

Union Makes Us Strong: Space, Technology, and On-Demand Ridesourcing Digital Labour Platforms

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The entry of on-demand ridesourcing digital labour platforms (OR-DLPs) in Kolkata, India, restructured the local taxi-cab service industry's economic geography and spatial practices. Notably, they eroded the significance of the spatial fixity of taxi stands operated by traditional trade unions, enmeshed in local society's partisan political dynamics. Therefore, OR-DLPs triggered a reconfiguration of the socio-spatial and political practices around the taxi-cab industry in the city. Globally, traditional trade unions have struggled to organise workers in informal work arrangements and DLPs. However, in Kolkata, the Kolkata Ola-Uber App-Cab Operator and Drivers Union has proved to be successful. They established hybrid and networked unionism through technological affordances, placing worker-organisers rather than external organisers at the centre of their organisational structure. Furthermore, they undertook tech-mediated resistance against the OR-DLPs, local bureaucracy (e.g. the police) and the state. We explore this context to examine the impact of OR-DLPs on labour geography, worker-organising and resistance practices, along with the revitalisation strategies of traditional trade unions in response. From a non-Western context, we expand the frame for CSCW and HCI scholars' ongoing efforts to design worker-centric technologies for resistance.

CCS Concepts: • **Human-centered computing** → **Collaborative and social computing**.

Additional Key Words and Phrases: labour, space, ridesourcing, digital labour platforms, trade union, resistance

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1 Introduction

In 2014, on-demand ridesourcing digital labour platforms (OR-DLPs) – such as Uber and OLA – entered Kolkata, a city in the state of West Bengal in eastern India. This event fundamentally restructured the economic geography and spatial practices of the local taxi-cab service industry. Prior to this, the iconic yellow taxis, whose drivers were deeply intertwined with the local political landscape through established traditional trade union structures, dominated the cityscape. Passengers could take these taxis from the taxi stands or the streets, making them a constant presence in the city. However, these yellow taxis, licensed and metered with government-regulated taxi fares, soon started losing business to these newly entered OR-DLPs. Although unionised yellow taxi drivers expressed their frustration through street protests [105] and later made an unsuccessful taxi app proposal [38, 39] to compete in the market, by 2017, the number of registered ridesourcing cabs

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had surpassed that of yellow taxis in the city [10]. However, as we show in this paper, the scenario disrupted not merely the business of traditional taxis, but the socio-spatial political dynamics around taxi stands. Furthermore, it questioned the relevance of traditional trade unions in the taxi-cab service sector.

Existing Computer-Supported Cooperative Work (CSCW), Human-Computer Interaction (HCI), and labour scholarship have often characterised traditional trade unions as failures in organising workers engaged with digital labour platforms [116] due to the dispersed nature of the workforce and the lack of a shared collective identity. Globally, labour protests within digital labour platforms, even when organised by traditional trade unions, make up less than 20 percent [20]. Therefore, studies have been exploring new forms of collective action that are more appropriate to digital labour platforms (DLPs), including informal unionism [40], social movement unionism [35], informal cooperatives [153], platform cooperatives [123], mutual aid [116], organic ‘spontaneous’ organisations [153] and many others. In this context, it is necessary to understand whether traditional unions still have a role to play and how they are “restoring their efficacy and relevance by innovating organisational forms, crafting identities and patterns of sociality, forging alliances, and remaking working classes” [82], in the context of informal work arrangements and DLPs.

CSCW scholars have argued for expanding the design process to include worker advocacy, trade union activities, and advancing industrial democracy [28, 49, 65], with a current emphasis geared more toward data-driven worker advocacy and co-design with workers, especially in Western contexts [85]. Other works have delved into workplace inclusion and information asymmetry [1, 29]. However, workers’ antagonism often extends beyond DLPs, and targets local bureaucracy and the state, particularly in the Global South. Moreover, the affordances for resistance are also shaped by the conjectural socio-spatial and political dynamics imbued in urban cities. Evaluating the space in which workers/drivers operate is quintessential, and consequently, in this paper, we approach OR-DLPs and tech-mediated labour resistance from a space and labour geography perspective.

The aim of this multi-phased ethnographic study, employing a case study protocol, is to respond to the following research questions:

- (1) How are traditional unions, such as the Kolkata Ola-Uber App-Cab Operator and Drivers Union, adapting to the entry of on-demand ridesourcing Digital Labour Platforms (OR-DLPs), and
- (2) What role is technology playing in the collaborative resistance practices of union workers?

Our study investigates how OR-DLPs have restructured Kolkata’s labour geography and dynamics of resistance. We specifically argue that OR-DLPs destabilised the “spatial fixity” of taxi stands – signifying the convergence of commodities, i.e. the taxi cabs, information, shared knowledge of travel routes, labour, and flow of customers, into a bounded geographical place. We explore how this impacted the ordering of space and politics in the city, and we find that drivers overcome spatial atomisation and dispersion caused by OR-DLPs and facilitate collective action by adopting communicative technologies. Furthermore, we examine the strategies and technologies employed by a traditional trade union, and how it emerged successful in Kolkata through restructuring their organisation as hybrid and networked unionism with worker-organisers as the central actor rather than external-organisers. Additionally, we look at the tools used by workers to resist not just DLPs but also local bureaucracies and the state, and show how they have appropriated technology, integrating them into their everyday work-life practices, and leveraged it against OR-DLPs, local bureaucracies, and the state.

This paper contributes to CSCW and HCI scholarship by highlighting the need to look beyond addressing information asymmetry to actively supporting worker struggles, especially in non-Western contexts. We emphasise the potential of traditional trade unions in this endeavour and offer

recommendations on how CSCW researchers can help revitalise traditional trade unions to better respond to transformations in labour geography. We outline how appropriate technologies can strengthen the associational power of trade unions and bolster collaborative workplace resistance practices. We believe that this is crucial for developing scholarship on the design of activist and resistance technologies [29, 43, 98] to support under-resourced and marginalised labour communities, especially in the Global South.

2 Related Work

2.1 The Peer Economy and CSCW/HCI

CSCW and HCI scholarship has examined the digitally mediated workforce in cab services such as Uber, Lyft, and Ola, which function as online peer-to-peer (P2P) ridesharing platforms within the broader online sharing economy. Although peer-to-peer economic activities predate the Industrial Revolution and were primarily popular among working-class and marginalised racialised communities [135, 137], the novelty of online peer-to-peer economic activities lies in the technology-enabled scaling of ‘sharing’ that leverages the “wisdom of crowds to bring strangers together” [127, 137]. The sharing of personal assets, such as vehicles, offers opportunities for income generation while maximising resource usage (such as through idling capacity). These forms of sharing also facilitate the building of community among drivers.

CSCW and HCI scholarship has focused on the socio-technical systems and processes that sustain the sharing economy, including trust building (for example, through algorithmic ratings) [27, 112], privacy and safety [26, 124], and collaboration [92] among multiple stakeholders in online peer-to-peer (P2P) ridesharing platforms. Other studies have examined the implications of the socio-technical design of these platforms [42] (for example, entry barriers and community interactions and issues related to user onboarding and support) [41, 94], motivations of providers and customers for participation [16], and nature of social interactions and community building [109]. Studies that examine the design aspect of these platforms have also considered both the driver [158] and the customer [131] perspectives, and their social implications [106].

Research on the lived experiences of drivers participating in online peer-to-peer (P2P) ridesharing platforms reveals their vulnerability due to algorithmic management that encompasses ride allocation, ride monitoring, wage determination, dynamic pricing systems, work surveillance and the deployment of rating systems [90, 111, 140]. They also face heightened insecurity and anxiety due to information asymmetry stemming from these opaque algorithms, frequently changing work policies, and platforms’ unfair incentive structures and the lack of support systems [161]. Furthermore, the dependence of drivers on these platforms [99], especially in regions with high unemployment and lower education levels, such as India, hinders drivers from leaving ridesharing platforms [111]. This has led to a reevaluation of the categorisation of these platforms as part of the sharing economy [93, 100]. The monetisation of human labour and possessions by platforms like Uber and Lyft [93] has blurred the lines between sharing and the on-demand economy or the gig economy [100], as they primarily focus on economic transactions and not on human needs, reciprocity, and solidarity [83]. Building on these scholarships, we distance ourselves from the conceptual framework of the ‘sharing economy’ to understand the online peer-to-peer (P2P) ridesharing platforms as it is not appropriate to describe a profit-driven and market-mediated service [48]. We instead, understand them solely as part of the on-demand gig economy.

2.1.1 Terminologies: On-demand Ridesourcing Digital Labour Platforms. The CSCW and HCI community employ a variety of terminologies to characterise these services. This include peer-to-peer applications [1], ridesharing platforms [34, 102, 118], on-demand service platforms [132], real-time ridesharing systems [81], and ride-hailing platforms [101, 129], among others. Similarly, there are

other usages, such as digital taxi platforms, passenger taxi ordering services, and aggregators [162]. These polysemic usages arise from different ways of classifying and interpreting platform design, application architecture, and platform ethos.

In this paper, we adopt the term ‘on-demand ridesourcing digital labour platforms’ (henceforth, OR-DLPs) to capture a) profit-oriented operation of DLPs and their real-time algorithmic matching of customers with drivers, who typically offer services outside their personal travel plans [120], and b) the multiplicity of practices shaping the transport economy in the South Asian context. Hence, our aim is to underscore the labour dimension of online platforms such as Uber and Ola, avoiding the misclassification of these platforms as mere sharing of resources, which otherwise hold a progressive and egalitarian connotation.

2.2 Worker Resistance and OR-DLPs

HCI and CSCW research on worker resistance within OR-DLPs can be broadly categorised into micro-resistance and organised collective actions.

2.2.1 Micro-resistance. We identify micro-resistance as the assertion of worker agency in individual and small-scale collaborative resistance acts to frustrate expectations [122], work norms, and interests of the DLPs. Although defining the precise boundaries of this category is challenging [122], our broad classification captures everyday acts of resistance by drivers that are not based on organised collective actions and, per se, do not aim at structural changes in ownership structure, work processes, policies, or the design of technologies, but rather aimed at immediate work conditions. With respect to OR-DLPs, CSCW and HCI literature has identified drivers deploying strategies of micro-resistance primarily against the DLPs and harassment from customers or passengers.

In response to “governance systems” in OR-DLPs that lead to information asymmetry [30], driving communities often engage in resistance practises rooted in ‘algorithmic imaginaries’ [18] - a plurality of sensemaking of algorithms, based on how drivers and customers interpret and interact with algorithms. Drivers participate in online forums and social media platforms to make sense of algorithmic features [96], express their grievances with their peers and others, and gather emotional support [3]. Consequently, resistance practices include gaming algorithms for their advantage, using multiple OR-DLPs, or switching to completely new platforms [110]. At times, drivers also find ways to circumvent the algorithmic processes [77], such as by relying on “out-of-market transactions” after discovering passengers within the OR-DLPs [17]. Nonetheless, CSCW literature indicates that drivers’ involvement in micro-resistance practices beyond the tolerance limits of OR-DLPs, such as surpassing the limit for ride cancellations, could lead to income losses [129]. Hence, in the long run, drivers optimise their work practices by aligning with the best practices of OR-DLPs [129]. This highlights the significance of resistance practices beyond micro-resistance, including organised collective actions and the importance of actors such as trade unions.

CSCW and HCI scholarship has also documented resistance against passengers, such as surveillance behaviours like video recording passengers and themselves through mobile phones and dash cams for self-protection and evidence against future trouble [3, 124]. These practices also hold gendered dimensions [114], as OR-DLPs are gender agnostic [101], and insensitive to the disproportionate harassment, bullying, and challenges faced by women and genderqueer drivers. Similarly, other studies have identified drivers declining and cancelling rides to unfamiliar and hostile neighbourhoods [6]. At times, rather than resistance tactics, these actions might also reflect the drivers reproducing prejudice and stereotypes against marginalised neighbourhoods [145]. Although drivers’ micro-resistance do not often aim at challenging the structural relations in

OR-DLPs, they might serve as the basis for subsequent resistance measures [122, 128], such as organised collective action.

2.2.2 Organised Collective Action. The CSCW and HCI community has a history of closely collaborating with collective actions of workers and trade unions, especially in European and North American contexts [65, 87]. For example, the technical and research expertise within these communities has been harnessed to develop third-party software and data tools to benefit the trade union movement [65, 86, 87]. In line with this research, there have also been efforts to support worker rights and autonomy [52] in OR-DLPs. Scholars such as Dan Calacci argue for “digital workerism,” emphasising the need for workers to access, analyse, and use their work-related data and information to enhance their worker power [28]. In particular, through design interventions to assist workers in accessing and using their work-related data, supporting worker-led campaigns to audit algorithms, and implementing self-tracking applications [28, 29, 85]. This can also enhance the socio-technical resistance practices of drivers, such as their struggle against wage theft [44]. Similarly, scholars have also argued for worker-designed counter data infrastructures [136] and designing data probes as boundary objects [160], to help the process of collective action and collective bargaining. However, while data-driven worker advocacy [85] is helpful, it does not directly alter the working conditions of drivers [65] in OR-DLPs. This has also led to research visions for the design of worker-centric taxi dispatch platforms and taxi platform cooperatives through collaboration with the trade union movement [50, 138, 139].

Furthermore, CSCW research has highlighted the limited influence of traditional trade unions within the gig economy [116]. Notably, the non-traditional trade unions and other new forms of grassroots organisations have spearheaded the most successful cases of worker organising [150, 159], leveraging online communities and technologies for collective action [3, 103]. The weakness of traditional trade unions in organising non-standard workers, such as drivers in OR-DLPs, can be attributed to various factors. Some of them include: a) the emergence of spatially atomised and isolated work arrangement [116, 142], b) weak institutional support (e.g. lack of adequate legal regulations), c) inability to anticipate how technologies impact the labour geographies, d) agility in navigating new tech-mediated work management practices (e.g. algorithmic management), and e) inability to adapt organisations and resistance strategies to engage with emerging technologies [117]. Similarly, scholars have also emphasised that traditional trade unions are still grappling with the task of representing workers beyond the “white, working class, and blue-collar men paradigm” [159].

In this context, there has been a proliferation of new forms of worker organising and collective bargaining. For example, Rida Qadri’s work in CSCW [116] highlights the mutual aid networks formed by drivers in Jakarta. In other disciplines, such as labour, social, and political studies, scholars have identified self-organised network associations and hybrid organisational forms that emerged in African cities [152], platform cooperatives of women drivers in Brazil and Spain [123], the case of social movement unionism in Italy [35], and informal unionism in India [40]. Compared to other disciplines, the CSCW and HCI community has not adequately focused on the emergence of new and old forms of labour actions, formations, and organisations in the gig economy (e.g., traditional trade unions, social movement unionism, and platform cooperatives) across diverse labour geographies. Studying the socio-political particularities of labour formations and organisations and labour geographies will enhance the toolkits of CSCW and HCI community to support worker resistance in gig economy, beyond the western contexts. The future of work is also about the future of resistance, which means extending opportunities to learn from Global South experiences [116].

2.3 On-demand ridesourcing Digital Labour Platforms and their Impact on Labour Geographies

The entry of OR-DLPs has impacted the economic and labour geography of the taxi industry. The traditional taxi industry, dominated by licensed metered taxis and radio taxis (managed by private companies that typically own cabs) [5], is highly state-regulated to facilitate fair pricing and equitable access to services [79]. In contrast, OR-DLPs evade regulations by misclassifying drivers as independent contractors or partners. Moreover, OR-DLPs do not own vehicles, conduct vehicle maintenance, but operate based on gaining commissions from real-time algorithmic ride-matching and management, connecting drivers with customers exclusively through smartphone apps [120], forming what labour geography scholars identify as a “just-in-place” worker regime [155].

CSCW and HCI literature also offer significant insights to understand the changing labour geography of the taxi industry. Notably, the OR-DLPs have made traditional driver skills obsolete (e.g. finding passengers, negotiating fares, and possessing knowledge about trip routes and locations). Instead, their drivers are required to enhance digital literacy [1] and need to perform emotional and affective labour to make rides pleasant for customers [58, 118]. This shift has transformed social interactions within the cab into transactions for capital gains [130]. The communicative acts of the drivers, both bodily and verbally, have been reoriented to accommodate customers’ likability, which now determines drivers’ reputation and rewards through ratings.

Existing scholarship in both CSCW, HCI, and labour geography lacks a close examination of the concrete forms in which both old and new actors have emerged/engaged and negotiated in response to the entry of OR-DLPs. Our work, examining the concrete forms in which traditional trade unions engaged, negotiated, and adapted to the changing labour geography brought about by the advent of OR-DLPs in Kolkata, West Bengal, will be a contribution to the CSCW and HCI community in this direction.

3 Theoretical Framework: Space and Labour

As mentioned in the previous section, CSCW and HCI have examined the role of geography in shaping OR-DLPs. However, they focused mainly on human geography to understand a) the systemic (geographic) biases inherent in the platform design of OR-DLPs, notably the biases against lower socioeconomic status and suburban areas [145], and b) how geography impacts the motivation of drivers to take up the task and the influences on wages [143, 146]. Our work contributes to these emerging conversations that deploy analytical lenses from geography in understanding OR-DLPs, by focusing on a labour geography perspective, i.e., how labour practices and its attended social and political praxis are geographically structured, constituted or reconstituted [72].

We approach the question of space as a central point to understand labour geographies. While the works of Henri Lefebvre [97], Doreen Massey [107], and Edward W Soja [133, 134] are crucial in establishing an understanding of the ‘spatial’ and ‘social’ as inseparable, mutually formative, and socially constructed, these works, along with other critical scholarships in economic geography (e.g., David Harvey [68–70]) prioritise the examination of how capital actively produces spaces or how space is crucial for processes of capital accumulation. In these evaluations of ‘geographies of capitalism,’ as noted by Andrew Herod, the role of labour in shaping these geographies is either neglected or reduced to a passive or, at best, as an inert factor of production [71]. Therefore, our focus lies in emphasising how labour shapes their spatial praxis against capitalism’s evolving economic geography, particularly where labour relations are increasingly mediated by technology. In particular, we are concerned with labour’s resistance practises against OR-DLPs, which are “simultaneously embedded and disembedded from the space-times they mediate” [61] to evade regulations.

Previous CSCW and HCI works have examined questions about managing spatially dispersed workforce and how technology restructures social relations and bonds among workers [74]. Similarly, there are also studies on the temporal and spatial aspects of work, mainly within collaborative environments [67, 91, 113]. Dourish [45] argues that “the production of space is a process in which both technology and collaboration are critical elements.” He also considered spatiality to be a product of both embodied action and lived experience [of workers] [45]. Drawing on these works, we will explore how the entanglements of human-spatial interactions with technologies advance, limit, or transform worker-organising and their social and political functions. Here, by political functions, we mean how scarce resources in society are owned, distributed and allocated, and how mediation of conflict resolution in such instances is actualised [133]. In particular, in this paper, we examine the case of Kolkata, an Indian city, where the discharge of political functions vis-a-vis human-spatial interaction in taxi stands has facilitated patronage politics of trade unions and political parties. By analysing the worker-organising scenario following the entry of OR-DLPs (e.g. Uber and OLA), we aim to identify how technology has restructured the labour geography and labour resistance in this context.

3.1 Spatial Fixity and Spatial Non-Fixity

In this paper, we employ the term ‘spatial fixity’ to denote the convergence of commodities, information, multifaceted human and non-human interactions, norms, customs and social practices in a bounded geographical place. Similarly, ‘spatial non-fixity’ is employed to illustrate the disruption of these convergence points. Our usage of the term ‘spatial fixity’ deviates from the perspectives of economic geographers [60, 157] as we do not delve into aspects of financialisation, real estate, or the conditions of capital’s illiquidity, non-transferability, and non-exchangeability. Further, we deviate from Harvey’s usage of ‘spatial fix,’ which highlights the relentless pursuit of the logic of capital to overcome or resolve its intrinsic proclivities for a crisis by “geographical expansion and restructuring” [69, 70]. Instead, our focus is on how OR-DLPs have restructured the taxi industry and disrupted their anchor points, such as taxi stands. Our inquiry is limited and contingent on examining how the disruption of the ‘spatial fixity’ of the traditional taxi business with the entry of OR-DLPs impacted the dynamics of unionisation and workplace resistance, and the role of technology in this scenario. We propose the framework of spatial fixity to help CSCW and HCI scholars to analyse the convergence of various elements within a geographical location and how technologies can disrupt these convergences, such as the disruption of the socio-technical practices of workers with the entry of location-based DLPs.

4 Data and Methods

4.1 Study Overview

This research adopted a multiphased ethnographic case study approach, chosen due to the project’s specific time constraints [53], research questions [13, 66] and research parameters. These parameters included focusing on Kolkata as the location, examining the Kolkata Ola-Uber App-Cab Operator and Drivers Union, and exploring unionisation and worker resistance. The research was approved by the Research Ethics Board of the host university of the first and third authors, and is part of a larger research programme studying worker resistance and unionisation in diverse contexts. Participants were informed of the research objectives and gave their verbal consent to participate in the study. For semi-structured interviews, consent was obtained to retain audio recordings of the conversations until transcription.

The study was conducted in three phases from February 2022 to December 2022. The first phase (February - June 2022) involved building interpersonal connections with worker-organisers and

Table 1. Timeline of Kolkata Ola-Uber App-Cab Operator and Drivers Union Activities

Date	Event	Venue
18 Jul 2018	Young Workers Conference	Trade Union Office
18 Dec 2018	Meeting with Gig Workers	Trade Union Office
6 Jan 2019	Union Formation	Trade Union Office
28 Jan 2019	Protest for Fair Ride	Uber Office
13 Sep 2020	Commercial License Demand	Labour Office
22 Oct 2021	Protest Against Police Atrocity	Police HQ
5 Jan 2022	Rally Against Fuel Price Hike	City Rally
15 Feb 2022	Protest Against Driver ID Block	Uber Office
4 Mar 2022	Demand for Accident Compensation	OLA Office

trade union leaders and collecting publicly available information, including trade union’s Facebook activities. The second phase (July - August 2022) consisted of field visits, participant observation, informal conversations with drivers, semi-structured interviews with participants, and organised focused group discussions. The third phase (November - December 2022) addressed gaps from the previous phases and included informal conversations with drivers and additional telephone semi-structured interviews.

4.2 Phase 1: February - June 2022

During the first phase, the second author, an activist-researcher based in Kolkata, leveraged her pre-existing social network and attended a Gig and Platform Workers Convention organised by the Centre of Indian Trade Union (CITU) on February 26, 2022. She collected pamphlets and documents from the Kolkata Ola-Uber App-Cab Operator and Drivers Union and identified potential interviewees among conference attendees with whom researchers eventually developed a good rapport and trust. From March to May 2022, the second author conducted multiple visits to the CITU headquarters in Kolkata, where she had informal conversations with external organisers with OR-DLP drivers and the leadership of industrial unions. This helped us gain the traditional trade unions’ political perspectives on organising the OR-DLPs drivers and other workers in the gig economy. The drivers also began sharing news articles related to their protests and links to their public Facebook pages. Using informal conversations, news articles, and Facebook pages, we were able to identify key local actors involved in our field site and the activities conducted by the union. We also created a short timeline of their key activities, which we then refined with input from external organisers of the union. This timeline (Table 1) informed us about the multiple sites of the trade union’s contention, apart from OR-DLPs, including the local bureaucracy and the state, and helped us frame the interview questions for phase 2.

4.3 Phase 2: July - August 2022

The second phase involved data collection through participant observation, informal conversation by taking trips with Uber and OLA drivers, recorded semi-structured in-depth interviews, and focused group discussions. The first author maintained a field diary, where reflections for each day were organised by date [62], while the second author used audio memos to keep track of her observations along with jotting notes while interviewing participants.

During the entire fieldwork, the first and second authors were housed in Howrah, nearly 16 km outside of Kolkata city, providing us with a 45-minute ride time in a taxi-cab. We also used

Table 2. In-depth Semi-Structured Interview Participants

ID	Gender	Age	Language	Operation Area	Role in Union	Phase
P1	M	30-35	Bengali	Kolkata	External Organiser	2
P2	M	45-50	Bengali	Kolkata	Worker Organiser	2
P3	M	40-45	Bengali	Kolkata	Worker Organiser	2
P4	M	40-45	Bengali	Kolkata	Union Member	2
P5	F	35-40	Bengali	Kolkata	Worker Organiser	2
P6	F	30-35	Bengali	Kolkata	Union Member	2
P7	M	45-50	Bengali	South Kolkata	Worker Organiser	2
P8	M	30-35	Urdu	North Kolkata	Worker Organiser	2
P9	M	55-60	Bengali	Kolkata	Union Member	3
P10	M	45-50	Bengali	Baranagar, North 24 Parganas	Union Member	3
P11	M	35-40	Bengali	Barrackpore, North 24 Parganas	Former Union Member	3

a combination of these taxi-cabs for intra and inter-city rides, depending on availability. When drivers consented, we would have informal conversations with them about their working conditions, perspectives on unionisation, and political and labour contestations in their localities. We did not record any of these conversations and did not ask them to share their identity, but we only took notes. None of them chose to accept payments, but were okay with us taking longer rides while we talked to them. These rides provided us access to drivers outside the traditional trade union we were studying, and their demographic was diverse, including migrant workers from nearby states, non-unionised workers, and drivers affiliated with TMC. However, we never encountered a female driver during any of these times.

The second author had good familiarity with the region and the people, and we spent our days either at the trade union offices, talking to our participants, participating in trade union-related protests and rallies, or spending time at tea shops near the railway station and other yellow taxi stands. Leveraging relationships from Phase 1 and employing snowball sampling, we conducted eight in-depth interviews, each lasting 60-90 minutes. The participants consisted of worker organisers from Kolkata Ola-Uber App-Cab Operator and Drivers Union, and external organisers' from CITU. Even with consent, contrary to our expectations, communicating with worker-organisers who primarily rode with Uber and Ola was challenging. They remained continuously in motion to meet their daily ride targets for making a living, seldom stepping out of their cars. They would provide their work routes via the mobile phone which we had to reach when they stopped for breaks. In contrast, scheduling meetings with external organisers was relatively effortless. This experience provided us with insights into recognising 'space' and 'labour geography' as a conceptual framework for understanding the challenges of unionising activities in OR-DLPs.

Semi-structured interviews consisted of topics [126] such as work conditions, experience with algorithmic management, challenges of navigating city life, everyday resistance strategies, motivations for forming / joining the union and insight into union organisational structures. We also probed them with follow-up questions to understand inter-union and intra-union dynamics about local and provincial politics. Confidentially shared information, solely intended for our broader understanding, was omitted from the transcript and data analysis. After each interview, both authors also shared and documented their insights. Based on our shared understanding, we iterated the questions in subsequent interviews. Our participants varied in terms of gender, age, and linguistic background as shown in Table 2.

Table 3. Focus Group Discussion Participants

ID	Gender	Age	Language	Operation Area	Role in Union	Phase
R1	M	30-35	Bengali	Kolkata	Worker Organiser	2
R2	F	45-50	Bengali	Kolkata	Union Member	2
R3	M	30-35	Bengali	Kolkata	Union Member	2
R4	M	30-35	Bengali	Kolkata	Union Member	2
R5	M	25-30	Urdu	Kolkata	Union Member	2
R6	M	25-30	Hindi	Kolkata	Union Member	2
R7	M	35-40	Bengali	Kolkata	Union Member	2
R8	M	25-30	Bengali	Kolkata	Union Member	2
R9	M	20-25	Hindi	Kolkata	Union Member	2

In addition, the authors observed and participated in several protest rallies and sit-ins, thus gaining first-hand insight into collective bargaining processes and the nature of demands. One such event on 15 July 2022 allowed the authors to conduct a focus group discussion (Table 3) with nine union members, just before drivers started their protest rally at the OR-DLPs office, discovering their motivations for joining the union and their perceptions of the OR-DLPs, the local bureaucracy, and the provincial government. However, managing in-group power dynamics during this discussion was a challenge.

4.4 Phase 3 November-December

The third phase, from November to December 2022, addressed the missing gaps that we identified in previous phases. It involved several short intra-city trips with drivers of yellow taxis, Uber, and Ola. We aimed to gain a deeper understanding of the grievances of yellow taxi drivers and their history of contradictions with the OR-DLP workers. Additionally, we explored questions about how yellow taxi stands formally functioned. The second author also had informal conversations with trade union leaders of diverse political affiliations who had engagements with taxi unions. Furthermore, three telephonic interviews with yellow taxi drivers in Kolkata were also conducted to trace the nature of taxi driving before the advent of OR-DLPs (Table 2). This stage also involved reviewing past newspaper reports and social media pages of unions to understand their public-facing discourse regarding OR-DLPs and drivers' protest politics.

4.5 Data Analysis

While the field notes were in English, we translated and transcribed all interviews into English to help in a joint analysis. The first and third authors initially conducted an inductive thematic coding [64] of the transcripts and field notes jointly and finalised the data analysis in January 2023. From these codes, we developed the following themes: spatial politics, (in)visibility, political patronage, resource mobilisation, worker-organiser, hybrid and networked Unionism, and technology-mediated resistance. After developing the themes inductively, we re-examined the themes in relation to existing theoretical frameworks. This provided insights into the applicability of existing theories to our specific case study and highlighted where the theories could be expanded or modified. For instance, we assessed whether the theme of spatial politics fit into or challenged existing frameworks of spatial fixity and labour geography. Based on this re-examination, we expanded the existing conceptual usages around the term spatial fixity, to capture the dynamics of worker mobilisation and political contestations in local society.

4.6 Positionality and Reflexivity Statement

In the research process, we acknowledge that the positionality of the researchers plays a role, influencing both the drivers' confidence in sharing information with us and our subsequent analysis of the information. The first author, a South Asian man with proficiency in English, Malayalam and Hindi, has an academic background in HCI, CSCW, and political science. Although he possesses prior academic familiarity with West Bengal's labour and political history, he remains an outsider to the West Bengal society lacking fluency in its native language, Bengali. The second author is a South Asian woman student-activist and left-wing trade union ally. A native Bangla speaker, she is also proficient in English and Hindi. She has an academic background in geography and specialises in the study of international migrants. Her activism includes extensive engagement with the processes of labour union formation in West Bengal. For this study, she was able to leverage her pre-existing contacts in the traditional trade union for finding participants, creating strong bonds with them, and collecting their policy documents on gig economy. Her positionality also influenced our access to the trade union conventions of Uber and Ola drivers. However, her positionality also created difficulties when approaching members of trade unions who differ in their political affiliation. The third author is a South Asian man with a proficiency in Hindi and English and a background in HCI, CSCW, and economic sociology. Although he had only basic familiarity with the politics of trade unions in West Bengal, he was experienced in the inductive analysis process used in this paper. He critically assessed the data and methodologies and guided the analysis of the data which the first author led.

Both the first and second authors were cognisant of their positions, limitations, and standpoints throughout the research process. Furthermore, we recognise that simply sharing the same language or socio-cultural proximity with participants would not necessarily result in a first-hand understanding of the social meanings embedded in the usages, words, and signals [46] used by the workers in OR-DLPs. We also recognise that immersion in ethnographic research is "not about being in places but instead about being in a space" [46]. This realisation shaped our research process, prompting us to take extensive rides and spend time in spaces commonly frequented by drivers. This approach not only contributed to familiarising drivers' social spaces, but also played a crucial role in building trust between the participants and the researchers. We also paid close attention to gossiping, recognising it as a social process through which drivers engage in meaning-making [149], thereby revealing power dynamics within the union, political parties, and local society.

5 Background

5.1 Politics in West Bengal

West Bengal, a state in eastern India, is known for its enduring political stability under successive ruling powers. The state saw a three-decade rule (1977 to 2011) by the Left Front government, led by the Communist Party of India (Marxist) (CPI(M)). From May 2011 to the present day, the All India Trinamool Congress (TMC) has dominated the political scene in the state. Scholars have sought to understand the factors contributing to the unique political stability in West Bengal, and have examined the specific strategies used to maintain influence among the masses. According to Bhattacharya [22, 23], politics in West Bengal does not primarily hinge on religion, ethnic affinities, or caste memberships, but rather on citizens' integration within political parties. Thus, these parties mediate between the state, civil society, and the market, redirecting the benefits from these entities to influence social life for political ends, a phenomenon he identifies as a 'party society'. Furthermore, the Left Front benefited from the informalisation of the economy [125] as, with a strong cadre-based political structure, they could facilitate the transfer of institutional power to a politicised lower strata [88, 156]. In contrast, the TMC, which did not have a comparable

organisational setup, employed populist politics with pro-poor policies and used rent seeking practices, such as the operation of racketeering syndicates to maintain its political influence [78]. Thus, both parties, during their time in government, accessed financial resources and coercive power to suppress opposition during elections. This backdrop is critical when assessing the various economic and socio-spatial configurations in West Bengal.

5.2 Trade Unions in India and West Bengal

Under the Left Front rule, the relationship between state, capital and labour in West Bengal was characterised by trade union militancy against private employers and settlements made between the ruling parties' trade unions and the government with respect to state public enterprises [14]. A strong correlation was found between worker loyalty to traditional trade unions and high union participation in major industries [25]. However, a steady decline in industries from the 1970s affected the membership of these traditional trade unions.

The neoliberal turn in India's economic policy, introduced by the union government in the 1990s, met with resistance from West Bengal's Left and Communist-oriented trade unions. The provincial state not only lacked insulation and alternatives against this pro-market policy shift, but also witnessed strong worker antagonism against the state and ruling elites. Despite having pro-labour legal initiatives and a regulated labour market (compared to other Indian states), there was a "gradual slackening of the implementation of the words of law" from the 1990s, coupled with the state's diminished role in resolving industrial disputes [31]. Moreover, the labouring poor perceived the experience of unemployment and vulnerabilities around their contracts in the workplace as not merely an economic phenomenon linked to global economic liberalisation, but as a political crisis emanating from the betrayal of the working classes by the ruling elites [59].

Moreover, there were few autonomous trade unions without political affiliations in the state; instead, workers were primarily organised by the Centre of Indian Trade Unions (CITU) affiliated with the CPI (M), the All India Trinamool Trade Union Congress (AITTUC) affiliated with the TMC, the Indian National Trade Union Congress (INTUC) affiliated with the Congress Party, and the All India Trade Union Congress (AITUC) affiliated with the Communist Party of India. It was also not unusual to witness the involvement of local MLAs/ local strongmen with political ties to the ruling party or the non-state actors in labour disputes [31]. The Left Front's defeat in the 2011 election re-oriented the balance of power in union strength towards AITTUC. This was also a period when traditional trade unions were perceived as failing to represent workers' interests beyond permanent workers, including casual/temporary workers, the informal sector, gendered arenas of labour (e.g. care workers and nurses) and migrant labour [31, 119].

5.3 Brief History of Taxi Business in Kolkata, West Bengal

In 1958, the Kolkata Taxi Association took the initiative to convert Ambassador, a car modelled after Britain's 1956 Morris Oxford Series III, into taxis after Hindustan Motors Ltd (HML), an Indian automotive manufacturer, started operating in West Bengal [11, 24, 144]. These cars, painted in yellow-black for intra-city and yellow for inter-city travel, remained dominant, and were metered taxis operating with permits issued by the West Bengal State Transport Department. Over the years, Kolkata gradually transitioned to the ubiquitous dominance of yellow taxis for commuting services, with their operations anchored in taxi stands. Notably, most taxi stands operated illegally and were sustained with the help of political patronage – aligning with the ruling party or locally influential trade unions.

The city saw a boom in yellow taxis by the late 1990s due to a growing population and economy, with over 15000 cabs in operation. However, increasing traffic congestion and public demands to regulate illegal taxi stands created challenges. Despite these issues, political parties were not

interested in regulating taxi stands due to political patronage [121]. Furthermore, the social composition of the taxi community also evolved, with an influx of migrants from nearby states. These new migrant divers faced stereotyping as ‘rogue,’ ‘uncivilised,’ and a ‘menace’ [36]. Yellow taxis also developed an infamous reputation for their high refusal of rides, frequent strikes, and for not using a standardised metre to calculate the fare [12, 141]. In this context, in post-2012, the TMC government introduced new non-Ambassador taxi cars painted in party’s blue and white colours that promised no-ride refusal [36]. They also introduced more permanent taxi stands in the city [9], accessible mainly through association with the ruling party’s trade union. Furthermore, in 2014, Uber and Ola, the OR-DLPs also started their operations. Their entry brought new values and normative rules to the taxi market, with drivers undergoing training sessions and prioritising quality service, comfort, and passenger safety to ensure customer satisfaction [55]. In 2017, the registration of OR-DLPs exceeded yellow taxis in the city [10].

5.3.1 Traditional Trade Unions and Yellow Taxis. Traditional trade unions associated with yellow taxis are typically stand-based, i.e., tied to specific spatial locations around the city. Only taxi-cabs stationed at a particular taxi stand were eligible to be members of that union unit. Although controlled by local trade union leaders, the local taxi stands aim to be operationally self-sufficient. Membership in the taxi stand is usually voluntary, but mandates a daily contribution of Rs 2 to Rs 5, in addition to a membership fee. These funds, apart from covering operational costs, are used for members’ financial emergencies, such as road accidents, member-drivers’ children’s education expenses, and marriage. The local unions also employ a ‘starter,’ a non-driver who keeps track of the taxis available on the stand, records their ride-bookings, and monitors fares charged by the drivers.

The taxi drivers not only navigated their relationship with Kolkata’s city and its infrastructure, but they were also strongly absorbed by the local society’s political dynamics - including the politics of patronage. This politics of patronage manifests itself in the formation of “supportive exchange dyads” [15, 95], where the union mediated the distribution of scarce resource such as membership in (illegal/legal) taxi stands, resolution of issues with local police, and other welfare benefits, in return for drivers’ loyalty. For political parties, taxi stands in the city, apart from being an avenue to influence the lived experience of drivers, assured significant benefits for partisan politics. Although a source of daily cash flow, these taxi stands were also rapid mobilisation points for trade union and political programmes, usually steered by local political strongmen who are not taxi drivers. The unions’ strength depended on which political party was powerful in particular localities. In the context of West Bengal, what was “conceived as union strength is actually partisan political dynamics operating through the union” [104]. Furthermore, the union leadership, most of them referred to by drivers as ‘*dadas*’ (elder brothers), also appeals to drivers’ moral sensibility to influence interpersonal relations and mediate conflicts within and beyond their workspace. Therefore, political patronages are not merely “instrumental transactions” for votes, rather they signify a “living moral idiom that carries much of the life of South Asian politics and society at large” [19, 56, 115, 154].

Nonetheless, in the post-2011 period, after the decline of parliamentary communists, TMC, the ruling party secured the monopoly of collective bargaining and union membership in taxi stands. However, this does not denote the complete abandonment of the multi-trade union scenario in the city, but rather an evident shift in the balance of power, which was impeding and constraining the former trade-union powers.

6 Findings

6.1 Entry of DLPs: Destabilising ‘Spatial Fixity’ of Taxi Stands and Traditional Trade Unions

The arrival of OR-DLPs, such as Uber and Ola, in 2014 significantly reshaped the labour geographies of the taxi business in Kolkata, altering the unionising landscape for traditional trade unions. The OR-DLPs took advantage of longstanding customer dissatisfaction against the yellow taxis and primarily facilitated the destabilisation of the “spatial fixity” of taxi stands – signifying the convergence of commodities, i.e. the taxi cabs, information, shared knowledge of travel routes, labour, and flow of customers, in a bounded geographical place. This indicates that passenger commutes no longer originate primarily from illegal and legal taxi stands typically managed by trade unions, as algorithmic ride-allocation systems disrupted them. Algorithmic mediation desocialised the workplaces of taxi drivers, as they were no longer required to step onto shared spaces such as taxi stands or look for passengers in the streets. The functions of taxi dispatchers, as well as the role of local trade union leaders within taxi stands, were consequently challenged.

By weakening the entry barrier to the taxi market, OR-DLPs attracted new and old drivers as recruits and encouraged the self-mobilisation of vehicles. The erosion of spatial fixity in the taxi business, rooted in the materiality and social character of the trade union-controlled taxi stands, initially offered certain benefits to drivers. For example, while there was reduced human interaction in the distribution/allocation of rides between customers and drivers, OR-DLPs offered better incentives for drivers to join their market, optimising convenience for both drivers and customers in terms of price and waiting time for searching rides. As our participant P10 explained,

“When Uber came first time, it used to give a lot of money. It used to give double the fare of a single ride. They used to give so much incentives that I bought two cars from the car owner. Right now Uber is looting us.”

Similarly, another participant R7 brought an additional car through equated monthly instalments (EMI) from the bank and encouraged his brother to join him in the trade.

The advent of OR-DLPs, challenging the spatial fixity of taxi stands, actively contributed to eroding the unilateral dominance of yellow taxi unions. Especially for drivers previously affiliated with left trade unions, and experiencing a profound livelihood crisis as their political adversaries assumed control over Kolkata’s taxi stands in the post-2011 era, the proliferation of OR-DLPs provided an alternate entry point to rejoin the trade without the fear of facing conflicts and confrontations with traditional taxi unions and influential political leaders. Participant P2 detailed the challenges they faced following the end of 34 years of the Left regime’s governance:

“...they [TMC] forcefully captured many party and union offices. We lost taxi unions; we lost taxi stands. Anywhere they saw a red flag waving, it was identified as a threat. Many of our union members were forced to join their union; if they did not comply, they were not allowed to keep their cars in the taxi stand. Many drivers gave up in front of their pressure, but some came to us later and took the membership secretly. That is why you will see a huge dual membership among taxi drivers. They can’t do CITU openly as it threatens their livelihood, but they attend our programme away from the locality where they park their taxis.”

This excerpt highlights that the operations and dynamics within yellow taxi unions and taxi stands extend beyond the taxi business itself. They actively shape the power geometry of these spaces [107], resulting in differentiated mobility or the exclusion of drivers based on their political affiliations. For drivers who did not align with the ruling party, their concerns extend beyond the asymmetrical distribution of opportunities in taxi stands; instead, the control exerted by certain

groups over resources (such as taxi stands) and mobility becomes a means of dispossessing and weakening others. Furthermore, P4, a former yellow taxi driver from the Left trade union said:

“... I got a yellow Taxi in the year 2012, but when I went to the [taxi] stand they said that I used to do “laal jhandar party” (red flag organisation or the CPI(M)). If i have to do my business there I have to pay 50,000 rupees as fine to them, or they won’t let me work. How am I supposed to have this much money?”

Drivers, like P4, aligned with partisan left politics, joined Uber to sustain their livelihood. This highlights that the spatial non-fixity of OR-DLPs was empowering certain drivers, particularly those who wanted to distance themselves or were marginalised within the institutionalised unionism in taxi stands and their patronage politics. OR-DLPs offered a counter-space for drivers needing a livelihood and was perceived as a significant improvement over the patronage politics in taxi stands. Following Soja [134], we can view OR-DLPs facilitating the erosion of unequal collective (or individual) advantages and opportunities practised in taxi stands. Drivers contested the ‘spatial (in)justices’ in taxi stands by switching to OR-DLPs, thereby challenging the political organisation of space and the yellow taxi union’s exclusionary zoning of drivers based on political affiliations. Nevertheless, the spatial reordering of the work in the taxi business does not indicate the democratisation of power relations; rather, it signified the emergence of new forms of power relations mediated by technology and capital.

6.2 Strategies of Unionisation

Post-2011, ruling party TMC’s trade unions and their leaders dominated yellow taxi stands and other transport unions in Kolkata. The TMC was also the first to initiate a registered app-cab-based taxi union. In 2015, the West Bengal Online Cab Operators’/Owners Guild (WBOCOG) started its operation, recognising the increasing presence of OR-DLPs in the streets. Despite enjoying the ruling party’s patronage, WBOCOG could not replicate the dominance that TMC otherwise enjoyed in other transport unions. As participant P11 observed:

“You won’t get this [OR-DLPs] people in one place, you have to run behind. The TMC leader look for “anugami” (followers) who come for his [political] need when and where required. With app cab drivers, that is not possible. So they didn’t take much interest.”

The spatial non-fixity of OR-DLPs hindered the traditional partisan strategies of grassroots leaders of the TMC. Local leaders prioritised organising other taxi drivers (e.g., yellow taxis) over OR-DLPs drivers because the former had the spatial fixity of taxi stands, conducive to trade union politics in contrast to OR-DLPs drivers, whose workflow are algorithmically determined and socio-spatially atomised. Traditional taxis were more helpful for political mobilisation, and the spatial fixity of taxi stands also delivered material benefits, such as regular cash flow to the unions. Moreover, unionising OR-DLPs drivers was challenging, particularly in the initial stage, because many Uber/Ola drivers viewed themselves as self-employed. Many of these drivers were trying to own a car via a bank loan or government subsidies, in contrast to the traditional model of leasing and renting a car from the transport bosses in the state often linked to ruling party unions. Furthermore, significant driver antagonism was also directed against the local bureaucracy, mainly against police extortion and unjustified fines for alleged violation of the transport rules. According to our participant R5,

“...TMC-backed Ola and Uber union never speak a word against the police fines or government. They come to us and are eager to know our course of action, but when we tell them about protests, they always backtrack. They don’t want anything against the government.”

The WBOCOG, the union supported by the ruling party, faced significant constraints in initiating protest actions or political interventions against the police because of how the local police were connected to the ruling political party. Compared to traditional taxis with strong unions, Uber and Ola drivers were also easy prey for the police. However, the ruling party's constraints and limitations in organising OR-DLPs drivers, mainly their dominance in taxi-stand-based traditional taxi unions, the involvement of transport bosses in the union, and the inability to protest against or challenge the local bureaucracy, provided an opportunity for the opposition-backed traditional trade union.

6.2.1 The Entry of Traditional Trade Union by Opposition Party. In mid-2018, the Centre of Indian Trade Unions (CITU), a traditional trade union affiliated with the opposition party of West Bengal, began organising OR-DLPs drivers in the city. This initiative capitalised on a contingent political opportunity that arose locally. The police assaulted an Uber driver in a stronghold locality where an influential trade union leader and a former minister from opposition reside. The driver sought assistance from the opposition party and our participant P1, a youth leader and a trade unionist from the opposition party, intervened and negotiated a settlement with the police. This incident provided CITU an opportunity to organise OR-DLPs drivers, leveraging the new contacts they had gained through their successful mediation.

Mobilising references of drivers from their informal social networks, the CITU organised a meeting that saw the participation of only 17 drivers. However, despite this, they persisted in their efforts, forming a small organising committee for the app-cab union on January 6, 2019, and protested outside the Uber office, demanding improved working conditions. Over the next three years, through a series of impactful collective bargaining sessions and protests against OR-DLPs and the state, the trade union experienced remarkable growth, expanding its influence among drivers, with membership exceeding 2000 drivers.

The following section will examine the unionisation strategies employed by the Kolkata Ola-Uber App-Cab Operator and Drivers Union, demonstrating how a traditional trade union successfully unionised ridesourcing DLP drivers.

6.2.2 Traditional Trade Union's mobilisation of Resources. Acknowledging the low turnout for OR-DLPs drivers' organising meetings, the traditional trade union capitalised on its pre-existing organisational network. First, as part of the broader left political movement, they tapped into their informal social connections in youth and student organisations. Secondly, they enlisted the support of workers in other sectors for initial protest demonstrations and gathering. As R1 said;

“since we have been part of student movement earlier, we knew people who were part of our organisation and now work in these platforms. We did use our network to recruit people for this union. But we got more people who are not earlier associated with our movement by just using the one to one connection between the drivers.”

With few initial members, they needed more participation in protest gatherings to highlight the strength of their union. Therefore, workers from CITU's other trade union fronts (e.g., health sector, industrial workers) extended solidarity, held placards and flags, and shouted slogans in protest demonstrations against Uber and OLA management. As our participant P3 explained;

“We already have our network placed in the other union; in the beginning, they also came for the protest. They also helped us in tracing new people.”

This solidarity from different labour sectors was an organisational resource for the traditional trade union, tactically deployed to create an initial momentum for collective action amongst OR-DLPs drivers, who are typically socio-spatially atomised and dispersed. Other members of the trade union front also supported the union by connecting OR-DLPs drivers from their informal networks

and localities with them. This organising tactic was successful in attracting the participation of numerous drivers who were initially ignorant or uncertain about unionisation. Many drivers, while visiting the OR-DLPs' office to voice their grievances or navigating the city's traffic, became intrigued by the sizeable gatherings, exchanged mobile numbers with union members, and eventually joined the protest efforts and even joined the trade union. It was crucial for the trade union to convey to these ridesourcing drivers that many others were also in similar situations of precarity, and that, being part of a traditional trade union with lakhs of members in different sectors, they had the resources to engage in a prolonged struggle against OR-DLPs and advocate for worker rights from the state.

6.2.3 Formation of WhatsApp groups. With extensive experience in worker organising, the traditional trade union recognised the need for a robust organisational structure to sustain the engagement of newly recruited drivers. However, traditional strategies of mobilising workers through in-person meetings and conventions were not effective for OR-DLPs drivers. Participant P1, an external-organiser, observed:

“It’s a different thing when you take part in a spirited agitation for one day, but continuing that in a regular organised fashion was not the drivers’ cup of tea.”

Understanding the challenges in organising OR-DLPs drivers, who were dispersed due to algorithmic technology and not anchored to fixed taxi stands, the trade union adapted its approach. They created a WhatsApp group with more than 100 drivers for information sharing. However, despite this digital approach, the union struggled to mobilise drivers for in-person union meetings, as many had no prior experience in trade union activities, leading to low attendance at union events, a challenge faced by earlier unions such as WBOCOG as well.

Consequently, the trade union was forced to rethink its traditional working style; instead of regular (in-person) hall meetings, they started driver coordination using communication technologies, mainly WhatsApp groups. A ‘mother group’ (admin group) was established with key worker-organisers and a few external organisers from the traditional trade union. These worker-organisers coordinated unionising activities with various locality-specific WhatsApp groups of OR-DLPs drivers. The adoption of WhatsApp indicated a significant shift; in-person meetings become avenues mainly to nurture and sustain existing social bonds. The embracing of WhatsApp as central to unionisation highlights how communication technologies help negotiate the challenges caused by spatial non-fixing of taxi stands and socio-spatial atomisation and dispersion of labour.

6.2.4 Technology, Visibility and Emergence of Worker-organiser. For unionising the OR-DLPs drivers, spatially dispersed and atomised by technology, the visibility and role of worker-organisers was quintessential. Participant P8, a worker-organiser, shared his strategies for encouraging OR-DLPs drivers to join the union:

“The basic method of our organising involves talking to fellow drivers while waiting for rides. It is obvious that when drivers are talking then they will talk about their work conditions and harassment by police etc. This is the starting point from which we work to organise those who are still out of the folds of our union.”

Besides being spatially atomised and dispersed, the opaqueness and information asymmetry around the net driver strength in a DLP also presented significant challenges for the union. Therefore, the union had to adopt visibility-enhancing techniques to find and connect with more fellow drivers in the OR-DLPs. Our participant P7 said;

“I used to start conversations with other OR-DLPs drivers in Traffic Signals. The union sticker in our cab helps as a conversation starter. I spoke about the union to my fellow

driver, and at times I have added a few of them to our WhatsApp group while at the signal itself.”

Algorithmically-managed taxi driving is often continually in motion, with the app ensuring a continuous flow of customer pickups (unlike waiting sequentially for their turn in taxi stands) and consequently restricting and minimising driver-driver interactions in their workscape. As worker-organisers, drivers affiliated with the union grew the network of drivers and facilitated collective action on each porous and temporal opening within the algorithmic work process. In this process, ensuring the visibility of their trade union was important. Therefore, pasting the stickers of their union on worker-organisers’ and union members’ vehicles was both a signifier of drivers’ unity and a friendly invitation for other drivers to engage in conversations about it. Moreover, OR-DLPs drivers also navigate the everyday uncertainties inherent in taxi driving, such as a vehicle breakdown, and their visibility as drivers’ fosters the workplace solidarity. As our P6 explained:

“It’s easy for me to communicate with fellow drivers. When we take a break in front of the tea stalls, we discuss the problems we face on the road. Many people think union doesn’t benefit anyone. But I have to make them understand... I can’t force them. They won’t understand if they don’t have needs. That’s human nature. Suppose the car is not starting or the tyre gets punctured or maybe a stepney (spare tyre) got punctured, being a driver it’s our duty to help other drivers. Because he has to go 10 Kms or 50 Kms away from the spot to get these repaired, but who is going to watch the car?”

These shared experiences and challenges arising from the uncertainties inherent in their work were crucial in fostering a sense of workplace solidarity. Our focus group discussions revealed a few major sites where worker-organisers facilitated trade union activities: outside the railway station and airport, where OR-DLPs drivers were bound to wait for passengers for at least some minutes, and outside the Uber/OLA office in Kolkata, where drivers usually come to report work-related troubles and grievances that they are facing. As mentioned previously, many worker-organisers also built their informal social network, for example, while stopping for a cup of tea on the highway, at traffic signals, and in the garage where they parked their car at night.

Since the trade union’s mobilisation was not limited to the issues within the OR-DLPs but also against the harassment by the city bureaucracy, they initiated confrontations (with the help of senior trade union leaders) in front of the police headquarters. The public visibility of confrontations, particularly against symbols of power in local society (e.g. bureaucrats and police), also motivated non-unionised co-drivers from the OR-DLPs to join the union.

6.2.5 Hybrid and Networked Unionism. The integration of ICTs in labour practices and subsequent worker resistance led to the formation of a hybrid and networked union, placing drivers at the forefront of organising. This marked a significant shift from traditional trade unions in other industries, which often rely on external organisers. Moreover, it challenges the notion that “workers are not needed as central actors in their own emancipation” [108]. Thus, the hybrid and networked unionism enabled the OR-DLPs drivers to take a lead role in organising, rather than being an inert worker-member or awaiting decisions from the top of union hierarchies. According to participant P1, an external organiser:

“If you look at our union, our leaders are mostly the drivers themselves. We were there initially, helped them in drafting letters, petitions, led the bargaining with the company and the police. But now we only go if there is a big emergency, rest everything they take care of themselves. They are learning to negotiate and even teaching the junior cadres.”

The excerpt demonstrates that these drivers had developed the confidence to navigate various labour situations independently. Moreover, they quickly acquired the skills of unionism, including engaging in negotiations with both police and OR-DLPs management. This allowed external organisers of the traditional trade union to be in a supportive role, rather than making active interventions on a regular basis.

The hybrid and networked union's everyday functioning significantly depends on ICTs (e.g. WhatsApp and the use of other social media platforms), and it helped override drivers' algorithmically enforced spatial dispersion. The drivers were organised into WhatsApp groups by operating in distinct localities, which served as the building blocks for effective coordination within the network. These individual locality groups seamlessly collaborated with each other via their respective admins (key worker-organisers), ensuring smooth communication and fostering a sense of unity. Ultimately, all local groups were connected with the "mother" group, serving as the hub for coordination, quick and proactive decision-making, and the rapid exchange of crucial information. This cohesive networked structure enabled drivers across different localities to engage in resistance and mutual support practices efficiently and effectively, strengthening their collective efforts in pursuit of their shared goals – the betterment of their precarious living conditions. For example, our participant P9 spoke about an encounter with the local police when he failed to stop at a traffic light:

"... two Green police chased him and told him to come out from the car. When they were abusing him verbally, he began to do a Facebook live. Police spat a slang to him and threw the phone. He was forced to go to the station and was arrested. When two drivers heard about his arrest and went to protest, they were arrested too. So we send voice [message] in [WhatsApp] group to bring all the cars to the road – let's see how many of them would be arrested. When OC heard this, under no conditions, they released the driver and all charges framed against him was dropped."

Thus, the technological affordances of ICTs for quick communication, coordination, and union actions help drivers reimagine spatiality with network dimensions. This mode of unionism, with digital coordination aiding their physical actions, helped the drivers contest the algorithmically enforced spatial atomisation and dispersion of drivers. Furthermore, since ICTs were central to the unionisation efforts of OR-DLPs drivers, they also reshaped the normative expectations and valuations around who is a good organiser. The people who could add more drivers to the WhatsApp group gradually became the group admins and were co-opted into the mother group. Similarly, the ability to quickly react, mediate, or attend to fellow drivers' concerns in WhatsApp groups also started indicating the good organising qualities of emerging worker-leaders.

6.3 Tools of Workers' Resistance: Associational Power of Labour and Tech-mediated Resistance

The resistance led by unionised OR-DLP drivers was directed against OR-DLPs, local bureaucracy, and government policies. From the OR-DLPs, the drivers demanded an increase in the commission rate, the introduction of accident coverage, unblocking driver IDs, and more social security benefits. Their grievances with the local bureaucracy were police harassment of drivers and illegal transport-related fines and charges. Furthermore, drivers demanded policy-level intervention from the provincial government to ensure dignified living conditions for OR-DLPs drivers from OR-DLPs.

6.3.1 Resistance Practices against the OR-DLPs. In recent years, drivers have won numerous small and big victories against OR-DLPs that refuse to recognise them as workers or employees. Significantly, the protest actions of these drivers asserted their associational strength and enhanced the public visibility of the challenges faced by OR-DLPs drivers. The trade union has framed the grievances of drivers not merely as an issue to be tackled by the OR-DLPs alone but as a matter

requiring state intervention and customer support. Notably, the union also demands accountability from their drivers regarding their conduct toward passengers. They also discourage drivers from engaging in micro-resistance practices, such as out-of-market transactions, ride rejection, and simultaneous usage of multiple platforms. As our participant R1, a worker-organisier explained;

“We regularly conduct meetings and counselling sessions to ensure that no one misbehaves with the customer. No one should cancel rides. In case of complaints, we verify the driver’s union membership with the company using their car number [licence plate], and appropriate action is taken. We take the responsibility seriously to ensure that no driver misbehaves with the customer, even if the customer behaves badly.”

As per the union, they discourage these acts of micro-resistance and emphasise accountability from the drivers towards customers to avoid hindering their collective bargaining process. Nevertheless, many drivers like P8 have not completely given up micro-resistance strategies:

“The cheating by these companies forces us to adopt unfair means like driving with other accounts. Even though our union tells us not to adopt such means, but with no work many of us adopt them.”

Moreover, the drivers also pointed out that customers also engage in unfair practices. However, the union emphasises avoiding confrontation with customers and instead focusses on making OR-DLPs listen to the drivers’ grievances. As participant R1 said; “Why should we go behind customers when the company has the power to alleviate the drivers’ situation?” Furthermore, according to worker-organisiers, their greatest strength lies in the associational power of the union, as protest actions based on that can significantly impact OR-DLPs’ business. According to P5, a worker-organisier:

“If we call for a protest, depending upon the intensity we can gather 600 to 2000 people at no time. Imagine suddenly so many cars being lifted from the business, it shows a “red,” meaning high demand and low supply. According to the algorithm, it automatically surges the price for customers. With the increase in fare, many are not likely to use the app, which affects the business of the company.”

Here, we see how the lived experience of drivers with technology facilitated the collective sensemaking of opaque algorithms and identifying openings for the associational bargaining power of labour. The unionised drivers believed that ensuring the sudden and massive withdrawal of their labour would cause a price surge, affecting customer opinions and preferences. However, our participants observed that more than these protests hampering their business, OR-DLPs were more concerned about public perceptions, especially given how public opinion often shapes state regulation. Thus, these protests helped drivers bring customers and the state into the discourse. Worker-organisiers, however, mentioned that they preferred dialogue, and only when they were out of choice, they resorted to visible forms of protest actions to appeal to customers and politically conscious citizens.

Besides acts of overt resistance, OR-DLPs drivers also use various mobile applications to navigate their everyday work life. They use weather apps to plan their workdays and decide which routes to avoid while accepting algorithmic work allocation. They use apps such as TAXImet, which calculates the distance covered in each trip to perform an algorithmic audit concerning their wage theft. Not only does this practice highlight drivers’ distrust of OR-DLPs, they are crucial technologies of resistance practices, as they provide evidence for their collective bargaining against the OR-DLP’s malpractices covered with algorithmic opacity.

Moreover, drivers also used union WhatsApp groups as spaces for sharing mundane information (e.g., about traffic in particular routes and weather conditions) and resource sharing (e.g., information

about a new mobile application they discovered). Therefore, in addition to resistance goals, these groups also serve as sites of mutual learning, enhancing the digital literacy of drivers. It is important to emphasise that all these workarounds are discoverable only for a driver from their everyday labouring experience, underscoring the significance of worker-organisers'.

6.3.2 Resistance Practices against the Local Bureaucracy. OR-DLP drivers routinely faced challenges with the local bureaucracy, especially the police. For police who were familiar with yellow taxis that enjoyed the flow of political patronage anchored in the spatial fixity of their taxi stands, the spatially dispersed workforce in OR-DLPs was a soft target for exerting authority. However, through unionisation, the OR-DLPs drivers learnt to coordinate and mobilise fellow drivers using communicative technologies, and started asserting their associational power by disrupting the city's traffic if the police overstepped their boundaries. The drivers realised that they were spatially dispersed only while their taxi cabs were in motion, but once they collectively halted, their cabs could disrupt the movement of humans, goods, and services in the city. This associational power forced local bureaucracies to start treating drivers with more respect. One of our participants, P8 as worker-organiser, recalled one of many such instances where a driver was harassed and immediately spread the word using the app 'Online Walkie Talkie Pro'.

"Police literally begged us, pleading to clear the traffic and discuss the issue at the police station. Drivers from different localities were present, they said that a discussion can be done but the cars won't move, until the police apologise."

P8 emphasised "union" and "strength" while speaking with us; his emphasis signifies how he perceived union and strength as synonyms. For him, dignity was central to the workers' resistance. The union not only fought for drivers' economic rights, but also attended to questions of dignity and recognition. Furthermore, drivers use a range of technologies in their resistance practices to flatten the power geometries of everyday urban life. P7, a worker-organiser, enthusiastically explained the app 'Online Walkie Talkie Pro' on their phones:

"The police have their walkie talkies to communicate. We are not intimidated by that. We, too, have our walkie-talkies on our phones. Whenever they create an unwanted fuss against us, we mobilise our people through this."

For drivers, having this app for voice communication is easier than using text, which is hassle-free, especially while driving. They can have multiple channels according to their needs, including a channel for emergency services. According to P3, a worker-organiser: "so we use channel 1 for emergency service; if you are stuck somewhere, you can directly leave a message on channel 1, this will reach everyone immediately." The app highlights how drivers leverage ICTs for driver mobilisation by finding the technological affordances that most suit their workspace. Moreover, it also gives drivers a sense of symbolic empowerment against the police since they regard the app as an equaliser against policing technologies.

Moreover, many drivers are not comfortable with the English language. Hence, they prefer voice-run software interfaces like 'Online walkie talkie pro' rather than text-based software interfaces. Therefore, the choice of drivers' software selections also indicates how they navigate their deprivations in educational capital. Nevertheless, with regular interaction in the WhatsApp groups, many drivers started picking up the essential English commands for running maps, metre app, etc.

The drivers also introduced us to the "CoolNCool" app, a background video recorder that they used during encounters with the police. The application records audio and video unnoticed. If the police confiscated their phone while conversing, the phone does not show any signs of any camera function. Drivers use these recordings as evidence if the police ask for bribes or resort to physical and verbal assault. Drivers share such videos on their union WhatsApp group and

later circulate them on social media, keeping the excesses of local bureaucracy in check. Many drivers also conduct Facebook Live streaming of conflicts they have with police or officials from the local bureaucracy. Here, drivers have appropriated, personalised, and reconfigured technologies to design resistance practices appropriate and relevant to their situation.

The apps like Online walkie talkie pro and CoolNCool, which are now crucial assets to their resistance against the police force in the streets, were randomly discovered by the union's worker-organisers. According to drivers, most of their technological know-how is self-taught and discovered in their leisure time on their smartphones. As P7, a worker-organiser described:

“...many of our drivers are illiterate or less educated. We have to teach them even the basic functions in WhatsApp as well. We, as a union, take the initiative to teach them about the functioning of WhatsApp, walkie talkie, and other apps for duty.”

The excerpt highlights how knowledge-sharing culture and measures for enhancing digital literacy amongst union members are crucial to their resistance practices. If drivers learn anything new, when they meet with other union members in-person or through their WhatsApp groups, they share their knowledge about newly founded apps. Such a culture, developed based on nurturing solidarity, provides insights about their hybrid and networked tech-mediated resistance practices and drivers' awareness of power relations working against them.

7 Discussion

Existing CSCW and HCI scholarship predominantly focusses on resistance experiences within Western labour geographies. Most ongoing conversations on supporting worker resistance are also heavily data-centric [28, 160] and design-centric [29, 85], relying on approaches such as creating new digital tools and data-driven worker advocacy to support worker resistance. Such approaches imply that attending to worker precarity is primarily about addressing information asymmetry against the black box of algorithmic management. We argue that beyond information asymmetry, worker precarity in OR-DLPs is primarily a product of the logics of coloniality and extraction inherent in the political economy of this new labour regime, which take advantage of broader socio-economic and political issues such as rising unemployment and vulnerabilities of migrant and other oppressed communities. Therefore, the CSCW and HCI community need to envision designs to democratise not just technology but also social and political relations.

Although challenging information asymmetry helps support workers/drivers navigate everyday vulnerabilities and exploitation [28], we also need to explore how designs can support workers in gaining labour rights and social citizenship through protest actions and struggles. As Dunne and Raby [47] argue, citizen actions, such as protests and boycotts, can be more effective in making a point than the design itself. The history of the labour movement also affirms that protests can compel private capital and the State to do what they would not otherwise do. It is in this direction that the revitalisation of traditional trade unions – which have an extensive legacy of gaining political rights through struggle – is pertinent. This is particularly important as we focus on workers in global contexts. First, unlike the North American context [87], in countries like India (with differing modalities on trade union recognition process [57]), most trade unions do not have extensive histories of utilising data-intensive computing tools to manage their membership and outreach. Some trade unions are also ideologically opposed to developing alternative applications and digital tools as part of the trade union movement, as they are sceptical of its sustainability [147]. Second, designing alternative platforms in contexts such as South Asia faces unique challenges due to resource constraints and a reluctance to digital unionism and the endorsement of digital activism for a variety of reasons [51, 148, 151].

In this context, our ethnographic study on the Kolkata Ola-Uber App-Cab Operator and Drivers Union, exploring the role of technology in the collaborative resistance practices of union workers, opens up conversations and provides insight even for trade unions and other worker organisers in South Asia and the majority world. This is one of the ways we envision for the CSCW and HCI community to support worker struggles in contexts outside of the West. Furthermore, studying the socio-political particularities of labour formations, organisations, and labour geographies, with a focus on the role of space, will enhance the toolkits of the CSCW and HCI community to encompass a more global view of labour dynamics.

7.1 OR-DLPs, Spatial Practices, Technology: Implications for CSCW

We extend existing CSCW and HCI work on the interplay between spatial practices of labour and technologies [37, 45, 91]. We argue that to understand the relationship between labour practices and technology, we must consider the ‘affordances of spaces’ [54], which is not merely an outcome of design, but rather a complex assemblage of ‘historical’, ‘social’ and ‘political.’ Further, to evaluate spatial practices in labour geographies, researchers should pay attention to the unfolding of political contestations in spaces. Hence, designers need to consider not merely the intersection of space and technology but also how they are embedded and unfolded within existing power dynamics [2, 89]. We can then perceive design as conjectural and evolving, and not as a finished and settled process.

As identified in our study, prior to the entry of OR-DLPs, taxi stands represented the associational power of drivers and the strength of traditional trade unions in West Bengal. These stands served as discursive sites where political contestations were articulated, especially in matters concerning the allocation of scarce resources, such as ride allocation and welfare benefits. Although not rigid, the exclusionary character of these stands often preserved the local partisan political order, and consequently the spatial fixity of taxi stands determined the limits, possibilities, and dynamics of unionisation. The entry of OR-DLPs challenged these socio-spatial and political dynamics. Hence, previously marginalised actors in taxi stands, such as drivers aligned with rival political parties, found an entry point to sustain their trade and livelihood. Therefore, the CSCW community needs to recognise that the restructuring of space and spatial practices by technology is not a zero-sum game. The gains and losses of the stakeholder communities are contingent on the socio-spatial and political dynamics in local society. Therefore, studying space and labour geography for the CSCW community highlights possibilities to assess the costs and benefits for stakeholder communities, as the design of technologies can facilitate the transformation in spatial order and relationships.

Furthermore, the spatial atomisation of the labour process was also eroding the ‘social’ and ‘political’ of drivers and turning them into a neo-classical economic subject - a rational individual focused on maximising benefits. A socially isolated driver is highly dependent on the OR-DLPs, whereas a socially involved driver leverages community support for the social reproduction of labour. Hence, OR-DLPs by restructuring the spatial practices of driving disrupted not merely the influence of traditional trade unions (and, by extension, political parties) but drivers’ affordances for collective action by declining common spaces for sharing experiences. This experience forced the OR-DLPs drivers in Kolkata to reimagine spatiality through tech-mediated network dimensions, which we identified as hybrid and networked unionism.

The case of Kolkata Ola-Uber App-Cab Operator and Drivers Union is particularly notable because, in the current epoch, there is a significant failure globally of traditional unions in organising and unionising OR-DLPs drivers. They are no longer the primary catalyst for labour unrest [7]. Instead, we observe that workers’ mobilisation and their labour actions are evolving into more new forms of unionism [7]. Therefore, the lessons from the Kolkata Ola-Uber App-Cab Operator and Drivers Union will be valuable not only for the CSCW community in designing worker-centric technologies but also for worker-organisers around the world.

7.2 The Relevance of Traditional Trade Unions

Beginning from the 1980s and 1990s, the informalisation and fragmentation of the production process led to a significant decline in traditional trade unions' membership and capacity for collective bargaining [84]. In this context, scholars have argued that traditional trade unions often fail to represent workers outside of industrial workers in the formal sector, including the gig economy, and are losing relevance [159]. While the CSCW and HCI community has worked closely with traditional trade unions to support their activities [52, 65, 85, 86], the question of revitalising them for the new digital labour economy needs further exploration. In the context of gig economy, while the CSCW and HCI community has explored the non-hierarchical self-organising networks of workers [63, 75, 102, 116] built on informal networks and personal trust, these formations have significant limitations as non-institutionalised actors, especially if we are envisioning a structural transformation of the existing work relations within OR-DLPs or confronting actors such as the state. In these contexts, we contend that traditional trade unions are not only relevant actors in worker organising and resistance, even in the gig economy, but hybrid and networked unionism reimagines traditional trade unions to incorporate these informal elements of support such as mutual aid networks [116] and online support communities [75]. We identify four crucial aspects where traditional trade unions can enhance the toolkit of workers' resistance in the gig economy, particularly in non-western contexts.

First, as noted in our study, the CITU, the national-level traditional trade union, could leverage their cross-organisational resources and pre-existing informal social networks to assist the Kolkata Ola-Uber App-Cab Operator and Drivers Union. This strategy enhanced the visibility of the drivers' protest actions and encouraged new drivers to identify the union as a resourceful entity to support them.

Secondly, the social and political legitimacy of traditional trade unions and their external organisers in local society is crucial for drivers to initiate their negotiations with OR-DLPs, local bureaucracy, and the state. Unlike the norms in Western countries, the associational power of unions like the Kolkata Ola-Uber App-Cab Operator and Drivers Union, as well as other unions in the informal sector, is not often legitimised through any collective bargaining agreement with OR-DLPs. Instead, the size and membership are a proxy for their political relevance. By affiliating with CITU, the Kolkata Ola-Uber App-Cab Operator and Drivers Union leveraged the latter's legitimacy as well as strength in engaging in strategic bargaining, preparing press releases, utilising their networks in the media, and accessing legal resources.

Thirdly, external organisers of traditional trade unions are not a hindrance to worker organising. As our study demonstrated, external organisers might not be the most efficient actors to organise drivers on an everyday basis, given the erosion of spatial fixity. However, they can still play a crucial supporting role. External organisers are full-time trade unionists, trained and skilful in bargaining with companies, possess influential social and political networks in local society, and represent the potential for external mobilisation and political support for drivers. Importantly, as noted in our study, they also provide the courage for amateur drivers to confront other symbols of power in local society, such as the police and labour officers.

Fourthly, traditional trade unions can play a crucial role in orienting drivers' focus points in the resistance, as they do not perceive the grievances of drivers in OR-DLPs in isolation. Instead, they place the drivers' and other gig workers grievances within the broader political economy and political processes of the state. Hence, they mobilise workers to self-identify as part of the national labour movement, and participating in events like general strikes. They also organise and wage protests against provincial governments, demanding state regulation of OR-DLPs, and against the union government on issues such as fuel price hikes. Given that traditional trade unions are not

spontaneous workplace mobilisations to address immediate grievances, but rather institutionalised actors with prolonged histories, they have the potential to broaden the political frames for OR-DLPs drivers and other gig workers to identify the interconnectedness of issues related to precarity, economic downturns, political polarisation, rapid technological shifts in workplaces, casteism, islamophobia, racism, and ecological crises.

As HCI and CSCW scholarship imagines new futures where we build solidarity between various labours across borders and contexts [8], we need to consider how traditional trade unions can be effectively utilised, and how their revitalisation in a digital age can contribute to workers' resistance. We offer some recommendations on how CSCW researchers can help revitalise traditional trade unions to better respond to transformations of labour geography, characterised by socio-spatial dispersion and atomisation.

7.2.1 Technology and Traditional Trade Unions: The spatial fixity enjoyed by traditional trade union politics is eroded by OR-DLPs algorithmic technologies, destabilising existing work relationships and political mobilisation in local society. However, technology can also serve as an antidote, offering the potential to reimagine and reconstruct social spaces. This is one important reason why CSCW and HCI scholars need to recognise the importance of space and labour geographies in understanding the gig economy and supporting their resistance practices.

In our study, we identified the Kolkata Ola-Uber App-Cab Operator and Drivers Union as crafting new spatial imaginations with the help of technologies, fostering new ways of connecting, sharing, and organising. This involves relying on platforms like WhatsApp and communicative applications like Walkie Talkie instead of the conventional approach of regular in-person meetings. As noted in previous CSCW studies on gig work [116], in-person meetings primarily help to nurture and sustain existing social bonds. Furthermore, in constructing a technology-mediated spatial imagination to sustain union functioning, drivers emerged as crucial nodes in the network, and their activities determined the motion and momentum of the union. These drivers found the porous avenues and temporal moments within algorithmic work processes to recruit new members that developed and expanded the union's network.

Therefore, as everyday functions increasingly rely on ICTs and worker organisers emerging as the central actors of unionism, the organisational structure of trade unions has undergone a reconfiguration. We identify this transformation as hybrid and networked unionism, where drivers have reimaged and redrafted their relationship to spatiality through tech-mediated network dimensions. This indicates lessons for other contexts; if tailored to the conditions of local society, trade unions can leverage technology to revitalise their organisations amid changing labour geography and the shrinking social spaces for labour.

These drivers also reinvented their social world using communicative technologies like WhatsApp and Walkie Talkie apps. The design of these non-hierarchical communicative platforms, such as WhatsApp and Walkie Talkie is significant as it also enabled the drivers to voice their grievances and concerns and helped them mobilise 'sociality of empathy' [40] and solidarity from fellow drivers. In particular, affective exchanges and interactions helped solidify social relationships among drivers as they discovered a shared platform to voice their concerns, received immediate support, and fostered a sense of community. Further, the ability to quickly react, mediate, or attend to fellow workers' concerns in communicative platforms, identify new participants, and regulate participant decorum in communicative platforms became essential leadership qualities.

Moreover, the design of these platforms helps maintain transparency, and the arbitrary distribution of resources is difficult by design. Drivers find it easier to voice injustices within these communicative platforms than in-person meetings where different norms of performativity, decorum, and power relations are at play. We thus add to design scholarship [21] that shows how the

use of communicative technologies can facilitate non-hierarchical organisation. In our study, we see how normalising the flattening of intra-union hierarchies within these platforms translates to solidarities on the streets. Hence, these communicative technologies play a crucial role in ensuring democratic discourse both within a union and more broadly.

The Kolkata Ola-Uber App-Cab Operator and Drivers Union represents a scenario in which traditional trade unions have utilised technology to confront the challenges of unionism posed by algorithmic spatial dispersion and atomisation of drivers. While drivers appropriate and customise technology according to their workspace needs, it is important to recognise that technology also shapes their union's organisational structure and processes. However, as discussed in earlier sections, the political will and degree of openness for traditional trade unions to engage in such experimentation are contingent upon the political opportunity structures within the local society. Therefore, for the CSCW community, it is crucial to note that the appropriate design of resistance technologies does not necessarily guarantee their adoption by unions. Instead, technology use is just one aspect of the socio-political processes unfolding in the local society.

7.3 Tech-mediated Strategies of Resistance

Existing CSCW and HCI literature on resistance primarily concerns strategies and tactics against OR-DLPs and customers [3, 28, 90, 96]. In non-Western contexts such as India, both the micro-resistance and organised collective actions of drivers are also oriented against the local bureaucracy – for example, the police, for extracting illegal fines and bribery. Drivers also lead protest actions and demonstrations against the provincial and union governments for matters such as price hikes in gas prices and other transport-related policies. Hence, we need to closely examine the socio-technical resistance practices of the driving community beyond the OR-DLPs and customers.

As emphasised in our study, technology, besides fostering hybrid and networked unionism, also plays a critical role in everyday resistance strategies of drivers. Technology allowed drivers to create protest spaces in the urban landscape and leverage the porous avenues in the labour geography of OR-DLPs business to (re)discover their spatial fixes. Particularly, communicative technologies facilitated drivers' coordination and collectively brought them back to the streets to assert their associational power. This ability to unite drivers counters the spatial dispersion of labour enforced by the algorithmic management, enhances their agency, and opens up the possibilities of asserting the driver's structural bargaining power in the taxi industry.

Strategic disruption of city traffic by halting their cabs is among the most significant tactics to push back against local bureaucracy (e.g., police), the apathy of the state, and OR-DLPs. If micro-resistance was an organic proclivity of spatially dispersed and unorganised labour, organised under a traditional trade union, drivers were more prone to labour strikes, demonstrations, *dharnas*, and confrontations against various power relations. Notably, drivers shed their 'invisibility' imposed by algorithms and emerged as a 'visible' workforce on the streets, compelling ridesourcing DLPs, customers, and state authorities to acknowledge them. Their protests not only could dictate the discourse on the streets, but also disrupt its flow. If mistreated, the blaring horns of motionless app-cab taxis disrupted the hustle and bustle of city life, pressuring concerned authorities.

Drivers also used technologies (ex. TAXImet) to conduct algorithmic audits, screenshot instances of wage theft and violation of incentives, and share in their WhatsApp groups as a mode of sensing, collecting, and sharing evidence to help the collective bargaining process. Though they also used weather apps and maps, through their communicative apps (WhatsApp and Online walkie talkie pro), they were also to alert other drivers about traffic situations in various parts of the city, the condition of roads and the weather, to navigate their work-life smoothly.

An essential aspect of drivers' resistance practices involved collectively sensemaking of opaque algorithms and sharing of knowledge in both online and physical spaces, based on their driving

experiences [73]. Notably, collective sensemaking helped the drivers weave strategies of resistance against the OR-DLPs. Following Chandra and Pal [33], we understand these efforts of drivers to build collective knowledge by exchanging their interpretations, experiences, and unverified information about algorithms as an attempt to make sense of the unfamiliar and ambiguous labour situations it creates. Although previous studies in HCI and CSCW have highlighted cases of sensemaking and the use of online forums by drivers for socialisation and sensemaking of algorithms, they were mainly about improving drivers' ratings and work conditions [4, 96]. However, our study emphasises that drivers engage in collective sensemaking of algorithms in hybrid spaces (both online and physical), mainly to develop resistance strategies. In this process, the role of the union as a 'central authority' was key in synthesising different fragments of drivers' collective sensemaking into an actionable protest plan.

The drivers' resistance strategies also addressed issues of their dignity and recognition in the cityscape. By using background video recording and walkie-talkie apps, drivers not only found an equaliser against policing technologies but also began to flatten the power geometries of everyday urban life. Moreover, the drivers' adoption of voice-based interfaces and voice messages in communicative platforms to socialise and coordinate resistance strategies underscores their creative potential in appropriating technology to overcome educational deprivation (such as typing in English) and ensuring workplace convenience (such as communicating while driving). Hence, these drivers were 'design actors' [32], discovering, experimenting, and appropriating technologies to suit their everyday work requirements, navigate their socio-educational deprivations, enhancing resistance strategies, and overcoming socio-spatial atomisation imposed by DLPs.

Furthermore, our findings align with previous research [103] that driver interactions enhanced through digital technologies help overcome the individualisation of drivers in DLPs, facilitate their social relationships, motivate and shape a positive experience of unionisation. From a CSCW perspective, this is evidence of how appropriate technologies can strengthen the associational power of trade unions and bolster their resistance in cities.

8 Conclusion

Although algorithmic management of OR-DLPs erodes the spatial fixity of taxi stands, it simultaneously standardises and homogenises their working conditions [80]. For drivers to initiate collective action, they need to overcome spatial atomisation and dispersion, and communicative technologies can play a valuable role in this effort. The success of Kolkata App Cab Ola Uber Union demonstrates the role technology can play in revitalising traditional trade unions in the gig economy and enhancing their internal democracy. Their integration of technological affordances with the organisational structure of the trade union – a hybrid and networked unionism approach – brought workers back to the centre of organising. These strategies facilitated drivers as 'design actors,' where they appropriated and customised technology to navigate their workspaces and facilitate everyday resistance.

This study also emphasises that the success and failure of various forms of unionism should be understood contextually, particularly by evaluating the socio-spatial relationships, organisational formations, and power dynamics within the local society. This enables the CSCW and HCI community to expand their toolkit for supporting workers' resistance in various labour geographies, including non-Western contexts. Similarly, researchers should evaluate the discourse on worker resistance by going beyond the concerns of information asymmetry. This evaluation should include the role played by the political economy and political processes in shaping precarity and resistance.

Furthermore, our study demonstrated that drivers in OR-DLPs appropriated existing technologies primarily for algorithmic auditing, navigation, coordination, and anti-policing technologies. These appropriations of technology suggest that worker-centric designs should consider the contingent

spaces ridesourcing drivers engage in for work-related practices, and acknowledge that their resistance practices target actors beyond OR-DLPs, including local bureaucracy and the state. Consequently, design for resistance should be malleable for appropriation and customisation and recognise that workers and drivers engage with technology on their own terms. Such technology appropriation and customisation, notably low-tech, is crucial to under-resourced communities' survival struggles [76]. Future studies in CSCW and HCI should also emphasise more on the study of space, recognising the significant impact of technology and design in structuring and restructuring social spaces and shaping economic and labour geographies. Furthermore, it is important to understand the role that technologies and space play in enabling affordances for resistance.

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A Themes generated from open coding

The themes, sub-themes, and open codes from data analysis are below:

1. Space, Political Patronage and Unionisation

- 1.1 Spatial Fixity
 - 1.1.1 Dependency on Taxi stands
 - 1.1.2 Control of Union Office
- 1.2 Political patronage
 - 1.2.1 local politics.
 - 1.2.2 workspace and political affiliation.

2. Strategies of Unionisation

- 2.1 Traditional trade union's Mobilisation of Resources
 - 2.1.1 Revamping student-youth network.
 - 2.1.2 Borrowing cadres from other TUs.
- 2.2 Technology, Visibility and Emergence of Worker-organiser
 - 2.2.1 Platforms of communication and coordination.
 - 2.2.2 Networking within Algorithmic work process.
 - 2.2.3 Physical notifier as conversation starter and resistance.
 - 2.2.4 Physical Confrontation
 - 2.2.5 Instilling Dignity
- 2.3 Hybrid and Networked Unionism
 - 2.3.1 Tech-mediated social connections
 - 2.3.2 Tech-mediated resistance

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