipatory anxiety:

> "Anyone else ever get that Monday morning anxiety? It doesn't matter how much I made the week before. When I see those zeros I always get a sinking feeling like I'll never make another dollar again."

These schedule changes were sometimes extremely frequent, which made it difcult for the shopper community to assess if they were indeed true changes or random, one-of incidents. Shoppers who witnessed inconsistency in batches due to possible technical glitches expressed irrational fears of deactivation from the platform. Others seemed to be unnecessarily self-critical, and expressed self-doubts. Overall, inconsistencies caused confusion in the shopper community. The shoppers' posts below highlight the confusion created by one such schedule-fuctuating incident:

> "I used to get [store name]'s orders everyday at 10AM. Yesterday I got them at 8:30-9AM, and they were all gone so fast. This morning they were showing up at 6:30-7am! I saw the message this morning about being able to go before it opens but a little more of a heads up would've been nice."

> "So are we NOT getting [store's] batches early? Or is it just that no one ordered for early delivery today? Or did IC make a mistake yesterday by releasing them early?"

Inconsistencies in algorithmic scheduling gave rise to speculation among workers; shoppers would hypothesize a specifc set of issues and gather feedback from their peers. For instance, following a "lack of batches" issue, one shopper proposed theories of diferential treatment of shoppers. One shopper seconded the oppositional attitudes of Instacart platform towards workers. Some shoppers interjected with "Conspiracy Theories," grounded in anecdotal evidence collected from fellow shoppers on Reddit; they retrospectively attributed low-tipping customers to Instacart stealing tips. Others corroborated such alternative theories of Instacart defrauding shoppers with "evidence":

> "Tipping was never great here, but it seems to have totally collapsed this past week. IC is combining multiple orders in 90 percent of batches here. Even the new shoppers seem to be passing on these a lot. I know IC got

caught [...] stealing tips in the past. It's hard to believe that over 90% of customers now barely any leave tip."

Thus, inconsistent algorithmic scheduling opened up the logics of Instacart's algorithmic management to shoppers' imaginations.

5.2 Shoppers' Responses to Ambiguity

While open-endedness (and the ambiguity that comes with it) was indeed a frustrating experience for shoppers, we also found that shoppers used the open-endedness as opportunities for playful exploration and creative expressions. Shoppers: 1) Devised strategies and exploits, 2) Generated data and evidence, and 3) Developed identities and norms.

5.2.1 *Exploits and strategies.* Shoppers devised exploits and strategies to gain competence and reduce the negative impacts of ambiguity in Instacart work. Some commonly discussed strategies included planning ahead and budgeting time for unanticipated issues, managing expectations of customers by exchanging pleasantries and constant communication, and seeking help from employees at stores by being courteous to them.

Shoppers also learned the interpretations of Instacart's vague guidelines through self and peer experiences, experimented with limits of fexibility around rules, and explored ways to navigate moments of crisis. For instance, one experienced shopper had several nuanced suggestions that exploited vague rules, tamed conficting metrics, and overturned hurdles into high-earning episodes:

> "I click the 'start shopping' as soon as I get out of my car. While walking to the entrance, I count all produce/meat/poultry items and grab the required number of bags. It takes 30+ seconds per bag with dry fngers – so I get my fngers wet from the produce mist sprayers and semi open all bags. [While shopping] if I'm 100% confdent I have the correct item in hand, I will scan even as I'm walking back to my cart. I improved my speed by 50-70% by planning ahead and focusing at the start of the order."

Over time and through extensive research, shoppers could learn to efectively employ such strategies that capitalized on the ambiguity in Instacart work. New shoppers invested signifcant time "doing research" to discover exploits and strategies from veteran shoppers.[3] We found posts of length 500-1000 words from experienced shoppers with titles such as 'Learning to maximize new rules,' 'Reimbursement request guide,' 'Some tips from a 5-star shopper,' 'Tricks to make everyone happier,' etc., that contained advice to help peers with such plans, strategies and workarounds. Shoppers reported scouring for tips and tricks on online peer support groups, YouTube videos, tutorials, and online blogs created by other shoppers; they pieced together tricks from several sources as none of these sources independently satisfed all their informational needs.

5.2.2 *Data and evidence.* Shoppers conducted informal "audits" to peek under the platform's hood and deal with ambiguities. Shoppers noted their own experiences and drew out patterns. They drew several comparisons: between previous instances of technical issues and glitches; between diferent customers; between their peers;

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[3]experienced shoppers who had been with Instacart for a few years

between other gigs. Shoppers even attempted to generate arbitrary metrics to compare their relative standing on Instacart; they asked around for shoppers with the highest tips and the most amount of help from support, impacts on ratings from review suggestions, etc. Shoppers used such data to conduct 'trends analysis.' They analyzed trends of batch and order availability, trends of technical issues, trends of customer interactions, workplace satisfaction, and general trends of well-being of the shopper community.

This practice came in handy to assess if issues they faced were unique to them, or were also faced by the broader community:

> "Anyone else hit a wall around 12 where there's just no good batches around? This happens to me a lot. By then I'll usually have done at least 2 or 3 batches and then I'm waiting 20-30 mins with good cell service & 5 stars. Most of the time now I just go home when this happens. Today it was more like an 11 o'clock wall."

Audits gave rise to a design space for shoppers. Based on these audits, shoppers proposed alternative designs for enhancing shopper well-being. Some of these were priority lists, tags for different cus-tomer orders, ways to improve informational precision in the app, 1-click customer feedback buttons for accountability, and designs for protecting themselves from questionable tactics of Instacart.

Further, shoppers collected data to defend themselves on Instacart. While shoppers found "Shopper Help" services largely unhelpful with providing solutions to the issues on hand, but often used them to draw information that was not easily accessible to them. They contacted representatives to verify if an issue was unique to them or was faced by the broader community, to receive supplemental information and to confrm any changes in policies. They also persisted with Instacart's Shopper Help to fght against negotiate ratings and disputes with customer.

For instance, one shopper collected responses from diferent service representatives at shopper help to uncover what they believed was intentionally hidden information:

> "I noticed that IC rep can only tell how many batches not how many orders I completed. I used to asked them once in awhile, I guessed Instacart blocked their ability for rep to see the info. I asked a few diferent reps."

As one shopper put it, "[harassing] IC care every single day about transferring a false rating to the fraud department faster [could make] something happen."

To aid in this efort, shoppers preemptively armed themselves with media evidence while completing their tasks. We found that shoppers meticulously took pictures of delivery with time, date and location stamps, screenshots of customer conversations and unusual requests to protect themselves from customers who could "jeopardize their jobs." Such evidence came in handy when customers tried to "defraud" shoppers by "misreporting" on their orders:

> "I just delivered an to someone who left very specifc delivery instructions. I double checked the address where they wanted it and got acknowledgement from them when unloading the groceries. Then they left a 'missing items' complaint. I took plenty of pictures. Support said trust and safety would contact for the evidence."

5.2.3 Identities and Norms. Shoppers developed identities through Instacart work. They competed with one another for the better batches, pay, better paying customers, and other material gains on Instacart. Some shoppers used screenshots of the "highest pay for a batch" they had received, sparking comparisons and conversations around their shopping practices. Screenshots of largest tips they received from customers, number of seconds they spend on items, average speed were routinely shared as identity badges and badges of honor with one another. They engaged in status display by posting screenshots of their rewards, and accompanying messages such as "Not my biggest unicorn, but still a good day for me :)," "Finally broke $120 again in my typical six hour day," "I was blessed with this lovely customer today" and so on. These interactions gave rise to shopper identities such as "5-star shoppers," "responsible shoppers," "safe shoppers," etc.

Shopper drew on their identities to make meaning of their experiences on the Instacart platform. When discussing issues, they would explain their issue in the context of their identity like being a 5-star shopper or responsible shoppers. They also leveraged their identities to persist and fght for issues with shopper support. For instance, this shopper who had customer issues lodged against them, drew on their identity of being a responsible shopper to confdently fght "misreports":

> "I'm a 5 star shopper and I woke up to my frst missing item reports today. I disputed both of them (with customer support). The items were purchased and delivered (by me). I have photos of the receipts."

Through their identities, shoppers on Reddit actively developed, enacted and refereed acceptable community norms. Shoppers implicitly and explicitly hailed as behaviors such as doing research about issues before posting on Reddit, following Instacart's rules, not exploiting 'loopholes', striving their best to earn 5-star reviews from customers, and showing humility in peer interactions as good behaviors. Similarly, shoppers condemned those who used "unfair practices to gain advantage on the platform", "used bots to secure batches" or "those who were judgemental of other shoppers". Shoppers developed arbitrary heuristics such as shopper mannerisms to profle and police one another. For instance, one shopper reported auditing the platform as a customer to identify irresponsible shoppers. Based on this experience, they proposed "the rate of item substitutions" as a proxy for shopper integrity:

> "I placed an order that had less than 30 items and a tip of $4. A quarter of the items were refunded, and 2 were replaced. I gave the shopper 5 stars and increased my tip to $12. When I went to the [same] store the next day, I found almost every item that the shopper refunded was available. I should've known there was something fshy because I was refunded an item as soon as another item was picked up."

Thus, shoppers on r/InstacartShoppers sub-reddit built community by sharing experiences, competing with one another, developing identities and generating their own norms.

6 DISCUSSION

We investigated the experiences ambiguity for Instacart shoppers (i.e., gig-workers) that gave rise to open-endedness in Instacart work. Our fndings highlighted fve diferent sources of ambiguity in Instacart's algorithmic management and the accompanying afective responses that these ambiguities evoked in shoppers.

From our fndings, we also identify fve types of ambiguity that shoppers experienced: 1) informational ambiguity, 2) relational ambiguity, 3) contextual ambiguity, 4) performative ambiguity, and 5) analytical ambiguity, which map to pre-exisitng categories extend the framework proposed by Gaver et al [25]. Shoppers experienced informational ambiguity i.e., how to interpret the information they received through routine informational imprecision and opacity. Shoppers experienced relational ambiguity, i.e., ambiguity about how to view their relationship with the platform through the subjectivity in platform's mediated interactions that introduced wavering morale. They experienced contextual ambiguity i.e., ambiguity about how to interpret unexplained outcomes when they were exposed to inconsistencies in algorithmic management. In addition, shoppers experienced what we term analytical ambiguity i.e., how to troubleshoot errors without adequate support from Instacart; and performative ambiguity ambiguity i.e., how to perform work that leads to success on the platform when they were evaluated by Instacart's confcting sets of metrics. These ambiguities gave rise to afective experiences for shoppers; shoppers experienced feelings of excitement, surprise, ecstasy, anger, confusion and frustration (Sec. 5.1). Afective experiences nudged them to approach Instacart work with elements of curiosity, exploration, refection (Sec. 5.2).

We attempt to explain the seeming contradiction in our fndings and in prior work on algorithmic management by introducing the frame of ludifcation; one we borrow from design [22–26] and media studies [53]. An orientation to ludic design (or our preferred term, ludifcation [53]) refers to the process of transforming mundane activities into playful, experimental and creative experiences [53]. Like gamifcation, ludifcation describes the design of experiences that rely on intrinsic motivation. However, unlike gamifcation that borrows elements of play to motivate towards goals, ludifcation aspires to place playfulness at its core, where curiosity, exploration and refection are central goals [22–24, 26]. Further, according to Gaver et al. [26], while ludic design aspires to non-utilitarian ideals, it can be difcult to achieve in practice [26] since ludic activities might be difcult to predict in advance [22, 23].

Thus, we follow a suggestion from Gaver et al. [23] to move beyond the "success" and "failure" binaries to assess ludic designs and instead capture the rich descriptions of engagements that the users have with the artifacts, documenting the experiences, activities and interpretations from a variety of perspectives. The question that the ludic design framework then poses is not "Was the design successful" (e.g., did it generate ludic value), but rather "what happens" when a design with ludic orientation is deployed [23]. Our investigation provides answers to the question of "what happened when shoppers interacted with Instacart, a platform that exhibited aspects of what designers understand as ludic designs?" (regardless Instacart or their designers' intentionality and orientations).

Below, we expand on shoppers' afective experiences through the lens of Gaver et al.'s framework of ludic design [25, 26] and argue that ambiguity inherent in Instacart's algorithmic management of work intentionally or unintentionally blurred the lines between work and leisure. That is, ambiguity 1) functioned as strategies for behavioral conditioning of workers and enabling production, and 2)

enabled playful participation of shoppers in the online community on Reddit. We then highlight the contradictions between the ideals of ludic design and on-the-ground experiences of shoppers. Finally, we discuss the implications of our findings for workers' collective action and platform accountability.

We would like to note that our goal in this work is not to argue that shoppers derived ludic value or that they perceived any value they derived as ludic. Neither do we argue that shoppers were aware that their experiences originated from ludic designs or that shoppers' affective experiences were non-utilitarian. Rather, our analysis of shoppers' experiences suggests that the Instacart platform could be assessed as an artifact of ludic designs (even if its outcomes on shoppers contradicts the paradigm's original ideals).

6.1 Ludification as a Lens for Algorithmic Management

Ambiguity in Instacart work enhanced intrinsic motivation for shoppers. As we observed in our findings, shoppers approached Instacart work with curiosity to uncover what they believed were hidden information. The suspense induced by partial information led some shoppers to audit the platform. These audits led shoppers to compare their experiences with others and reflect on their own performance on tasks. Shoppers paid increased attention to Instacart tasks to avoid being wrongfully penalized by technical glitches and buggy interfaces. Shoppers developed additional competencies through exploration and sharpened their planning and execution skills when dealing with imprecise, inaccurate and insufficient information such as disoriented maps, misleading navigation, and misleading icons. They also invested in props, which were sometimes sold by Instacart themselves, to achieve competence and increase their productivity. Shoppers reflected on their work practices and modified their behaviors to fit (arbitrary) norms devised by the shopper community (e.g., a shopper who "played by the rules" was a 'responsible shopper'). They even policed one another to enforce those norms. Thus, ambiguity led shoppers to self-regulate their work practices through implicit means unlike the badges, rewards and leaderboards of gamifcation [58, 59].

Ambiguity evoked affective responses for shoppers and enabled their playful participation in Reddit's online community. Instacart served as an arena for multiple activities and intrigued shoppers; they widely speculated as to how it worked or what it could do. Shoppers explored different strategies, and shared tips and tricks with one another (even if only partially [75]). They discovered workarounds and devised creative exploits that could enhance their material gains from Instacart platform. Shoppers' "alternative data" and "evidence" led to speculations on Instacart's shortcomings and provided a space for alternative imaginations. Shoppers derived meaning through peer and customer interactions.

Playful interactions between shoppers, enabled by ambiguity inherent in Instacart work, could help them subvert the dominance of algorithmic management (even if only partially) [14, 15]. Shoppers built solidarity with one another through memes and jokes on difficult customers, and found opportunities for social interactions with customers and shoppers in an otherwise solitary job. They also fostered empathy with customers that broke down the customer-shopper barriers raised by the platform. These interactions (rather than shopper-platform interactions) that were filled with laughter, creativity, empathy, and worker solidarity could be viewed as alternate dimensions of play that is integral for dealing with harsh realities of Instacart work [14, 15, 70].

However, by making space for shoppers' affective experiences and interpretations [64], ambiguity inherent in Instacart work invoked workers' self reflection and self-direction towards enhancing the quality of labor produced by the platform. Thus, ludification can be viewed as an alternate form of control where workers regulate their behavior in the pursuit of pleasure and serve exploitative capitalist projects. As such, this raises questions about the implications for worker-led collective action and platform accountability.

6.2 Implications for Workers' Collective Action and Platform Accountability

Our findings pose a question on platform designs: how can an orientation to ludic design retain its intent to produce ludic value for its users [26], but mitigate the power and control afforded to platform designers? Algorithmic and platform accountability may be reasonable solutions [72].

Yet, accountability of on-demand work platforms remains a serious challenge. Algorithmic and platform accountability mechanisms are often based on auditing the functionality and efficiency of systems, and rely on the transparency of platform's algorithms to achieve its goals. Current ways of approaching algorithmic and platform accountability do not give us the tools to audit problematic algorithmic and platform mechanisms that structure customer-worker relationships in exploitative ways, or seek their voluntary participation in emotionally exhausting gamified environments that we observed in our findings.

Collective action organizing has been a promising worker-led alternative to demand accountability in several parts of the world. For instance, in 2021, Uber drivers in the UK were reclassified as "workers", qualifying them for social benefts through worker orga-nizing eforts [48]. However, given that victories come after several months (and sometimes years) of worker organizing, many workers find themselves powerless to stand up against platforms [39, 49], and are sometimes reluctant to join worker organizing eforts [75]. Such eforts from workers can be complemented with work from the academic community. For instance, audits can been extremely powerful in calling attention to discriminatory and harmful outcomes of proprietary algorithms, and nudging platforms to make changes toward mitigation [13, 33, 68].

Further, design principles could aid in enhancing worker solidarity. In our findings, we saw that interpretive flexibility of Instacart could make space for shoppers' narratives and resist designers' accounts. As we saw, Instacart as a platform was designed in a way that it did not lend itself easily to any single interpretation; shoppers contested the rules among themselves, offered varied interpretations of outcomes, and developed alternate explanations and theories for hidden and unexplained outcomes. Some of these cast doubts on the credibility of the platform. These alternative accounts are the ones that could eventually lead to resistance.

However, Instacart's interpretive fexibility casts doubts on the ability of shoppers to develop a shared narrative and sustain political resistance. As we found, subjectivity of platform-mediated interactions allowed Instacart shoppers to ascribe diferent meaning to their experiences. Instacart's shoppers were divided among themselves about their attitudes with customers, and in general possessed varied, deeply unique relationships with the platform on the whole. Shoppers projected subjective feelings onto Instacart work, resulting in extremely personal relationship between shoppers and Instacart. This led to shoppers employing a diverse range of strategies towards seeking better material benefts from Instacart work. The efects of this were pronounced when shoppers were faced with negative experiences, such as low wages, tips or ratings through Instacart work. Some of these strategies were directed towards the platform, some towards customers, others towards themselves. This diversity of tactics arising from ambiguity poses barriers for shoppers to build and sustain meaningful resistance.

This brings us to the questions of designer and platform accountability. In using ludifcation as a lens to view algorithmic management, and as Bucher [12] points out, we ofer a suggestion to view afective experiences (or emotional experiences) and being open to multiple interpretations as central components of encounters with algorithmic systems. Such a view enables new implications for thinking about the ecosystem for supporting the responsible design and use of algorithmic systems. For instance, one could envision ludoliteracy [53] as essential components of algorithmic literacy that is required to enable worker success under algorithmic management. Borrowing from Sengers et al. [64], we also suggest that designing for systems with ambiguity must also include evaluations that allow for multiple meanings. They say, "designing systems to support a rich range of interpretations does not abdicate the designer from responsibility for the eventual success of the system. Instead, designers might develop new kinds of evaluation criteria that focus on their design goals." Taking cue from this, we ofer a suggestion to extend Gaver et al.'s [23] framework for assessing ludic designs in the feld. We call for designers to recognize the power relations between stakeholders and its implications for designer and platform accountability [54]. That is, we call for designers to not only ask "What happened?", but also "Where did our design happen?," "Who did our design impact?," and "What is our relation to those impacted by our designs?"

7 CONCLUSION

We investigated the platform-worker relationships structured by Instacart's algorithmic management. Through a qualitative analysis of Instacart workers posts on r/InstacartShoppers sub-reddit, we found that ambiguity in Instacart work gave rise to open-endedness for workers that served dual purposes of conditioning workers and generating afective experiences for them. We proposed a new frame of Ludifcation to explain the blurring lines between work and play in algorithmic management, and concluded with implications for platform accountability in on-demand work.

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