Algorithmic Surveillance in the Gig Economy: The Organization of Work through Lefebvrian Conceived Space

Gemma Newlands[iD]
BI Norwegian Business School, Norway

Abstract

Workplace surveillance is traditionally conceived of as a dyadic process, with an observer and an observee. In this paper, I discuss the implications of an emerging form of workplace surveillance: surveillance with an algorithmic, as opposed to human, observer. Situated within the on-demand food-delivery context, I draw upon Henri Lefebvre's spatial triad to provide in-depth conceptual examination of how platforms rely on conceived space, namely the virtual reality generated by data capture, while neglecting perceived and lived space in the form of the material embodied reality of workers. This paper offers a two-fold contribution. First, it applies Henri Lefebvre's spatial triad to the techno-centric digital cartography used by platform-mediated organisations, assessing spatial power dynamics and opportunities for resistance. Second, this paper advances organisational research into workplace surveillance in situations where the observer and decision-maker can be a non-human agent.

Keywords

data, digitalization, gig economy, organisational control, platforms, sociology of work, space, surveillance, virtual

Introduction

> Knowledge falls into a trap when it makes representations of space the basis for the study of 'life', for in doing so it reduces the lived experience.

> (Lefebvre, 1991 [1974], p. 230).

Workplace surveillance, as a potent and pervasive organisational control mechanism, has been traditionally implemented to ensure that labour is performed in compliance with managerial goals

Corresponding author:
Gemma Newlands, Nordic Centre for Internet and Society, BI Norwegian Business School, Nydalsveien 37, Oslo, 0484, Norway.
Email: gemma.e.newlands@bi.no

(Fleming & Spicer, 2008; Giddens, 1984). Accordingly, researchers have directed their attention to how and why organisations adopt specific surveillance systems, ranging from direct face-to-face surveillance to bureaucratic monitoring (Ball, 2010; Lyon, 2007; Sewell & Barker, 2006). Facilitated by the steady expansion of organisational ICTs, workplace surveillance is frequently augmented with electronic mediation, extending the control of managers outside traditional organisational boundaries and enabling many occupations to shift to remote work (Brocklehurst, 2001; Elliott & Long, 2016; Orlikowski, 1991; Rossiter, 2016; Sewell & Taskin, 2015).

Yet, workplace surveillance is conventionally understood as being a largely dyadic process, with a discrete *observer* and *observee*. While variations have been proffered, such as synoptic (Lyon, 2006), panoptic (Foucault, 1975) and lateral modes of surveillance (Andrejevic, 2002), each permutation presupposes the existence of a human observer. Complementing these human-to-human surveillance modalities, some organisations are adopting an emerging form of 'algorithmic surveillance', where some monitoring, assessment and managerial tasks are conducted by algorithms. In particular, for platform-mediated and on-demand organisations, commonly referred to as 'gig economy platforms', algorithmic surveillance is leveraged as the dominant surveillance modality within multimodal surveillance assemblages (Goods, Veen, & Barratt, 2019; Rudolph & Gruber, 2017; Veen, Barratt, & Goods, 2020). Deliveroo, Foodora and UberEATS are a few examples of food-delivery platforms which deploy algorithmic surveillance as the crux of their organisational processes. Operating on heuristics data captured from workers' personal smartphones, algorithms for these platforms are used to determine the allocation, remuneration, chastisement and sometimes even the termination of human labour (Anderson, 2016; Goods et al., 2019). Although scholars are beginning to address the implications of gig economy platforms for organisational research (Fleming, 2017; Peticca-Harris, deGama, & Ravishankar, 2020), there is limited discussion of how reliance on algorithmic surveillance affects organisational knowledge-building. Because algorithms operate only on machine-readable data, organisations heavily reliant on algorithmic surveillance have fewer instruments with which to garner additive, contextual and embodied information about the experiences of working, and thus a more limited capacity to make accurate and fair managerial decisions.

Platform-mediated food-delivery workers must navigate themselves, in a very literal sense, through busy, congested and often dangerous urban streets, facing harsh weather or terrain, all while ensuring that their cargo does not spill or get cold. Simultaneously, they must navigate affective interpersonal interactions with customers, restaurants, bystanders and fellow road-users who may treat them with indifference or even open disdain. Such details, which could offer context to managerial decisions, are rendered invisible to organisations, for whom a clean, unproblematic and digital cartographic representation is often sufficient. Since organisational space is the medium through which power asymmetries and social relations are manifested (Beyes & Steyaert, 2011; Dale, 2005; Dale & Burrell, 2008), this paper reflects on the limitations of algorithmic surveillance in the gig economy, especially since the epistemological gap between digital-based and human-based surveillance generates opportunities for workers to resist control and to reappropriate the spaces of production (Briziarelli, 2018; Waters & Woodcock, 2017).

Due to the potent interplay between the immaterial and the material in algorithmic surveillance, this paper adopts Henri Lefebvre's spatial triad as a tool for analysis. Lefebvre's spatial philosophy has continued to be an inspiration for modern organisational research (Beyes, 2018; Dale, 2005; Kingma, Dale, & Wasserman, 2018; Nash, 2020; Taylor & Spicer, 2007; Tyler & Cohen, 2010; Watkins, 2005). As a French Marxist centrally concerned with how space reflected and generated power relations, Lefebvre argued for the existence of a spatial triad composed of abstract representations of space (conceived space), habitual spatial practices (perceived space) and subjective representational space (lived space) (Lefebvre, 1991 [1974]). Lefebvrian *conceived space* is the abstract mental space conceived by experts. It is an idealistic and deliberately immaterial rendering

of reality, generated 'like a cold technical representation' (Lefebvre, 1991 [1974], pp. 38–9). *Perceived space*, by contrast, reflects the habitual reality of individuals, which enables the every-day functions of society. *Lived space*, completing the spatial triad, is the purely subjective informal knowledge of a space experienced and perceived by individuals (Watkins, 2005; Zhang, 2006). Algorithmic surveillance, which is reliant on rendering physical space and movement into digital manifestations, can thus be understood as privileging the techno-centric, abstract 'conceived' space of digital cartography while neglecting – either purposefully or incidentally – perceived and lived space, namely the material embodied reality of the workers.

This paper therefore offers a two-fold theoretical contribution to organisation studies. First, it advances ongoing research into Henri Lefebvre's philosophy and applies his notion of space to the techno-centric digital cartography used by platform-mediated organisations. Brenner and Elden (2009) suggest that 'Lefebvre's key concepts and analyses must be pushed, challenged, updated, and rearticulated in order to be made relevant' (p. 374). Responding to this call, this paper adopts Lefebvre not only to assess digital space, but also to assess spatial power dynamics and opportunities for resistance. Second, this paper advances organisational research into workplace surveillance in situations where the observer and decision-maker is a non-human agent. Organisational literature has yet to examine how the relegation of surveillance and management tasks to algorithms render platform organisations heavily reliant on the reliability of the algorithms, the reliability of the captured data, and close correspondence between the data captured and the material reality of the work itself.

The paper proceeds as follows: I shall first introduce the gig economy and the multimodal surveillance assemblage, delineating the varied functions of algorithmic, managerial and customer surveillance. The paper then provides a discussion of Lefebvre's spatial triad and continues with two sections, drawing on Lefebvrian emphasis on integrating considerations of the body and space. One section examines the abstraction of the worker's body into a digital data double and the other section focuses on the transformation of the urban workspace into abstract digital cartography. The paper concludes with a discussion of how interstitial gaps between conceived and lived spaces offer opportunities for worker resistance, as well as a discussion of the paper's key implications for organisational practice.

The Gig Economy

As an emerging, though no longer quite nascent, force in the global economy, the 'gig economy' has helped to reshape the urban landscape, facilitated by a succession of platform-labour organisations catering to a societally developed 'on-demand' mentality (Dablanc et al., 2017; Rosenblat, 2018; Rosenblat & Stark, 2016; Scholz, 2017). Gig work is usually typified by four characteristics: irregular work schedules; workers providing some or all capital (e.g. mobile phones, cars, or bikes); piece-rate work remuneration; and work being arranged and/or facilitated by digital platforms (Stewart & Stanford, 2017). Current scholarship argues that the gig economy is eroding working conditions due to widespread designation of workers as independent contractors, as opposed to formal employees (Goods et al., 2019; Healy, Nicholson, & Pekarek, 2017; Stewart & Stanford, 2017; Valenduc & Vendramin, 2016). Labour scholars have also argued that these 'flexible' employment arrangements result in precarity, with workers absorbing market risks and social responsibilities (Kalleberg & Vallas, 2018). Although there are some distinct exceptions, such as Foodora's use of contracted employees within Scandinavian markets, most food-delivery platforms continue to fight legal challenges and worker protests in order to maintain an independent contractor designation (Goods et al., 2019; Newlands, Lutz, & Fieseler, 2018; Prassl & Risak, 2015; Stanford, 2017). This contractual arbitrage can be understood as platforms marginalising

workers by pushing them outside formal organisational boundaries. Incidentally, the balance between algorithmic and human surveillance is highly dependent on the intended contract status of platform workers. Avoidance of certain employment classifications, such as recognising the on-demand workforce as employees, is reliant on minimising overt forms of human oversight and direct managerial control in favour of algorithmic surveillance (Newlands et al., 2018).

Founded in 2014, German-based Foodora is one example of an on-demand food-delivery platform, through which consumers can order food for delivery from local restaurants. British-based Deliveroo, founded in 2013, operates on a similar model, with couriers transporting freshly prepared food to consumers. The labour process on both food-delivery platforms is similar (Gandini, 2019; Veen et al., 2020). In essence, workers log in to a dedicated worker app at the start of pre-arranged shifts, thus signalling their availability to work (Kuhn & Maleki, 2017; Waters & Woodcock, 2017). When an order is placed by a customer, and subsequently approved by the corresponding restaurant, an algorithm automatically allocates the delivery task and sends a notification to the selected worker. Once the task is accepted, the worker navigates to the restaurant, collects the order, and then delivers it directly to the customer by bike, moped or car. Throughout the labour process, the worker's movements, location and performance are captured in real time by the worker's smartphone (De Stefano, 2016; Veen et al., 2020). This data is then rendered visible, both to the organisation and to the worker, through its abstract visualisation on a digital cartographic interface, the worker's movement throughout the digital map taking on a one-to-one correspondence with the human worker's movement in physical space. It is upon this data, visualised and contextualised within digital space, that the algorithmic processes of platform-mediated organisations are levied for the purposes of calculating remuneration, assigning tasks and assessing performance based on opaque and frequently changing criteria.

Multimodal Surveillance Assemblage

For platform-mediated organisations, algorithmic surveillance is the dominant factor in a tripartite multimodal surveillance assemblage, consisting of algorithmic, managerial and customer surveillance. Drawing upon Deleuze and Guattari's radical focus on multiplicity within otherwise discretely bounded phenomena, Haggerty and Ericson (2000) proposed the notion of the 'surveillant assemblage' in their discussion of convergent surveillance systems. Arguing that contemporary surveillance is distinct from historic, more analogue, forms of surveillance, their surveillant assemblage is characterised by the use of 'machines to make and record discrete observations' (Haggerty & Ericson, 2000, p. 612). Lyon (2007) further refines this theoretical framework, conceptualising surveillance processes as being constituted of multiple systems operating simultaneously, such as face-to-face, bureaucratic and electronic surveillance. The tripartite multimodal surveillance encountered in platform-mediated work is a further expansion on these concepts, since workers are subject to simultaneous surveillance from distinct entities with specialised purposes. Rather than attempting to draw together data from varied technical sources into a single surveillant assemblage, platform organisations rather utilise distinct modes of surveillance to monitor performance, shape worker behaviour and achieve organisational goals. The simultaneous presence of all modalities generates an encompassing culture of surveillance which is handled by workers as the 'new norm' of work (Ball, 2010; Lyon, 2018; Sewell, 1998). Accepted as necessary for the logistic functioning of the platform, such widespread surveillance is also viewed by workers as being particularly banal given the broader context of platform and surveillance capitalism (Srnicek, 2017; Zuboff, 2015).

Platform-mediated food-delivery workers are acutely aware of the immediate surveillance of the algorithmic systems, which exert *control* over their physical activity and movement by tracking

their movement in real time through digital space (Deleuze, 1992). Algorithmic surveillance contrasts with, yet enables, the more remote managerial and customer surveillance modalities which enforce *discipline* (Foucault, 1975). Since algorithmic surveillance is the dominant modality, determining workers' task allocation, performance assessment and remuneration rate, it is the accurate 'gaze' of algorithmic surveillance which is the most significant for workers. Indeed, for workers temporarily disconnected from the algorithmic 'gaze' through smartphone failure or loss of internet connection, re-establishing their own algorithmic visibility is the top priority. No level of managerial or customer 'gaze' can act as a substitute. Indeed, if the algorithmic 'gaze' is disrupted, a worker must end their shift immediately. The algorithmic 'gaze' is also the most significant for platform-mediated organisations. This means that the limitations of the algorithmic 'gaze', resulting from over-reliance on Lefebvrian 'conceived space', create the biggest problems for organisational knowledge-building. To illustrate this further, I shall briefly outline each surveillance modality below, as it operates in the platform-mediated food-delivery sector.

Algorithmic surveillance

Algorithmic surveillance can be conceived of as an assemblage of computational processes, which automatically generate data, evaluate worker behaviour and assign labour activities (Howcroft & Bergvall-Kåreborn, 2019; Möhlmann & Zalmanson, 2017; Schildt, 2017). As a distinctive feature of the gig economy (Ajunwa, Crawford, & Schultz, 2017; Just & Latzer, 2017; Levy, 2015), a growing body of research is interested in the adoption of 'algorithmic management', a similar phenomenon which refers to 'software algorithms that assume managerial functions and surrounding institutional devices that support algorithms in practice' (Lee, Kusbit, Metsky, & Dabbish, 2015, p. 1603). Initial arguments for the introduction of algorithms in organisational settings centred on their capacity to make judgements with greater objectivity than human counterparts (Christin, 2017). However, this narrative of objectivity has come under attack by opponents who argue that algorithms are not neutral artefacts and should be subject to greater human oversight (Couldry & Hepp, 2017; Gillespie, 2014; Pasquale, 2015).

As a prerequisite, algorithmic surveillance requires large amounts of continuous data related to the activity of the worker. As Gillespie remarks, 'algorithms are inert, meaningless machines until paired with databases upon which to function' (2014, p. 169). For this aspect, I can draw on the work of Philip Agre (1994), who distinguishes two models of data acquisition: the surveillance model and the capture model. In Agre's (1994) surveillance model, the activity being observed is accompanied by a simultaneous act of surveillance, such as from a CCTV camera or a human manager. In the capture model, the activity being monitored generates data while it is being performed. Data capture, according to Agre (1994), was thus part of a 'reorganisation of industrial work activities to allow computers to track them in real time' (p. 101). Examples of the capture model include retail check-outs, electronic ankle bracelets, and GPS trackers in trucks. Evans and Kitchin's (2018) investigation into electronic monitoring software in retail stores, for instance, provides a valuable case study for data capture, where the act of scanning items became the organisational 'site of administration' (p. 47).

Although food pick-up and delivery information is manually entered into the smartphone interface by workers, in the form of pressing buttons to indicate task completion, platform-mediated organisations are fundamentally reliant on the capture model to gain information about the worker's location and movement (Sprenger, 2019, p. 79). Specifically, platform-mediated organisations rely on global navigation satellite systems (GNSS) for direct location tracking, leveraging the GPS-enabled receiver in riders' personal smartphones (Berreneche, 2012; Michael & Clarke, 2013). This transition towards smartphone-based surveillance has also been adopted in established

industries such as taxi-driving, where fixed taximeters are being phased out in favour of drivers' personal smartphones (Anderson, 2016).

One vital reflection in Agre's (1994) model is that 'a system can track only what it can capture' (Agre, 1994, p. 114). Unpacking this statement, one can identify the unidirectional correspondence between what is captured and what is *capturable*. In other words, for a platform-mediated organisation to use certain data about a worker in an algorithmic decision-making process, data about that worker has to be collected. Importantly, for data to be collected, it has to be collectable in a format that can be read and understood by the algorithm. This therefore requires the transformation of human labour into machine readable input. As Agre (1994) describes, this is a process where 'activity is reconstructed through assimilation to a transcendent ("virtual") order or mathematical formalism' (Agre, 1994, p. 107). Workers' activity thus has to be rendered into code with the attendant requirements that messy qualitative information is ignored, leading to oversimplification where 'subcategories of "invisible" activity might go unrepresented' (Agre, 1994, p. 111). Translated into Lefebvrian terminology, the subjective informal knowledge of space and reality, namely Lefebvre's representational space, must be subsumed, transformed and reduced so as to be readable within the 'logico-mathematical' realm of conceived space (Lefebvre, 1991 [1974], p. 19).

In Kitchin and Dodge's (2011) conceptual separation between 'data' and 'capta', there is a similar distinction between 'everything that is possible to know about that person' and 'what is selectively captured through measurement' (p. 5). The choice of 'capta' categories is thus a powerful and central organisational tool levied by platforms in a non-neutral fashion. The need for standardisable data collection also diminishes the capacity for platform-mediated organisations to collect situated knowledge of their workers (Bailey, Leonardi, & Barley, 2011; Rolland & Monteiro, 2002). As Levy (2015) argued in her analysis of the truck driving industry, abstraction into data diminishes 'what can be perceived through physical presence at remote worksites' (p. 161). Indeed, 'by converting work practices into ostensibly objective, morally neutral records of human action, information technologies legitimate certain types of knowledge and experience, while rendering others invisible and nonactionable' (Levy, 2015, p. 161).

Managerial surveillance

In terms of managerial surveillance, defined as oversight, monitoring and decision-making by human managers, most current research on the gig economy operates on the assumption of its absence (Jabagi, Croteau, Audebrand, & Marsan, 2019). With regard to Deliveroo, for instance, Waters and Woodcock (2017) note 'the absence of supervisors or managers roaming the workplace and surveilling workers directly . . . This means being away from the supervisory gaze, not feeling the physical pressure to modulate behavior beyond meeting the time requirements of the platform'. While Waters and Woodcock (2017) are accurate in noting the absence of a direct, human, supervisory gaze, it would be incorrect to overlook the layers of managerial surveillance which operate in conjunction with algorithmic surveillance. To adapt a popular concept from machine learning and simulation fields, what we are now seeing in platform-mediated organisations is a transition away from dyadic human surveillance towards a 'human-in-the-loop' model of workplace surveillance. In this model, organisations operate largely automated processes and human intervention into the processes of algorithmic surveillance occurs only reactively or when explicitly requested (Rahwan, 2018).

Food-delivery platforms, for instance, utilise human dispatchers who 'maintain omniscient views of worker fleets on real-time digital maps' (Shapiro, 2018, p. 2959). Dispatchers can be contacted by workers in instances of issues or concerns on a reactive basis (Waters & Woodcock, 2017), such as if the rider needs a temporary shift-break. Occasionally, dispatchers can also be

proactive in their surveillance, contacting workers to question why they have been stationary for too long (Waters & Woodcock, 2017). In an interview conducted by the author, as part of a broader qualitative study,[1] a former Deliveroo dispatcher discussed how at an earlier date and before a switch in the algorithm from 'Louis' to 'Frank', dispatchers held a very hands-on role in surveillance and oversight:

> We did a lot of manual tweaking. . . what we actually could do is unassign that order from that rider and give another order to that one. . . we could actually click on stuff so we actually saw where the rider was, where the restaurant was, and also where the customer, where it needed to go. (Interview with a former Deliveroo Dispatcher)

However, such active intervention into the system was removed with the implementation of the new algorithm, 'Frank'. Manual tweaks were phased out to the extent that the dispatchers were discouraged from intervening into any operations to allow the algorithm to learn. The former Deliveroo dispatcher explained further how 'we could interfere but we shouldn't. We still could interfere, but the algorithm has to learn' (interview with a former Deliveroo dispatcher).

Foodora, as a rare example of a food-delivery platform which combines algorithmic surveillance with multiple levels of managerial surveillance, uses human rider captains as an additional layer of surveillance. Rider captains are otherwise regular workers but their food-delivery duties are augmented with managerial responsibilities, namely monitoring, motivating and giving feedback to workers within their team. Additionally, they act as a unique mechanism of upwards information transfer by sharing qualitative detail to the organisation on each worker's behaviour in the form of weekly reports. In an interview with the author, a current Foodora rider captain explained the increased level of human oversight as follows:

> It's checking up more thoroughly about why people are not doing their job, so why are they late? Do they have a valid reason for not getting in touch? Yeah, then basically make a report about that. . . then one of the managers decides. (Interview with a Foodora Rider)

However, this managerial surveillance from rider captains provides only an additive surveillance function in the best-case scenario, operating post-facto and with limited organisational impact.

Customer surveillance

Complementing algorithmic and managerial surveillance, customer surveillance provides a valuable but variable role in food-delivery platforms (Veen et al., 2020). Customer ratings and reviews are a common form of workplace surveillance in the on-demand ecosystem, especially among platforms which rely on emotional or affective labour (Orlikowski & Scott, 2015). Care work and ride-hailing platforms are both heavily reliant on customer reviews to establish trust and credibility, as well as to discipline unwanted behaviour (Lutz, Newlands, & Fieseler, 2018; Ticona & Mateescu, 2018). In terms of food delivery, however, customer ratings are used less frequently. Neither Foodora nor Deliveroo use customer ratings as a form of worker surveillance; even UberEATS only uses a simple thumbs up or thumbs down rating, rather than Uber's five-star rating mechanism for ride-hailing workers.

That is not to say, however, that customers do not participate in surveillance. Rather, surveillance is leveraged through the observation of workers' location and movement within the customer app. The digital mapping interface provided to customers displays a real-time tracking of the worker, similar to the mapping interface used by dispatchers for operational surveillance. The lack of a customer review function suggests that this surveillance tool is solely intended to provide

customers with a sense of anticipation regarding the arrival of the food. However, this function also becomes problematic in instances of disconnect between customer expectations and rider reality. For instance, riders can be given multiple orders to complete simultaneously, meaning that rider activity which follows an indirect path between the restaurant and customer can appear to the customer as erratic or lazy behaviour (Sun, 2019). Illustrating this dynamic, a current Foodora rider discussed with the author that:

> The problem is that sometimes we are given several orders at the same time and then there is no explanation for a customer who can track you in real life – 'why isn't this courier going directly to my place but instead is making circles?' and in real time you are going to another customer and it's very difficult to explain to a customer. (Interview with a Foodora Rider)

Henri Lefebvre's Spatial Triad

Algorithmic surveillance, as the dominant modality within the tripartite multimodal surveillance assemblage, thus creates an epistemological gap between the worker and organisation. Because algorithms operate only on machine-readable data, human activity needs to be parsed into a digitally readable format and contextualised in a digital cartographic space. Due to the interplay between immaterial and the material space in algorithmic surveillance, therefore, this paper adopts Henri Lefebvre's spatial triad as a tool for analysis. Specifically, Lefebvre's distinction between 'logico-mathematical space' and the otherwise embodied practico-sensory realm provides a framework for understanding the spatial power dynamics of the gig economy (Lefebvre, 1991 [1974], p. 19). As noted above, this paper is situated within an ongoing stream of academic exploration into Henri Lefebvre's philosophical contributions (e.g. Beyes, 2018; Kingma et al., 2018; Nash, 2020), where increasing attention on Lefebvre can be attributed to the 'material turn' and sociomaterial approaches (Meyer, Höllerer, Jancsary, & van Leeuwen, 2013; Orlikowski, 2007).

The most influential work of Lefebvre for the field of organisation studies has been his magnum opus *The Production of Space* (Lefebvre, 1991 [1974]). In this work, Lefebvre details a spatial triad of conceived, perceived and lived space. As described above, conceived space is the abstract mental space conceived by experts, such as technical maps. It is described as an idealistic view of reality, generated 'like a cold technical representation' (Lefebvre, 1991 [1974], pp. 38–9). Importantly, for Lefebvre, the conceived space is deliberately generated by an individual or group for a purpose. It is not a neutral reflection of reality but a deliberate immaterial rendering of reality with attendant biases and hierarchies. Perceived space, by contrast, reflects the habitual embodied reality of individuals. The third and final mode of space is the so-called 'representational space' or 'lived space' which is simultaneously real and imagined space. This phenomenologically experienced space is the purely subjective informal knowledge of a space experienced and perceived by individuals (Zhang, 2006). Beyes and Steyaert (2011) describe lived space as the 'intensities, capacities and forces, rhythms, cycles, encounters, events, movements and flows; instincts, affects, atmospheres and auras; relations, knots and assemblages' (p. 47). Although Lefebvre's spatial ontology of conceived, perceived and lived space may be read as three independent yet hierarchical spaces, they should not be considered as operating independently, nor are they ordered in a hierarchical fashion (Beyes, 2018). Rather, the three spaces flow together into a 'single moment of social space' (Taylor & Spicer, 2007, p. 335).

It is important to embed Lefebvre's spatial triad within his political environment and his Marxist philosophy (Elden, Lebas, & Kofman, 2003). As a practising Marxist and a member of the French Communist Party (Merrifield, 2006), Lefebvre argued that space and power are intertwined and

space is produced according to capitalist logics. Space is a sphere within which power relations and hierarchies operate (Dale & Burrell, 2008) and power dynamics 'simply emerge in space, at the level of space, and so engender the contradictions of space' (Lefebvre, 1991 [1974], p. 358). One of the key power dynamics within space is the domination of the lived space by the conceived space. To quote his biographer Merrifield (2006), Lefebvre argued that the 'social space of lived experience gets crushed and vanquished by an abstract conceived space. In our society, in other words, what is lived and perceived is of secondary importance compared to what is conceived' (p. 175). Lefebvre's argument follows that the conceived abstract space holds a position of primacy and power over the lived material reality of space. Yet, dominance over the lived experience has negative consequences, since the everyday has irreducible remainders that cannot be subsumed into the conceived realm. Lived experience should not be 'disdained, regarded as an insignificant residue' (Lefebvre, 2008 [1981], p. 10).

If one adopts a Lefebvrian lens to assess the dynamics of algorithmic surveillance in the gig economy, it is possible to identify a parallel power dynamic between the conceived mathematical realm of the platform's technocratic interface and the lived embodied space in which the worker moves, works and lives. The digital interface, as accessed through the worker's smartphone and through organisational dashboards, produces an abstract virtual representation of reality which is designed, coded and executed as a technical scientific 'representation' of not only the worker's movement but also the space in which he or she operates, namely the urban landscape of streets and buildings. In his *Critique of Everyday Life*, Lefebvre warns that with the rise of the computer, 'capitalism's abstract logic of commodification is extended to the realms of information and communication' (Fuchs, 2018, p. 11). One can observe this capitalist commodification in the transformation of all non-digital media into a single unitary form. Indeed, digitalisation reduces all media to overcome spatio-temporal barriers (Reeves & Packer, 2013). The embodied lived experience, all the remainders of which cannot be subsumed into the conceived, or in Agre's (1994) terms parsed into computer-readable data, is rendered invisible and, unless deliberately sought out with remedial managerial surveillance, permanently lost to the organisation.

From an organisational standpoint, reliance on the technical conceived space raises questions as to the consequences of a mono-spatial approach. If a Deliveroo rider, for instance, fails to make a delivery on time due to an icy road, an unfortunate road blockage, or a stolen bicycle, the algorithm would not know why, only the binary option of either task failure or success. The algorithm would be presented with geolocational data reflective only of the rider's global position, as opposed to the 'situation on the ground'. The burden is then placed on the rider to contact a human dispatcher, evoking managerial surveillance, to counteract such a negative data trace, which could have already been coded into the system with consequences not only for this task but also for future labour opportunities. By relying too heavily on the conceived technical reality as an accurate representation of lived embodied reality, platform-mediated organisations may be constraining themselves by systems of surveillance which result in organisational blindness to the parameters of work (Danaher, 2016; Evans & Kitchin, 2018). Moreover, by situating the worker in an abstracted virtual space, the organisation further abstains from generating a rich holistic understanding of the spatial context of work.

In order to explore further the fragility and consequences of a mono-spatial approach to algorithmic surveillance, I shall continue below with two sections. Since platform-mediated workers are subject to geolocational tracking as objects-in-space, it is important to consider the power dynamics and politics of both body and space. Indeed, Lefebvre is insistent that body and space should be considered both within its social context and as a unitary whole, not subject to abstraction or reduction (Elden, 2004; Lefebvre, 1991 [1974], p. 405). One section therefore examines the abstraction of the worker's body into a digital data double and the other section focuses on the transformation of the urban workspace into abstract digital cartography.

Data doubles

Since platform-mediated workers are perceived primarily through digital capture in the format of digital traces (Thatcher, 2014), they are, in effect, transformed in a process of digital metaphorisation into data; transformed from a physical materiality to a nonphysical materiality (Leonardi, 2007; Orlikowski, 2007). To adopt the concept of Haggerty and Ericson (2000), workers are abstracted into a 'data double', a decorporealised re-assemblage of 'discrete signifying flows' of data captured about them by the platform (Haggerty & Ericson, 2000, p. 612).

With such a transformation, each worker is not captured 'in its totality as a unitary entity, but as a collection of discrete pieces of information' (Zureik, 2003, p. 40). The differential agency involved in decorporealisation, whereby the platform codifies the worker in a subject-object relationship, is a potent reflection of the capitalist logics of abstract space. Lefebvre argues that workers in space 'must either recognize themselves or lose themselves' (Lefebvre, 1991 [1974], p. 35). The unidirectional reductionism leveraged on workers by the platform thus raises questions regarding the potential for self-identification with their 'digital double', and the extent to which actions handled by the platform on their digital double can affect the subjective experience of the worker.

Turning briefly to the mode of visual worker representation, it is possible to observe a similar process of reductionism and decorporealisation in the use of pictoral icons. The physical body becomes 'a cold technical representation' (Lefebvre, 1991 [1974], pp. 38–9). Platforms such as Foodora and Deliveroo represent their workers as pictorial icons moving dynamically around a cartographic representation of space. Gig economy platforms did not invent the concept of abstract worker visualisation. Workers in many traditional contexts have been transformed into avatars for organisational purposes (Bengtsson, 2017). Within the study of organisations, there has been a notable 'material and visual turn' (Meyer et al., 2013). This has emerged partly as a result of the greater reliance of contemporary organisations on the visual as a mechanism for organisation (Boxenbaum, Jones, Meyer, & Svejenova, 2018). Under a critical semiotic approach, these visual icons of workers can be decoded to reveal how they are used to exercise power and authority (Alcadipani & Islam, 2017). As a primary reading of worker icons, it is possible to point out that workers are represented in a non-human fashion. Building on the earlier discussion of decorporealisation, it is striking that the worker is now decorporealised to such an extent that they no longer have a body even in graphical form.

When discussing the body-as-object it is also important to highlight the element of object-as-body in the gig economy, namely the interchangeability of the surveillance device with the embodied worker. It is significant that gig economy platforms primarily collect proxy data in the form of device-telematics rather than through direct surveillance of the body. Making the device the primary target of surveillance and control has implications for interchangeability. Riders can, in effect, 'swap' devices and thus workplace identities. A rider could outsource their own shift to a friend with little risk of organisational awareness or reprimand as long as the labour was carried out effectively. Moreover, organisational inattention towards the object-as-body can result in skewed performance data. The data of workers utilising push-bikes and electronic-bikes on Foodora, for instance, is not differentiated internally nor during performance appraisal, meaning that a relatively fast cyclist can end up at the bottom or middle of the performance rankings, utterly demotivated, simply because the sweat of their physical labour is no match to the speed of a machine unrestrained by biological limitations.

Cartographic dissonance

As discussed above, algorithmic surveillance necessitates the abstraction of the body into a data double. However, due to the geo-spatial characteristics of the trajectory data upon which algorithmic

surveillance is levied, this data double needs to be contextualised within a similarly abstract representation of space: into Lefebvrian conceived space.

Historically, maps have been used as important tools in the representation and analysis of spatio-temporal data (Kraak & Ormeling, 2010). Accordingly, platform-mediated organisations make use of various forms of digital cartography, usually preferring the particularly abstract vertical top-down perspective (Shapiro, 2018). Reflecting the increase in data-driven mapping technologies, options for digital cartography range from third party digital maps to in-house visualisations (Shaw & Graham, 2017; Thrift & French, 2002). Foodora, for instance, makes use of Google Maps for spatial representation. These interfaces thus become a bricolage of real-time activities 'draped over an otherwise atemporal landscape' (Graham, Zook, & Boulton, 2013, p. 8).

Gig economy platforms operate with the high expectation of mapping accuracy. For Deliveroo, 'the GPS tracking situates the rider in a four meter area through signals which travel in lines directly from terra firma to satellites' (Waters & Woodcock, 2017). However, the tracking technologies routinely levied by platform-mediated organisations have technical limitations that sometimes hinder their effective utilisation. Geo-location technologies such as GPS are unreliable and signal precision can vary depending on local circumstances and the reliability of high-functioning radio frequency signals transmitted between satellites and receivers (Lam, Tang, & Grundy, 2016; Michael & Clarke, 2013). Non-direct line-of-sight paths and urban canyons can also create issues of multipath propagation and shadowing, which reduce accuracy and hinder accurate positioning (Beinstein & Sumers, 2016).

Although geo-locational accuracy is a prominent concern for the efficacy of algorithmic surveillance, there has been limited discourse between organisational and technical literature in addressing it. In the field of location-based services, for instance, the adoption of location-based services for work and labour has been overlooked in favour of discussions regarding gaming and tourism (Michael & Clarke, 2013; Raper, Gartner, Karimi, & Rizos, 2007; Zhao, 2015). Levy's (2015) in-depth investigation of the introduction of electronic monitoring systems in the truck driving industry provides a valuable exception in revealing ambivalence of experienced truck drivers towards technological routing systems, such as GPS. For Levy's (2015) truck drivers, faulty GPS systems were one of the reasons for relying on their own knowledge to operate.

In addition to geo-location accuracy, algorithmic surveillance is also reliant on accuracy in the digital maps, with the expectation that the digital maps have a close correspondence with reality. However, reliance on the act of mapping summons the Lefebvrian tension between conceived and lived space, since technical scientific maps are key examples of not only how the conceived space dominates the lived space, but also how conceived space necessitates a form of reductionism and codified ignorance to infinite invisible activities. To quote Lefebvre,

> How many maps in the descriptive or geographical sense, might be needed to deal exhaustively with a given space, to code and decode all its meanings and contents? It is doubtful whether a finite number can ever be given in answers to this sort of question. (Lefebvre, 1991 [1974], p. 84)

We can therefore identify a tension in digital mapping, since digital maps are particularly reliant on a positivistic epistemology, founded on the scientific principles of cartography, mathematics and Euclidian geometry (Gregory, 1994; Harley, 1992; Sahay, 1998). However, drawing on Korzybski's (1933) notable invocation that a map is not the territory, we can argue that maps are representational artefacts which do not resemble the world. It would thus be a logical fallacy to expect exact representation (Borges, 2004). In line with Lefebvre, maps are rather reflections of hierarchies of power and embed themselves into pre-existing power structures, whereby social structures are 'often disguised beneath an abstract, instrumental space, or incarcerated in the coordinates of computer

mapping' (Harley, 1992). Kitchin and Dodge (2011) have also tried to question the value of maps as a secure spatial representation, presenting arguments that cartography can be profitably conceived as processual rather than representational, with maps lacking a secure ontological status.

In the gig economy, one can regard this abstraction of mapping as engendering a lack of awareness about the spatial conditions in which the workers operate, ranging from weather and traffic conditions, to potential hindrances or bystanders. The codified static nature of digital maps further acts as a dominating force, in that they reflect a reality which is potentially out of sync with lived space. Routes, roads, buildings and restaurant layouts may have shifted, but unless they have been recoded into the digital map in a form of ongoing curation, these changes will not be known by the platform or the algorithm which is providing directions or allocating tasks to the nearest rider.

Algorithmic surveillance, when reliant on digital cartography, also cannot take into account specific terrain faced by riders. Briziarelli (2018), for instance, notes how digital maps cannot 'reproduce all the contingencies of the concrete lived space of the city, made of for instance road cracks, weather, pedestrians, car commuters, and unforeseen detours' (Briziarelli, 2018, p. 835). Digital mapping systems, for instance, do not take into account the distance which must be travelled to the customer's precise location, such as on upper floors of apartment buildings or in office blocks (Shapiro, 2018). Goods et al. (2019) also discussed how, as a result of the transient nature of gig work, accidents are common. These hurdles, not reflected in the abstract representation, have immediate consequences for the workers. Any additional time required to comprehend and interact with material difficulties negatively impact worker performance metrics and payment (Shapiro, 2018). Moreover, if riders stray too far from expected routes or are delayed too long in a certain area, platform dispatchers may intervene (Veen et al., 2020).

Space for Resistance

Algorithmic surveillance, like all forms of intensive surveillance, generates opportunities for worker resistance (Ball & Wilson, 2000). While resistance can range from sabotage to manipulation and circumvention, a persistent prerequisite for resistance is the existence of 'a break, or a "gap" in the technology-mediated relationship between the watcher and the watched' (Ball, 2010, p. 99). Mirroring Ball's (2010) discussion of 'gaps', Lefebvre also argues that the epistemological distance between conceived, perceived and lived space generates space for resistance. Space, as socially produced, is always 'susceptible of being diverted, re-appropriated and put to a purpose quite different from its initial use' (Lefebvre, 1991 [1974], p. 167). Indeed, Lefebvre regards everyday life as the key domain for developing resistance towards the forces of capitalism.

The urban landscape where food-delivery workers operate is already a tension point for Lefebvre, since the urban form itself is representative of the concrete abstraction of social relations (Lefebvre 2003 [1970]; O'Kane, 2018). The city is where domination is consolidated, a space where the 'totalizing repressive space of the logic of commodities present in every object that is bought, sold and consumed' (Lefebvre 2003 [1970], p. 177). Distinguishing between 'dominated space' and 'appropriated space', Lefebvre argues that dominated space is space mediated by technology, while appropriated space is modified by a particular group for a particular purpose. Appropriation is the process where users 'can alter, add or subtract, superimpose their own ideas (symbols, organization) on what is provided' (Lefebvre, 2003 [1970], p. 130).

In food delivery, workers can generate spaces of resistance for the purpose of active protesting against organisational decisions. Briziarelli (2018), observing a 2017 Deliveroo worker protest in Milan, illustrates how resisting Deliveroo workers strategically cut across 'abstract' space and re-territorialize a third space dimension where workers can organise and antagonise digital capitalism. Briziarelli (2018) details how Deliveroo workers 'would log in then, when being assigned

delivery orders, would refuse to deliver them, thus breaching the circuit of production between the abstract digital realm and the lived space where a given order translates into a physical delivery' (p. 830). Further, by organising a street protest in the form of a leisurely group bike ride (*biciclettata*), workers created a 'space for radical contestation' (Thatcher & Dalton, 2017, p. 143). The conscious refusal to perform deliveries, instead cruising around common delivery routes, highlighted the gap between the individually experienced practice of riding within the city and the 'abstract representation of space as provided by Deliveroo's logistic imperatives' (Briziarelli, 2018, p. 831). A similar appropriation of space and resistance to algorithmic surveillance was noted at a Deliveroo protest in 2016, where workers co-opted the 'zone centers' where riders are usually expected to work. Although they were present in the 'site' of work, workers remained logged out of their apps and moved 'invisibly' to the Deliveoro offices (Waters & Woodcock, 2017). In this instance, the workers' 'dots on the maps all vanished, only to appear again as a physical presence, outside their offices *en masse*' (Waters & Woodcock, 2017).

More commonplace and quotidian forms of resistance can also be observed in the use of spatial resistance to optimise individual delivery allocations. By understanding the parameters of the algorithmic processes, including a full conceptualisation of what data is captured and how it is processed, workers can generate spaces of resistance. Indeed, workers often share their insights and 'hacks' through communities, such as WhatsApp groups or Slack channels (Chan, 2019).

Active manipulation of surveillance mechanisms through data obfuscation, especially concerning the location and movement of the worker, is also a powerful form of worker agency. Data obfuscation, defined by Brunton and Nissenbaum (2015), involves 'the deliberate addition of ambiguous, confusing or misleading information to interfere with surveillance and data collection' (p. 1). Workers can manipulate GPS signals through location-masking tools, or use software to deactivate auto-acceptance functions within the worker app (Veen et al., 2020). Workers can also informally switch orders among themselves (Sun, 2019). Yet, rather than data obfuscation being levied for political resistance or to enhance personal privacy (Brunton & Nissenbaum, 2011, 2015; Swanlund & Schuurman, 2019), workers use data obfuscation tools to alter which data is collected for economic reasons. Since workers are paid with a flat hourly fee and a per-order bonus, the financial model incentivises workers to 'play the system' in their own favour, obtaining deliveries in optimal zones or even multiple orders simultaneously.

A current Foodora rider captain, in an interview with the author, commented about how workers are using software and data obfuscating tools, noting that the organisation is nevertheless aware of these actions of resistance:

> I was a bit surprised, [Foodora] told me that some riders are still using that. I used that, we all used that. These guys that started this fake GPS. The idea at the beginning was to take more orders. For example, riders like to work in one [region] . . . What you do, you put the fake GPS in [specific region]. There. . . you always get deliveries in [region]. (Interview with a Foodora Rider Captain)

As Sewell and Barker (2006) note, monitoring and surveillance are always subject to negotiation at the micro level. In the case of platform-mediated workers, negotiations over when, where and how they are surveilled remain open. By leveraging the interstitial 'gaps' between conceived, perceived and lived space, workers are able to draw on the same logics of algorithmic disruption to enact both disorderly forms of resistance and micro acts of resistance. Yet, by tightly aligning worker remuneration with worker performance, 'resistance' results in workers seeking to appropriate more tasks and thus more labour for themselves. More, quicker orders at shorter distances lead to higher take-home pay when workers are paid per order. Rather than acting contra-organisationally, in the zero-sum game of food delivery, workers can end up turning the weapons of resistance against novice or more honest workers.

Conclusion

Gig economy platforms have a highly visible workforce in urban landscapes, with vibrantly coloured rider outfits and cargo-boxes functioning as a dynamic, moveable symbol. Indeed, the sight of a pink- or turquoise-clad rider hustling through urban streets in sun, rain or snow is for many individuals their primary conceptualisation of a platform-mediated organisation. The workers' overt observability actively invites public observance of their human labour. However, while such visibility serves as a potent marketing technique and aids in identifying the worker to restaurateurs and consumers alike, this vibrant visibility is juxtaposed with the invisibility of the worker within organisational processes.

In this paper, I have provided a theoretical exploration of the notion of algorithmic surveillance, which operates alongside managerial and customer surveillance in a multimodal surveillance assemblage. As an assemblage of computational processes which generate data, evaluate worker behaviour and assign labour activities, this non-human 'algorithmic gaze' does not merely replace human observation in organisational settings; it also replaces human decision-making. The prominence given by organisations to algorithmic surveillance is understandable since platform-mediated organisations are incentivised to avoid imposing direct managerial activities to avoid legal challenges around workers' employment classification (Newlands et al., 2018). The reduction of managerial oversight also reduces costs for organisations seeking to operate according to the minimalist principles of lean organisation.

Drawing on Henri Lefebvre's spatial triad, I outlined how platform-mediated organisations restrict their organisational knowledge-building if they rely too heavily on the conceived space generated through algorithmic surveillance and ignore the lived and perceived reality of workers. Rather than capturing in a holistic way the embodied reality of on-demand food delivery, platform-mediated organisations currently perceive only quantifiable data, with workers' bodies translated into abstract symbols moving on an abstract digital landscape. Cartographic dissonance, as discussed above, refers to the experiential and epistemological chasm between 'reality' and the abstract digital landscape. With increasing research into the material realities of organisational space (Ball, 2010; Beyes & Steyaert; Dale & Burrell, 2008), greater attention needs to be given to the digital representations of space upon which and through which organisational decision-making is increasingly levied.

The limitations of the 'algorithmic gaze' make over-reliance on algorithmic surveillance a risky organisational strategy. Without robust additive surveillance, by customers or human managerial staff, organisations will lose insight into their business activities, and insight into the material, embodied reality of their workforce. Organisations thus need to provide supplementary modes of upwards information transfer, whether in the form of worker representation, middle management or customer feedback.

However, the epistemological gaps between the immaterial reality captured by mechanisms of algorithmic surveillance and the lived embodied experience of the worker also generate spaces of resistance and reappropriation. For Lefebvre, spatial appropriation refers to traditionally disempowered spatial users modifying or superimposing their own ideals and forms of organisation onto the space provided for them. As such, workers have levied both collectivist and individualistic tactics of resistance. On a collectivist level, street protests and office occupations enthusiastically play with workers' embodied visibility. Their physical presence is a reminder that, unlike their digital avatars, they cannot be subjected to remote, digital control. They must be apprehended and approached as material, embodied workers with needs and rights. On an individualistic level, workers also perform micro acts of resistance through the use of technical measures, such as fake GPS signals. By exploiting gaps in organisational knowledge about a worker's 'actual' position, a worker can obtain more profitable work for themselves. This is one form of data obfuscation, though levied for purposes of economic benefit rather than privacy

enhancement. Workers do not want to avoid observation within the normal course of work and they go to great efforts to maintain the algorithmic gaze in instances where internet connections are disrupted or their smartphones run out of battery. Instead, workers want to appropriate the tools of algorithmic surveillance to modify the data signals, and thus grasp a form of control over the algorithmic decision-making. As opposed to more collective and class-based forms of resistance, data obfuscation is an individualistic practice and can negatively impact other workers. As a relatively novel form of workplace resistance, particularly given the conflict between individual and collective interests, this aspect should be given further attention in future research.

ORCID iD

Gemma Newlands https://orcid.org/0000-0003-0851-384X

Note

1. Quotes included for illustration are drawn from a wider, ongoing qualitative study conducted by the author. A total of 55 semi-structured interviews, lasting between 35 and 180 minutes each, were conducted by the author between April 2019 and January 2020. Participants included riders, rider captains and dispatchers from Deliveroo, Foodora and Wolt. Interviews were conducted across Norway, Sweden, Denmark and the Netherlands.

References

Agre, P. E. (1994). Surveillance and capture: Two models of privacy. *The Information Society: An International Journal*, *10*, 101–127.

Ajunwa, I., Crawford, K., & Schultz, J. (2017). Limitless worker surveillance. *California Law Review*, *105*, 735–776.

Alcadipani, R., & Islam, G. (2017). Modalities of opposition: Control and resistance via visual materiality. *Organization*, *24*, 866–891.

Anderson, D. N. (2016). Wheels in the head: Ridesharing as monitored performance. *Surveillance & Society*, *14*, 240–258.

Andrejevic, M. (2002). The work of watching one another: Lateral surveillance, risk, and governance. *Surveillance & Society*, *2*, 479–497.

Bailey, D. E., Leonardi, P. M., & Barley, S. R. (2011). The lure of the virtual. *Organization Science*, *23*, 1485–1504.

Ball, K. (2010). Workplace surveillance: An overview. *Labour History*, *51*, 87–106.

Ball, K., & Wilson, D. (2000). Power, control and computer-based performance monitoring: Subjectivities, repertoires and resistance. *Organization Studies*, *21*, 536–565.

Beinstein, A., & Sumers, T. (2016). Uber engineering: How Uber engineering increases safe driving with telematics. Available at: https://eng.uber.com/telematics/

Bengtsson, S. (2017). Avatar as second suit. Power and participation in virtual work. *Games and Culture*, online first, https://doi.org/10.1177/1555412017710616

Berreneche, C. (2012). Governing the geocoded world: Environmentality and the politics of location platforms. *Convergence*, *18*, 331–351.

Beyes, T. (2018). Politics, embodiment, everyday life: Lefebvre in spatial organization. In S. F. Kingma, K. Dale, & V. Wasserman (Eds.), *Organizational space and beyond: The significance of Henri Lefebvre for organization studies* (pp. 1–24). London: Routledge.

Beyes, T., & Steyaert, C. (2011). Spacing organization: Non-representational theory and performing organizational space. *Organization*, *19*, 45–61.

Brocklehurst, M. (2001). Power, identity and new technology homework: Implication for 'new forms' of organizing. *Organization Studies*, *22*, 445–446.

Borges, J. L. (2004). *A universal history of iniquity* (A. Hurley, Trans.). London: Penguin.

Boxenbaum, E., Jones, C., Meyer, R. E., & Svejenova, S. (2018). Towards an articulation of the material and visual turn in organization studies. *Organization Studies*, *39*, 597–616.

Brenner, N., & Elden, S. (2009). Henri Lefebvre on State, Space, Territory 1. *International Political Sociology*, *3*, 353–377.

Briziarelli, M. (2018). Spatial politics in the digital realm: The logistics/precarity dialectics and Deliveroo's tertiary space struggles. *Cultural Studies*, *33*, 823–840.

Brunton, F., & Nissenbaum, H. (2011). Vernacular resistance to data collection and analysis: A political theory of obfuscation. *First Monday*, *16*(5).

Brunton, F., & Nissenbaum, H. (2015). *Obfuscation: A user's guide for privacy and protest*. Cambridge, MA: MIT Press.

Chan, N. K. (2019). 'Becoming an expert in driving for Uber': Uber driver/bloggers' performance of expertise and self-presentation on YouTube. *New Media & Society*, online first. https://doi.org/10.1177/1461444819837736

Christin, A. (2017). Algorithms in practice: Comparing web journalism and criminal justice. *Big Data & Society*, *4*(2), 1–14.

Couldry, N., & Hepp, A. (2017). *The mediated construction of reality*. Cambridge, UK: Polity Press.

Dablanc, L., Morganti, E., Arvidsson, N., Woxenius, J., Browne, M., & Saidi, N. (2017). The rise of on-demand 'Instant Deliveries' in European cities. *Supply Chain Forum: An International Journal*, *18*, 203–217.

Dale, K. (2005). Building a social materiality: Spatial and embodied politics in organizational control. *Organization*, *12*, 649–678.

Dale, K., & Burrell, G. (2008). *The spaces of organisation and the organisation of space: Power, identity and materiality at work*. Basingstoke, UK; New York: Palgrave Macmillan.

Danaher, J. (2016). The threat of algocracy: Reality, resistance, and accommodation. *Philosophy and Technology*, *29*, 245–268.

De Stefano, V. (2016). Introduction: Crowdsourcing, the gig-economy and the law. *Comparative Labor Law & Policy Journal*, *37*, 461–470.

Deleuze, G. (1992). Postscript on the societies of control. *October*, *59*, 3–7.

Elden, S. (2004). Rhythmanalysis: An introduction. In H. Lefebvre (Ed.), *Rhythmanalysis* (translated by S. Elden & G. Moore) (pp. vii–xv). London: Continuum.

Elden, S., Lebas, E., & Kofman, E. (2003). *Henri Lefebvre: Key writings*. New York: Continuum.

Elliott, C. S., & Long, G. (2016). Manufacturing rate busters: Computer control and social relations in the labour process. *Work, Employment and Society*, *30*, 135–151.

Evans, L., & Kitchin, R. (2018). A smart place to work? Big data systems, labour, control and modern retail stores. *New Technology, Work and Employment*, *33*, 44–57.

Fleming, P. (2017). The human capital hoax: Work, debt and insecurity in the era of Uberization. *Organization Studies*, *38*, 691–709.

Fleming, P., & Spicer, A. (2008). Beyond power and resistance. *Management Communication Quarterly*, *21*, 301–309.

Foucault, M. (1975). *Discipline and punish: The birth of the prison*. New York: Vintage.

Fuchs, C. (2018). Henri Lefebvre's theory of the production of space and the critical theory of communication. *Communication Theory*, *29*, 129–150.

Gandini, A. (2019). Labour process theory and the gig economy. *Human Relations*, *72*, 1039–1056.

Giddens, A. (1984). *The constitution of society: Outline of the theory of structuration*. Berkeley, CA: University of California Press.

Gillespie, T. (2014). The relevance of algorithms. In T. Gillespie, P. J. Boczkowski, & K. A. Foot (Eds.), *Media technologies: Essays on communication, materiality, and society* (pp. 167–194). Cambridge, MA: MIT Press.

Goods, C., Veen, A., & Barratt, T. (2019). 'Is your gig any good?' Analysing job quality in the Australian platform-based food-delivery sector. *Journal of Industrial Relations*, online first. https://doi.org/10.1177/0022185618817069

Graham, M., Zook, M., & Boulton, A. (2013). Augmented reality in urban places: Contested content and the duplicity of code. *Transactions of the Institute of British Geographers*, *38*, 464–479.

Gregory, D. (1994). *Geographical imaginations*. Cambridge, MA: Blackwell.

Haggerty, K. D., & Ericson, R. V. (2000). The surveillant assemblage. *British Journal of Sociology*, *51*, 605–622.

Healy, J., Nicholson, D., & Pekarek, A. (2017). Should we take the gig economy seriously? *Labour & Industry: A Journal of the Social and Economic Relations of Work*, *27*, 232–248.

Harley, J. B. (1992). Deconstructing the map. In T. J. Barnes & J. S. Duncan (Eds.), *Writing worlds* (pp. 231–247). London: Routledge.

Howcroft, D., & Bergvall-Kåreborn, B. (2019). A typology of crowdwork platforms. *Work, Employment and Society*, *33*, 21–38.

Jabagi, N., Croteau, A-M., Audebrand, L. K., & Marsan, J. (2019). Gig-workers' motivation: Thinking beyond carrots and sticks. Online first. https://doi.org/10.1108/JMP-06-2018-0255

Just, N., & Latzer, M. (2017). Governance by algorithms: Reality construction by algorithmic selection on the Internet. *Media, Culture & Society*, *39*, 238–258.

Kalleberg, A., & Vallas, S. P. (2018). Probing precarious work: Theory, research, and politics. *Research in the Sociology of Work*, *31*, 1–30.

Kingma, S. F., Dale, K., & Wasserman, V. (2018). Introduction. In S. F. Kingma, K. Dale, & V. Wasserman (Eds.), *Organizational space and beyond: The significance of Henri Lefebvre for organization studies* (pp. 1–24). London: Routledge.

Kitchin, R., & Dodge, M. (2011). *Code/space: Software and everyday life*. Cambridge, MA: MIT Press.

Korzybski, A. (1933). A non-Aristotelian system and its necessity for rigour in mathematics and physics. In *Science and sanity: An introduction to non-Aristotelian systems and general semantics* (pp. 747–761). Lancaster, PA: International Non-Aristotelian Library Publishing Co.

Kraak, M-J., & Ormeling, F. (2010). *Cartography visualization of spatial data*. Bristol, PA: Taylor & Francis.

Kuhn, K. M., & Maleki, A. (2017). Micro-entrepreneurs, dependent contractors, and instaserfs: Understanding online labor platform workforces. *Academy of Management Perspectives*, *31*, 183–200.

Lam, L., Tang, A., & Grundy, J. (2016). Heuristics-based indoor positioning systems: A systematic literature review. *Journal of Location Based Services*, *10*, 178–211.

Lee, M. K., Kusbit, D., Metsky, E., & Dabbish, L. (2015, April). Working with machines: The impact of algorithmic and data-driven management on human workers. In *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems* (pp. 1603–1612). New York: ACM.

Lefebvre, H. (1991 [1974]). *The production of space* (D. Nicholson-Smith, Trans.). Oxford: Blackwell.

Lefebvre, H. (2003 [1970]). *The urban revolution* (R. Bononno, Trans.). Minnesota, MN: University of Minnesota Press.

Lefebvre, H. (2008 [1981]). *Critique of everyday life, Vol. III: From modernity to modernism* (J. Moore, Trans.). London: Verso.

Leonardi, P. M. (2007). Activating the informational capabilities of information technology for organizational change. *Organization Science*, *18*, 813–831.

Levy, K. E. C. (2015). The contexts of control: Information, power, and truck-driving work. *Information Society*, *31*, 160–174.

Lutz, C., Newlands, G., & Fieseler, C. (2018, January). Emotional labor in the sharing economy. In *Proceedings of the 51st Hawaii International Conference on System Sciences* (pp. 636–645). Honolulu, HI.

Lyon, D. (2006). 9/11, synopticon, and scopophilia: Watching and being watched. In K. D. Haggerty & R. V. Ericson (Eds.), *The new politics of surveillance and visibility* (pp. 35–54). Toronto, Canada: University of Toronto Press.

Lyon, D. (2007). *Surveillance studies: An overview*. Cambridge, UK: Polity Press.

Lyon, D. (2018). *The culture of surveillance: Watching as a way of life*. Cambridge, UK: Polity Press.

Merrifield, A. (2006). *Henri Lefebvre: A critical introduction*. New York: Routledge.

Meyer, R. E., Höllerer, M., Jancsary, D., & van Leeuwen, T. (2013). The visual dimension in organizing, organization, and organization research: Core ideas, current developments, and promising avenues. *Academy of Management Annals*, *7*, 489–555.

Michael, K., & Clarke, R. (2013). Location and tracking of mobile devices: Überveillance stalks the streets. *Computer Law and Security Review*, *29*, 216–228.

Möhlmann, M., & Zalmanson, L. (2017). Hands on the wheel: Navigating algorithmic management and Uber drivers' autonomy. In *Proceedings of the International Conference on Information Systems*.

Nash, L. (2020). Performing place: A rhythmanalysis of the city of London. *Organization Studies*, *41*, 301–321.

Newlands, G., Lutz, C., & Fieseler, C. (2018). Provider classification and collective action in the sharing economy. *New Technology, Work and Employment*, *33*, 250–267.

O'Kane, C. (2018). Henri Lefebvre and the critical theory of society. In J. Bauer & R. Fischer (Eds.), *Perspectives on Henri Lefebvre: Theory, Practices and (Re)Readings*, *4*(3), 55–76.

Orlikowski, W. J. (1991). Integrated information environment or matrix of control? The contradictory implications of information technology. *Accounting, Management and Information Technologies*, *1*(1), 9–42.

Orlikowski, W. J. (2007). Sociomaterial practices: Exploring technology at work. *Organization Studies*, *28*, 1435–1448.

Orlikowski, W. J., & Scott, S. V. (2015). Exploring material-discursive practices. *Journal of Management Studies*, *52*, 697–705.

Pasquale, F. (2015). *The black box society: The secret algorithms that control money and information*. Cambridge, MA: Harvard University Press.

Peticca-Harris, A., deGama, N., & Ravishankar, M. N. (2020). Postcapitalist precarious work and those in the 'drivers' seat: Exploring the motivations and lived experiences of Uber drivers in Canada. *Organization*, *27*, 36–59.

Prassl, J., & Risak, M. (2015). Uber, taskrabbit, and co.: Platforms as employers? Rethinking the legal analysis of crowdwork. *Comparative Labour Law and Policy Journal*, *37*, 619–652.

Rahwan, I. (2018). Society-in-the-loop: Programming the algorithmic social contract. *Ethics and Information Technology*, *20*, 5–14.

Raper, J., Gartner, G., Karimi, H., & Rizos, C. (2007). Applications of location based services: A selected review. *Journal of Location Based Services*, *1*(2), 89–111.

Reeves, J., & Packer, J. (2013). Police media: The governance of territory, speed, and communication. *Communication and Critical/Cultural Studies*, *10*, 359–384.

Rolland, K. H., & Monteiro, E. (2002). Balancing the local and the global in infrastructural information systems. *Information Society*, *18*(2), 87–100.

Rosenblat, A., & Stark, L. (2016). Algorithmic labor and information asymmetries: A case study of Uber's drivers. *International Journal of Communication*, *10*, 3758–3784.

Rosenblat, A. (2018). *Uberland: How algorithms are rewriting the rules of work*. Oakland, CA: University of California Press.

Rossiter, N. (2016). *Software, infrastructure, labor: A media theory of logistical nightmares*. New York: Routledge.

Rudolph, C., & Gruber, J. (2017). Cargo cycles in commercial transport: Potentials, constraints, and recommendations. *Research in Transportation Business & Management*, *24*, 26–36.

Sahay, S. (1998). Implementing GIS technology in India: Some issues of time and space. *Accounting, Management, and Information Technology*, *8*, 147–188.

Schildt, H. (2017). Big data and organizational design: The brave new world of algorithmic management and computer augmented transparency. *Innovation*, *19*, 23–30.

Scholz, T. (2017). *Uberworked and underpaid: How workers are disrupting the digital economy*. Cambridge, UK: Polity Press.

Sewell, G. (1998). The discipline of teams: The control of team-based industrial work through electronic and peer surveillance. *Administrative Science Quarterly*, *43*, 397–428.

Sewell, G., & Barker, J. R. (2006). Coercion versus care: Using irony to make sense of organizational surveillance. *Academy of Management Review*, *31*, 934–961.

Sewell, G., & Taskin, L. (2015). Out of sight, out of mind in a new world of work? Autonomy, control, and spatiotemporal scaling in telework. *Organization Studies*, *36*, 1507–1529.

Shapiro, A. (2018). Between autonomy and control: Strategies of arbitrage in the 'on demand' economy. *New Media & Society*, *20*, 2954–2971.

Shaw, J., & Graham, M. (2017). An Informational right to the city? Code, content, control, and the urbanization of information. *Antipode*, *49*, 907–927.

Sprenger, F. (2019). The network is not the territory: On capturing mobile media. *New Media & Society*, *21*, 77–96.

Srnicek, N. (2017). *Platform capitalism*. Cambridge, UK: Polity Press.

Stanford, J. (2017). The resurgence of gig work: Historical and theoretical perspectives. *Economic and Labour Relations Review*, *28*, 382–401.

Stewart, A., & Stanford, J. (2017). Regulating work in the gig economy: What are the options? *Economic and Labour Relations Review*, *28*, 420–437.

Sun, P. (2019). Your order, their labor: An exploration of algorithms and laboring on food delivery platforms in China. *Chinese Journal of Communication*, *12*, 308–323.

Swanlund, D., & Schuurman, N. (2019). Resisting geosurveillance: A survey of tactics and strategies for spatial privacy. *Progress in Human Geography*, *43*, 596–610.

Taylor, S., & Spicer, A. (2007). Time for space: A narrative review of research on organizational spaces. *International Journal of Management Reviews*, *9*, 325–346.

Thatcher, J. (2014). Living on fumes: Digital footprints, data fumes, and the limitations of spatial big data. *International Journal of Communication*, *8*, 1765–1783.

Thatcher, J., & Dalton, C. M. (2017). Data derives: Confronting digital geographic information as spectacle. *THE SPECTACLE 2.0*.

Thrift, N., & French, S. (2002). The automatic production of space. *Transactions of the Institute of British Geographers*, *27*, 309–335. https://doi.org/10.1007/s00146-018-0852-6

Ticona, J., & Mateescu, A. (2018). Trusted strangers: Carework platforms' cultural entrepreneurship in the on-demand economy. *New Media & Society*, *20*, 4384–4404.

Tyler, M., & Cohen, L. (2010). Spaces that matter: Gender performativity and organizational space. *Organization Studies*, *31*, 175–198.

Valenduc, G., & Vendramin, P. (2016). *Work in the digital economy: Sorting the old from the new* (No. UCL–Université Catholique de Louvain). Brussels: European Trade Union Institute.

Veen, A., Barratt, T., & Goods, C. (2020). Platform-capital's 'app-etite' for control: A labour process analysis of food-delivery work in Australia. *Work, Employment and Society*, *34*, 388–406.

Waters, F., & Woodcock, J. (2017, Sep. 20). Far from seamless: A workers' inquiry at Deliveroo. *Viewpoint Magazine*. Available at https://www.viewpointmag.com/2017/09/20/far-seamless-workers-inquiry-deliveroo/

Watkins, C. (2005). Representations of space, spatial practices and spaces of representation: An application of Lefebvre's spatial triad. *Culture and Organization*, *11*, 209–220.

Zhang, Z. (2006). What is lived space. *Ephemera: Theory & Politics in Organization*, *6*, 219–223.

Zhao, X. (2015). On processing GPS tracking data of spatiotemporal car movements: A case study. *Journal of Location-Based Services*, *9*, 235–253.

Zuboff, S. (2015). Big other: Surveillance capitalism and the prospects of an information civilization. *Journal of Information Technology*, *30*, 75–89.

Zureik, E. (2003), Theorizing surveillance: The case of the workplace. In D. Lyon (Ed.), *Surveillance as social sorting: Privacy, risk & digital discrimination* (pp. 31–56). London: Routledge.

Author biography

Gemma Newlands is a PhD candidate at the University of Amsterdam and a Doctoral Stipendiary Fellow at the Nordic Centre for Internet and Society, BI Norwegian Business School. Her research explores platform-mediated recognition in the digital economy, with a particular emphasis on surveillance, obfuscation and hybrid AI-human management systems. She has been published in *New Technology, Work and Employment, New Media & Society, First Monday, Internet Research, Journal of Business Research* and *The Law and Ethics of Human Rights.*