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# Spatiotemporal (in)justices in digital platforms: An analysis of food-delivery platforms in south India

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**Abstract.** With on-demand labour and location-based services becoming increasingly common, this paper explores the complex social justice impact of spatial and temporal elements of digital platforms. A conceptual framing of ‘spatiotemporal justice’ is proposed to explore the consequences of algorithmic control of space and time experienced by workers. An interpretive case-study is built focusing on work practices of food-delivery platforms in the south Indian city of Chennai. The qualitative methods used include semi-structured interviews of food-delivery workers and an autoethnographic study by the author as a worker on digital platforms. The empirical analysis demonstrates that (in)justice is involved with the workers’ negotiation of multiple micro-spatiotemporalities in their daily work practice. The impacts include workers being forced to balance spatiotemporal risk and stress against the benefits of employment. This is contextualised by inequities propagated due to imperfect digital representation of, and the asymmetrical information on spatiality and temporality within the platform. The workers are further affected adversely in their spatiotemporally subordinated power relationship with other groups of digital platform’s stakeholders. Spatiotemporal justice as conceptualised here has direct implications in how future of work is defined, governed and how digital platforms are held accountable – particularly in the global South.

**Keywords:** Gig Economy · Social Justice · Digital Labour · Spatiotemporality

## 1 Introduction

The recent conditions of COVID-19 globally have brought into focus the growing reliance on food-delivery digital platforms and the physical, health and economic risks faced by its workers. ‘Gig-work’ as a mode of flexible and temporary task-based employment using a digital platform is a result of the advances in spatial technology such as smartphone mapping, location-based services, and global positioning systems. A core tenet of gig-work platforms is the on-demand labour or ‘just-in-time’ customer service [19]. In scrutinizing these platforms centering their digitally mediated spatial and temporal practices, this paper analyses the social justice impacts using an empirical case-study of food-delivery workers in south India.

This paper contributes to critical studies of gig-work and the wider gig-economy, which emanate from fields such as information systems (IS), ICT4D, human geography and surveillance studies. Scholars studying digital platforms globally show evidence of

inequities arising due to the changing nature of work and the precarity associated with it [2,3,4]. Perspectives from Graham et al [5] and Heeks [6] focus on the developmental impact questioning what ‘decent’ gig work would and should look like. In a similar vein Graham and Woodcock [7] highlight the need to understand ‘fairness’ of work in factors such as income, working conditions and risks under digital platforms. Critical analysis of gig-work also hints at inequities arising from the core spatial and temporal characteristics of technologies. Works such as Shapiro [8] and Woodcock [9] reflect on workers negotiating between spatial and temporal autonomy - provided by the promise of flexibility to the workers, and control – brought about by the platform’s management of workers tasks through algorithmic manipulation of location and time.

Two gaps in research have been identified, which the paper addresses. First, a focused spatiotemporal angle with a detailed study of digital spatial and temporal elements in gig-work remains largely unexplored. A recent exception to this in IS research is Wu & Zheng [10] who strongly argue for a spatiotemporal perspective as a valid means to understand gig-work practices. Secondly, as protests unfold in south India within the food-delivery sector [11], there is growing interest for research on the workers experiences. The wider body of critical research on gig-work in India largely do engage with the various practices of spatial and temporal control as a main point of discussion. But most of such research are limited to studying cab-hailing platforms [4,12], with food delivery services under studied. Moreover, this paper takes a step further to query the implications through the minutia of the spatial and temporal features of gig-work. Through this, the paper seeks an insight into how data and algorithms related to routine management of time and space of the workers impact their claims to fairness and equity.

To answer this, the paper uses the lens of ‘social justice’. This would encompass issues such as fairness and equity within the work and livelihood of the gig-workers. Various interpretations of social justice have been connected to the study of digital technology such as Heeks and Shekar [13] and Dencik et al. [14]. But such literature does not address the specifics of spatial and temporal aspects, their inter-relationship and their (in)justice impacts. Much as Dencik et al. [14] considers the lens of justice works to identify an ‘ethical path’ through the critical and complex issues surrounding technology use. Encapsulating these ideas this paper proposes ‘spatiotemporal (in)justice’ to interrogate practices and peculiarities from global South and question whether the spatial and temporal elements, and their entwinement impact gig-workers in a fair and equitable way.

Given this context this paper seeks to answer the question: *‘What are the social justice impacts of the spatiotemporal characteristics of digital platforms?’*.

The rest of the paper is structured as follows. First the theoretical concepts surrounding space, time and social justice are introduced. Then the paper presents the case study background and the methodological basis of the research. Finally, the findings are presented with a discussion and concluding thoughts on the empirical case study.

## 2 Spatiality, Temporality and Justice

Multiple perspectives of justice have been connected to spatiality and temporality that become relevant to a construct of ‘spatiotemporal (in)justice’. Social justice and its intersection with digital platform have been used to understand the (un)fairness of the use of data and (in)equity among the users of technology [14]. The use of social justice as a research lens also acknowledges that issues of (in)justice as Fraser [15] presents emanate from underlying complex cultural, economic or political factors that may not be outrightly evident. It follows then that ‘spatiotemporal (in)justice’ as this paper proposes would zero-in on how elements of ‘space’, ‘time’, their entwinement, and their corresponding digital representations affect issues of (un)fairness and (in)equity within platform mediated work practices. Querying social justice then will involve understanding how management of time or space results in issues such as (un)equal distribution of economic value or resources, (un)fair conditions of work and (im)balance in power within the working environment. These notions can be explored within existing theorisation of spatiality, temporality, and their overlap to construct the conceptual basis for this paper.

‘Spatial justice’ as presented by Soja [16] seeks fair distribution ‘in space, of socially valued resources and opportunities to use them’. As a key interpretation of spatial justice Soja [16] invokes the ‘right to the city’ notion of Lefebvre [17]. He presented that spatiality is socially produced and reproduced through practices and daily routines, and that explicit ‘representations’ of space determine the various ways it is experienced. This has intersections with how technology control representations and access to space and spatial resources. Other researchers have picked on this thread. Akbari [18] for instance presents ‘spatial data justice’ derived from social justice theorisation of Fraser [15] and Soja [16]. She argues that spatial issues in digital context is a matter of intersectional claim for justice. This touches also on what Bissett-Scott et al. [19] term ‘spatiality of injustice’ and ‘injustice of spatiality’ in relation to digital technologies. This encompasses impact of digital technology distributed spatially and created by digital interpretations of spatiality.

Exploring ‘temporal justice’ would serve to understand digitally mediated time and its impacts. Goodin [20] interprets temporal justice directly in relation to labour using language of ‘distributive justice’ – of fairness in the form of ‘discretionary time’ available for the worker as a remainder after allowing for time at work and time for worker’s personal needs. Three other notions of temporal justice are discussed by Henckel and Thomaier [21]. They argue temporal justice: is dependent on structural, material, and spatial factors among others, is relative depending on cultural and economic context, and that temporal inefficiencies experienced are also a cause of temporal injustices. Sharma [22] advances a similar concept of ‘temporal worth’ – the notion that workers experience time differently and are varyingly compensated for their time, depending on how they are positioned and valued in a temporally dictated economy. This view is acknowledged by Wajcman and Dodd [23] who say that temporalities are experienced in ‘differential and inequitable ways’.

Picking on the above ideas and to engage with (un)fairness and (in)equity surrounding the dual concepts of spatiality and temporality this paper acknowledges first the co-

constitution of space and time [24,25]. That manifestations of space and time are interdependent and socially impact each other. This as ‘spatiotemporality’ is summed up by what Olmstead [26] presents. They refer to the seminal work of Massey [24] to declare that ‘unique spatiotemporal topographies’ exist across different platform (in mostly urban) contexts and call for exploring these in research.

Research on IS largely consider temporal constructs as reviewed by O Riordan [27] and Shen et al. [28]. Prominently Orlikowski and Yates [29] argued that temporal structures are shaped by and shape the daily ‘recurrent practices’ of worker’s organizational space. A similar perspective is provided by Díaz Andrade and Doolin [30] how temporal practices in the social lives are entwined with their use of technologies (using a case study of refugees’ experience). Within studies of digital platforms and gig-work the interleaving of spatiality and temporality become directly relevant. As Graham and Woodcock [3] argue platforms bring timely supply of and demand for labour together using location-based apps in a ‘geographically sticky’ manner. Once location is captured and the gig is assigned, the temporal elements such as scheduling or task management take over, providing on-demand, ‘just-in-time’ labour from spatially close gig-workers [1]. Graham [31] summarises this as platforms solving ‘space-time’ problems of consumers by approximating the world digitally – through maps, location-data, timestamps and related other data and algorithm. There is further evidence given by Baiyere et al. [32], Manriquez [33] and Moisander et al. [34] of the way digitally mediated spatiality and temporality work.

Many existing research studies focus on space and time with cues on issues of fairness and equity. But a gap can be still seen in addressing the intimate relationship between spatiality and temporality within the specific practices of gig-work and as experienced by workers. For instance, spatiotemporal ideas of (in)justice are found in Chen’s [2] work where the varying temporal experiences under algorithmic control of time interleaves with the inequities that Chinese taxi drivers face when they move spatially through the city. Similarly Sharma [35] researches on taxi-cab drivers, showing that power flows spatially and temporally – by workers providing their time as labour and in the act of physically moving the passenger around the city. An idea on spatiotemporal imbalance has been discussed by Kitchin [36]. He considers that gig-work practices result in ‘space–time movements being commodified’ and ‘leveraged for the benefit of some at the expense of others’. All these reflects albeit indirectly on ideas of (in)equity and (un)fairness as a result of digital representations of space and time.

A very strong cue for studying spatiotemporal (in)equities comes from Wu & Zheng [10] who take an important ‘sociomaterial’ perspective using a case study of Chinese food-delivery workers. They theorise that the ‘reconfiguration’ of space and time as the basis of, and that which shapes digital platforms. They argue for a spatiotemporal perspective in conducting a critical analysis of platforms and the power structures that these platforms embody. A similar hint on this issue is from Greenhill and Wilson [37] taking an IS perspective to consider that gendered nature of spatiotemporal flexibility in work as being driven by ‘perceived benefits to the employer, rather than issues of social justice’. Similarly, Graham and Anwar [3] mention that an understanding of ‘the spatialities and temporalities’ of digital labour market is needed to better shape them and hopefully provide the gig-workers a fairer future. In global South context Firmino

et al. [38] relevantly present that there is an inherent spatiotemporal algorithmic logic followed by digital platforms rooted in global North assumptions. They call for exploration of local contexts of workers in studying the commodification of their space and time echoing Kitchin [36].

Deriving from the above discussed notions spatiotemporal (in)justice then encapsulates various aspects within the work practices of gig-work. Much as Massey [24] considers every space and also its digital representations are governed by the rhythms of how time acts within it and in turn time is influenced by the space it is enacted within. This forms the basis of how spatiotemporality is queried in this paper - both in digital and its corresponding physical sense. These would involve analysing notions such as the (un)fairness in algorithmic sense resulting in management of workers space and time, discriminatory potential of spatiotemporal data, the adverse impact of users due to spatiotemporal inefficiencies and (in)equity faced by users through spatiotemporal elements. These ideas direct the empirical discussion and analysis that follows in the next few sections.

### **3 Research Background and Methods**

The app-based food-delivery market in India 2019/20 services 500 cities [39]. Of these, this research was conducted in the south Indian coastal city of Chennai (the capital of Tamil Nadu state). The research focuses on analysis of labour and business practices across Swiggy, Ola and Uber Eats – the 3 major digital food-delivery platforms. Customers using smartphone apps receive nearby list of food-delivery establishments like take-away places or restaurants. These orders are then algorithmically queued for the restaurant who use a separate app and the order is assigned to nearby rider who is available to pick-up food and deliver. Orders can be ‘batched’ together (or called ‘multi-orders’) with more than one order picked up from same restaurant and delivered to multiple customer delivery locations.

An approach of interpretive case-study has been used in this research [40,41], with data collection done between December 2019 and February 2020. First, qualitative semi-structured interviews were conducted with riders across the 3 main platforms who were identified using snowball sampling initiated through personal contacts. The author also conducted auto-ethnography by working as a part-time rider over 6 weeks. Over all 27 semi structured interviews were conducted with varying lengths between 30 minutes to 2 hours. These interviews took place either at the rest spaces (usually on the side of the roads and in front of restaurants where the riders congregate in between their order runs) or was conducted in public places such as cafes and the beach. Further observations were done visiting all 3 major platforms’ support centres as a potential rider (5 visits in total) and when author attended a strike action & a protest planning meeting (both done as a researcher and not as a rider). Interviews were also conducted at these locations. The author was part of two rider Whatsapp groups (one mandated by the platform and the other setup by local riders). Majority of the interactions were all conducted in Tamil language of which the author is a native speaker.

The methodological basis for studying the author's own use of digital platforms was under what has been presented as the paradigm of 'self-tracking' [42] and is acknowledged as a digital ethnographic method [43]. This entailed the author's observation and engagement with the data and accessible traces of algorithmic elements generated during the personal use of apps as a rider and as a customer. These include use of screenshots and screen video grabs of the smartphone. Data from apps were collected with due anonymisation and only accessed by the author who was the sole user of the apps [44]. The author also collected autoethnographic photos, video, and audio data during the process of daily work as a rider, memo audio and written notes as a form of research diary. The author has been sensitive to balance own experiences as a rider and interviewees' experience by using the autoethnographic engagement with apps, its data and algorithm mostly to substantiate and bracket data gathered from interviewees' direct experiences. A clear distinction is made while referring to these experiences in the paper mentioning the source of data. To contextualise the collected data, textual sources in form of technical blogs and public documents published by platforms and media articles were used where appropriate. All data were originally in or are translated into English, transcribed where appropriate and thematically coded.

Coding through 'template analysis' [45] resulted in themes and codes. First level themes were broadly categorised in relation to customers, workers and restaurants. This guided the analysis and reflects the structuring used during data collection covering the whole cycle of gig-work. The analysis and the patterns emerging from the data were sensitised by theory. Iterative rounds of data-driven coding were used to further probe the data with emerging sub-themes on spatial and temporal elements which formed the imperative for this paper.

## **4 Analysis**

This section presents the analysis of the case-study describing the details of digitally mediated spatiality and temporality that govern work and livelihood for the gig-workers. The section is structured based on the 3 major themes under spatiotemporal injustice identified: trade-offs, representations, and asymmetries.

### **4.1 Trade-offs between temporal stress and spatial risks**

A common denominator across the three platforms studied are the task-level temporal and spatial controls experienced by gig-workers. Multiple points of digitally mediated spatiotemporal interventions at play were observed by the author's in their own experience and garnered thorough interviews. This can be seen in the simplest flow of tasks during a gig in figure 1 below.

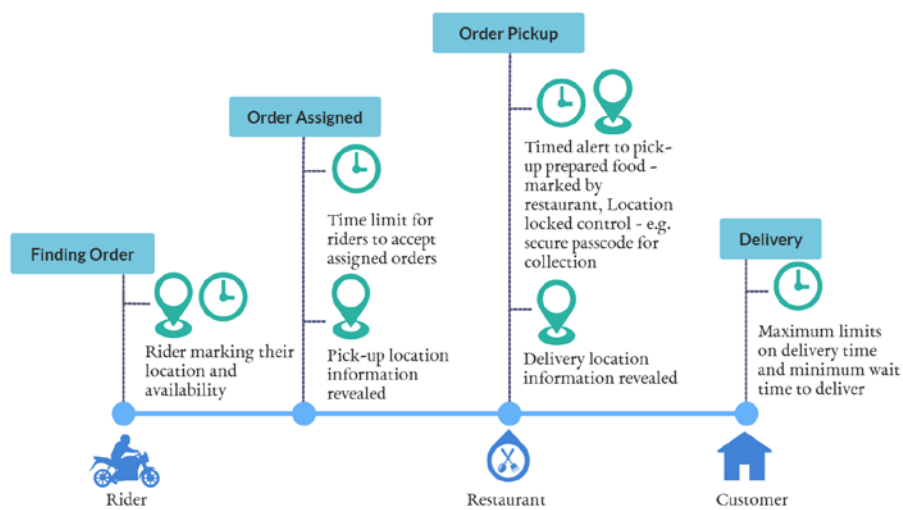
The work begins with riders marking their spatial location and availability, followed by waiting time until a gig is assigned. A timed alert follows (30 seconds to 1-minute - some instances were lower) to accept assigned order. The platforms design choice also does not reveal location of the restaurant until order is accepted (or customer address in case of food being picked up). After this route maps are displayed for the worker to

navigate to pick-up the food. Here a spatiotemporal balancing act is forced where temporal stress is used to control and institute competition forcing riders on longer distance of travel and speedy actions, as riders point out:

*I am pretty fast in accepting orders and press as soon as it buzzes. It's not like I have time to relax and see what is written in there. If I don't [accept the order] someone surely is ready to do it – why waste an opportunity?*

...

*Even if it is a long drive for the order, I will only know after I press the button [to accept the order]. I cannot decide that fast.*



**Fig. 1.** Multiple spatial and temporal interventions in a standard food-delivery process.

At a specific location such as a pickup point, spatial and temporal elements complement each other to create similar stresses using temporal triggers. For instance as experienced the author, time-limited action or a timed alert is complemented by a location-based spatial control. In one instance a securely generated passcode is needed to confirm pickup of food and is made available to the rider when their smartphone location is within 100 metres of the restaurant. These as 'micro-spatiotemporalities' of control is seen by riders as expectation to travel faster when they are farther away even if they can't act immediately during the ride:

*As soon as [the restaurant] marks 'food prepared' the app will say there is only 2 or 3 minutes. I will be 2 or 3 kms away. I cannot do anything until I reach the restaurant. Such temporal triggers or prompts linked to proximity of a location nudge the worker to be more efficient using haptic and audio-visual alerts. The larger impact is that the loud alarms and continuous vibration on the smartphone increase risk on road. As one rider recalls:*

*I will be in heavy traffic and will be focusing on not hitting the bike in front of me. My phone will go brrr... brrr... woo... woo... Its irritating. But I still need to click on it soon and not miss the order.*



In the author's own experience riders endure a rather panic driven work environment where 'alarms' cannot be silenced and need to be responded irrespective of spatial conditions and risk. The multiple intervening spatiotemporal stresses as part of the platform and app design push for speed of actions leaving risks solely as an issue of the worker.

Similar spatiotemporal trade-off of balancing longer worker hours against reaching distance-based targets are inherent to the payment structure set by platforms. For instance, meeting a daily minimum target of 20 location visits with 10 hours login time would pay a total of 900 rupees. It sets a target of having to physically travel to a new location (to a restaurant or a customer) every 30 minutes. But the cumulative weekly target stretches the expectation for moving to a new location averaging every 18 minutes (230 locations in 70 hours). These targets impose an elastic spatiotemporal control of work but with diminishing income returns across the week by commodifying and decoupling spatial and temporal targets. A rider choosing 10 hour per working weekday (total 5 days) would need to put in herculean effort to travel to a new location every 9 minutes working 20 hours over weekend to earn maximise weekly income. With delays, additional tasks and controls in play during a workday this can become next to impossible for many:

*I keep note of how close I am to daily and weekly target. But some weeks the effort I need to put in gets out of hand. Even if do achieve good targets the weekly targets will force me to put in more and more hours. There is no end and it just becomes really impossible sometimes.*

Even those who manage to meet the targets can end up spending close to 16 hours per day. This forces the riders to take decisions to trade-off spatial risk for temporal flexibility by front loading their weekly work to 'catch' as many orders – meaning some riders ride around widely earlier in the week, hoping remain time in the week can be more under their own discretion. But there are further complexities such as multi-orders, customer disputes or technology failure. These can trigger a payment condition that revokes their progress towards weekly target or even completely disqualifies them that week. Such unfair formulation means the rider can only try to start another similar spatiotemporal balancing act the next week. Ultimately the workers are put in a position to either take up longer hours or face greater risk on road without which the income target is mostly unachievable.

#### **4.2 Issues in digital representations of spatiotemporalities**

Platforms impose some assumptions of certainty in digital representations of locations and time. When reality does not match the digital representation, it forces the workers to step in as a sort of subjective human interpreters - of what the datafied processes intended to achieve. The platforms rely on mapping mostly in English. With Tamil and transliterated vernacular naming of location, places and routes critical spatiotemporal elements come regularly into question. There is clear need for interpretations and error corrections. This means restaurant and customer locations on maps, delivery routes and the estimated time for delivery are presented as objective information in many cases even if it may not be so. In the quote below a rider recalls an experience in delivering in Chennai's 'IT Corridor' – the hub for information technology offices alongside a

busy highway with fast moving traffic. This inevitably forms a major area of activity with active presence of customers and restaurants within food delivery platforms:

*It is a wide 6 lane highway and there is no place to take U-turn. Restaurant location is marked on the wrong side. I know this by experience... If we go depending on the map, that's it! Another 2 km fuel waste for sure.*

Every spatiotemporal negotiation is related to such financial or other costs, and even at work risk for the riders. The rider in this case would either risk by crossing the highway on foot or use their local knowledge to ignore the platform's mapping advice.

The riders also tackle commonly found problems of mapping, customer data literacy, or language issues by voice calls. They try to work around by relying on own local knowledge or by consulting fellow riders over Whatsapp groups – and support is almost always given immediately. In the author's own experience even while riding around in the city, riders help each other, irrespective of the platform they work on – including a case where a rider rode ahead showing the exact path to the author. The actual digital spatial controls and algorithmic rigidity means riders are forced to overcome platform erected barriers while achieving these workarounds. A case in point from author's experience is when a timed task must be done within 100m of a restaurant – but the actual location is marked incorrectly by the restaurant managers. This situation can easily escalate leaving the rider exposed to income reducing algorithmic triggers such as customer 'disputes' even as they work akin to a 'customer service' personnel to solve issues. Riders report that such disputes can see slow resolution or even an absence of one.

Underlying shortcomings of technologies tend not to account for real-world vagaries such as traffic and road conditions especially those which would be used by scooters. This increases inefficiencies for the rider as it takes away their ability to respond with practical solutions to the reality on road:

*When we get second order [in multi order] it would be good if I can decide where to go... [The app] will ask me to go via [a main road] over the flyover and come back another way. But I will never go on the flyover. If I can change and go to second delivery first it will be a easier ride and avoid the flyover.*

Platforms also reinterpret spatial representations such as multiple pickups or drop offs as one action in a multiple or batched order creating possibility of rider income reduction. Every order picked up or dropped adds more time, effort, and costs to the rider, but these efforts will not be counted towards income calculation. The platforms can and do change frequently the income calculations involving measurements of distance and time. These changes have made income per delivery and total incentive pay to steadily decrease (despite the initial promises of a high income).

The spatiotemporal elements further affect riders adversely when customers are presented with algorithmic estimations. When inevitable delays occur - like when rider solve errors in location - impatient customers who go by estimated time can intervene by calling up while the rider is negotiating traffic and adding to the risk on road. In an idealised delivery process the estimated time taken to pickup food (from the point of order being assigned to the rider) will be the same as the food preparation time at the restaurant (so would result in no waiting for the rider at the restaurant). But to account for demand at the restaurants the platforms algorithmically forecast preparation (specific to restaurant and the food ordered). In one of the known and complex models the platform can pre-assign a second order O2 to a rider (R1) when the delivery of the first order (O1) is ongoing. But the notification of the second order (O2) may be delayed

algorithmically to account for a different rider (R2) emerging spatially closer to second orders' (O2) pickup point. Estimation errors in this affect not one but two income opportunities of rider (R1). The temporal deadzone when rider may be assigned an order and not notified is a point of multiple micro-spatiotemporal unpaid efforts - such as using their local knowledge to go near a popular restaurant and involving fuel costs. These efforts may be overruled by new order (O2) being notified to require moving to a different place. Moreover, platforms misrepresent the process of assignment and a myth of predictability is presented in a bid to spur a rider's near constant availability. Riders across all platforms are consistently told (as experienced by the author in onboarding training sessions) to go near to 'busy restaurants' and essentially chase or hunt orders, though the algorithms can overrule this.

### 4.3 Spatiotemporal information and power asymmetries

The specific aspects of how digital platforms manage spatial and temporal elements impose asymmetry in power and information that works against riders. Given local power dynamics with restaurants or customers as income entities do not undergo as much spatiotemporal control as the rider. Riders with their clearly visible role (with brightly colored uniforms) face subordination at their gig-work spaces where they occupy a lower rung of socio-economic position. Much as in other situations of entrenched subordination along caste or class lines visible within informal and precarious workspaces, riders are open to expectations of servility. They become answerable to restaurant workers and managers - and with the customers being at the top rung of an imposed hierarchy. This aspect of worker subordination is also strongly evident when a necessary 'deferential' attitude towards customers and restaurants is inculcated through formal trainings at platforms' offices. An equivalence in protection or efforts for dignity of labour is not assured for the riders, making them undertake unpaid tasks rather than being able to challenge local power structures. A rider recalls the expectation for unpaid labour:

*We do everything from time to time. From parcelling food, picking spoons for the order, and cleaning the package if it spills... There is this [specific restaurant]. The manager their shouts at us to pack and move fast. That is not my job... But why risk offending him and get a complaint? He doesn't have the customer calling them. That is only my problem.*

An explanation can be found in the acontextual dematerialisation of a space as a mere 'location' on a map. Every point on a map that the rider travels to puts them into micro-spatiotemporal negotiation as a worker - done both digitally and in real world. This complexity is not captured in the digital food delivery process. As this rider explains:

*If I go to a specific location on the map it's not as if the work is done by itself. It's not as simple as giving the parcel to someone. There are multiple steps on the app. We have to call the customer and be nice. There is a gate, a security guard, parking issues... In office buildings it's even worse, after that its either lift or stairs...*

Something unexpected happening, such as when a food inventory runs out automatically means the rider is expected to resolve it given their subordinated position in an asymmetrical power relation. As recalled by a rider:

*If the restaurant runs out of food, [the restaurant] need to mark it as not available properly or give something else. What can I do? They ask me to call the customer and check. Can't they call? It is their customer too.*

None of these tasks are part of the calculation used for payments. But these extra efforts increase total time taken and rider's costs – and reduces times available for paid tasks.

An asymmetry in availability of information such as ratings also impact the work practices within digital platforms. Customers can have near constant visibility of the riders through location, ratings, and profile-based surveillance from the point when order is assigned until delivery. A rider mentions that such issues leave them to face intense scrutiny on the time taken and even the route taken to the customer address:

*We know how long the ride takes. I ride here every-day. Wont I know what will happen? The customers see me on their app and they get some information. The app [estimates] it wrong... Many customers won't bother but one or two may make it a problem and call and instruct constantly – turn left, take a U-turn...*

In author's own experience majority of the customers call the rider and expect calls as part of the service by the rider even while on road to follow up on the orders. But platforms actively discourage calling including by extra prompts on apps. The riders encounter this unpaid labour which again eats into the time available for paid work.

This is further bolstered by an unequal ratings and feedback process. The riders are expected to give star ratings to restaurants and customers for the pickup and delivery experience and answer a set of questions. Customers and restaurants can give similar ratings to both restaurant and delivery riders. But the information that these 'stars' represents only affect the riders in the form of performance and tips (some platforms give extra payment of 5 or 10 Rupees for a 5-star delivery). Even though ratings and survey data collected from riders about information like parking availability, road conditions, and correctness of GPS location do formally enhance the spatial data held by the digital platform, riders themselves do not get to see the qualitative information on restaurants or customers. Resolving pickup and delivery issues mostly becomes contextualised by informal knowledge that riders share among themselves over WhatsApp groups.

## 5 Discussion

This paper furthers the understanding of (un)fairness and (in)equity within the context of data, algorithms, and digital platforms by proposing the construct of 'spatiotemporal justice'. The case study analysing food-delivery practices of gig-workers show three major ways in which spatiotemporality is imbricated with social justice – of spatiotemporal trade-offs between risk and stress, issues of digital representations, and asymmetry of power and information. The spatiotemporal design choices of platforms and algorithmic control show that many practices begin with an unfair burden on workers to balance temporal stress against spatial risk on the job. Further, as platforms seek to digitise physical food delivery practices, it is evident that errors and imperfect digital representations of spatial and temporal elements can bring up issues of (in)justice - such as the unpaid labour faced by the workers in performing platforms' promise of service to the customer. It is also seen that the spatiotemporal dematerialisation can extend and even add to unfair practices in physical food-delivery process. By privileging power and information to customer and restaurants, the platforms use the workers to negotiate

difficult physical conditions. This happens under the close control and manipulation of workers' space and time. An ability performed by the platforms through data and algorithms.

This paper contributes a detailed analysis of the consequences of gig-work in south India. This is a valuable addition given the prevalence of similar research stemming from the global North. In this the paper's centering of spatiotemporalities in making claims for justice answers the call of Dencik et al. [14] for a new ontology of social justice. In doing so the research provides insight on the local conditions in the global South amidst the related issues of the uncertainty under COVID-19 for workers in India and the ongoing protests and strikes for fair pay among food-deliver workers in Chennai [46]. In such ongoing debates the workers consistently voice their issues using language and terms which highlights the manipulation of spatiotemporal elements of their daily work. This paper has picked up this strand to provide valuable auto/ethnographic accounts of gig-work. The findings show the intimate and individual spatiotemporal machinations inherent to gig-work, unpicks the local global South specificities and above all allows exploration of the mostly opaque nature of platforms and algorithms.

Spatiotemporal justice also has congruence with the strand of IS research on ethics. Chiasson et al. [47] recently position a need for IS research to study ethics of Big Data, in a way that helps to theorise not only the extractive nature of data-driven 'surveillance capitalism' [48], but to include study of social actors beyond the management layers and understand complex consequences. This paper's co-positioning of spatiotemporal-ity and justice helps us query practices beyond the notions of spatial and temporal at organizational level of the digital platforms. Gig-work is characterized by the capture and measurement of fleeting spatiotemporal elements such as worker location, distance driven, waiting times and timed alerts. By understanding the negotiation of these – what is termed here as 'micro-spatiotemporalities' – show that micro-politics is at play in the daily work practices of digital platforms. So, echoing Graham [31], it is this 'ephemeral' digital duplicate of the spatiotemporalities within the platform that becomes the arena for seeking justice and even resistance. Every task done by a gig-worker is a negotiation of what can be construed as a 'spatiotemporal cost' balanced against possible economic benefit.

The findings here go beyond the conceptualisation of platforms as an 'invisible' manager [49]. Spatiotemporal justice reconciles unfairness in digital representations with the actual impact on daily work practices of gig-workers. Reflecting on what boyd and Crawford [50] argue is an 'aura of truth, objectivity, and accuracy' ascribed to data and algorithms, this paper shows that inefficiencies, erroneous objectivity and unfairness in spatiotemporal representations have a direct impact on workers. Ethical design of algorithms [51] and fair governance of platforms then must consider the impact of their spatiotemporal approximations.

Both practitioners and academics can use the vocabulary presented in this paper of 'spatiotemporal (in)justice' to seek accountability from digital platforms. Spatiotemporal aspects can also help in claims for 'collective justice' given the clear subordination of workers compared to restaurants and customers. Globally as workers movements and struggles foreground 'fair pay' as a claim to economic or redistributive justice, the conception provided here exposes myriad (in)justices beyond the redistributive sense. Spatiotemporal justice then would help establish truly 'fair' practices, standards,

and metrics for food delivery gig-workers - as has been done before for workers such as cabdrivers or online freelancers.

Future research can pick up from this point to focus on the efforts of workplace resistance and collective action within gig-work environments and how they take a spatiotemporal dimension. One instance is the #Logout movements that are taking different forms involving gig-workers and businesses such as restaurants. Moreover, such study can extend valuable insight by conducting global south-south or north-south comparisons of digital platforms and their practices.

A limitation of this research stems from the author's acknowledged positionality as a member of privileged socio-economic class devoid of direct experiences of customary or entrenched forms of labour subordination and servility [52] - as these are rooted strongly in dynamics of caste and status in India. This is a strong line of interdisciplinary inquiry that needs critical and sensitive attention for future researchers to contextualise experiences of gig-workers specific to India.

## 6 Conclusion

The paper has presented an interpretivist case-study of digital work practices on food-delivery platforms set in south India. The paper contributes 'spatiotemporal justice' as a construct in capturing impact of spatial and temporal control and management which form the core of digital platforms. The analysis demonstrates that (in)justice is involved with workers' being forced to trade-off spatiotemporal risk and stress against benefits of employment. This is contextualised by inequities propagated due to imperfect representation of and asymmetrical information about spatiality and temporality which affect the workers in their subordinated position of power. The paper establishes that micro-spatiotemporal practices and negotiations inherent in digital platforms cause issues for workers such as unpaid labour, unfair income or risky working conditions. Spatiotemporal justice as conceptualised here has direct implications in defining future of work and holding digital platforms accountable by making spatiotemporality a main domain of contestation and claims for justice.

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