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Work, labour and mobility: opening up a dialogue between fmobilities and political economy through mobile work

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ABSTRACT

This paper demonstrates how mobilities perspectives might contribute to debates in political economy on labour and work, by interrogating mobility's relation to work and labour. The paper makes four interventions. It offers (1) an overview of the literature on mobile work, working with mobilities concerns to develop a typology grounded in movement in geographical space. (2) It then examines how different types of mobile work are coordinated. Coordination is achieved by devices, some of which (timetables and algorithms) choreograph movement in space and time whilst others (e.g. signals, tachographs, apps) control, record and evaluate movement. Focusing on coordination devices allows for mobile labour to be differentiated from mobile work. In platform-mediated mobile work the governance of work through dashboards of mobility, and the consolidation and marketization of mobility data from mobile workers, turns mobile work to mobile labour, and the relation of labour and mobility from one of contingency to dependency. The paper further shows (3) how coordination devices shape the conditions of mobile work and the affective experience of working on-the-move in space and time. As a condition of more jobs is that they are done on-the-move, a consequence (4) is that labour activists recognise the conditions of mobility in employment.

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1. Introduction

Whilst the primary interlocutor for mobilities research remains society, another concern is the connection of mobility and economy. There have been several touching points, including efforts to bring mobilities research into closer dialogue with transport geography (Shaw and Hesse 2010; Crang and Zhang 2012) and the inflection of freight through cargo-mobilities (Birtchell, Savitzky, and Urry 2015). A longer standing concern, however, has been with the connections of mobility, labour and work. An open question raised here is what additionality has been brought to the table. Does mobilities research have something unique and important to contribute to advancing how labour and work are understood? In what follows I seek to answer that question in the affirmative, through an examination of mobile work as movement in time-space.

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The broad contention which underpins this paper is that the primary problem facing mobilities research on labour and work, and inhibiting the development of its contribution to those fields, is that it has focused on mobility *per se* rather more than on mobility's relation to work and/or labour. That emphasis runs across and connects early research in the mobilities canon, which homed in on the global elite criss-crossing the world at speed, and later work which, in response, focused on the affective qualities of more mundane forms of passengering, by train, plane, ship, bus and coach. Less considered was that much of that mundane mobility entailed labour migration across multiple geographical scales. In other words, it was employment-related movement (Cresswell 2010) – be that the one-way movement of emigration; the international mobility required in numerous professional corporate settings; the seasonal international migration that supports construction work and agricultural work in the Middle East, Asia and Europe, or the day-to-day recursive, repetitive pattern of commuting that characterises multiple urban areas across the world. A question which can be posed of this body of research is what it has to contribute to broader understanding of employment-related mobility, beyond providing insights into the conditions people endure when travelling between the 'moorings' of home and work. Whilst it documents the asymmetries of capital and labour by foregrounding the distances, and lengths to which, people will travel – and in what conditions – to get a job and to earn money, it is difficult to see what's being added here that the extensive literature on labour migration doesn't already know: that labour dances to the tune of, and moves to, sites of capital accumulation.

Rather different is the strand of mobilities research which focuses ostensibly on mobile work. This is understood as 'anywhere/anytime' work, or work which is not tethered to a bricks and mortar workplace. Recognition of the mobile office afforded first by the mobile phone and laptop and then by Wi-Fi connectivity has characterised mobilities research since its inception. Laurier's (2004) study of sales reps' car-offices was the first to highlight auto-mobility's relation to mobile work (see too, Gregson 2017). A more extreme version of the same trend would be 'nomadic work' (Büscher 2014), be that of the untethered global elite for whom business class, wherever it is in the world, is the site of work, or of digital start-ups who frequently eschew a fixed workplace for access to co-working facilities (Richardson 2021). Look closely though and, with the exception of digital working, it is doubtful whether what looks at first sight to be 'anywhere/anytime' work is really this. Even in business class, this is work that can be done whilst on-the-move to a specific somewhere, where other – potentially more important – aspects of a job will then occur – meetings, evaluations, presentations, classes etc. Similarly, those who inhabited Laurier's car-offices were always on their way to meetings with a client, or potential client. Once this is acknowledged, then mobile work defined in this way is little more than an expression of the spatiality of firms and the business and professional networks which link them. Or, said slightly differently, it is a manifestation of the rather obvious point that the nature of contemporary work is such that it requires of at least some workers a mobility which provides the conditions for working.

The approach I develop in this paper differs from these interventions. Along with others, I see the primary contribution of the mobilities field to the wider social sciences to be the emphasis it places on movement (Cresswell 2010; Bastos, Nóvoa, and Salazar 2021). But, I am unconvinced that the ontological accounts of movement that prevail in the field, as in the experience and/or sensation of being on-the-move and/or of embodied movement, by themselves have much to contribute to wider debates on work and/or labour. Rather, I contend that if mobilities perspectives are to show what they can bring to the table here then there is a need to engage those insights more thoroughly with the wider social scientific literature in these fields, particularly with political economy.

To begin to open this up I suggest that there is a need for the mobilities paradigm to recognise how the Marxist political economy literature differentiates the meta-category labour from the more prosaic category that is work. Here, labour and work are not identical, loosely

interchangeable terms or concepts, as tends to be assumed in the mobilities canon (for an example, see the typology offered by Bastos, Nóvoa, and Salazar 2021). Rather, labour is inseparable from the capital-labour relation and debates about value, whereas the term work is reserved for the everyday tasks associated with a particular job and/or unwaged activity (e.g. voluntary work, domestic work). So, when we think about what Bastos, Nóvoa, and Salazar (2021) describe as ‘movement for labour’ then in Marxist political economy framings these are forms of labour migration and employment-related movement which are inseparable from the geographies of capital accumulation. By contrast what Bastos, Nóvoa, and Salazar (2021) identify as ‘movement as labour’ is the everyday tasks which comprise doing a particular job. This is better understood as mobile work, where movement is not just conditional to finding work, or being employed, but rather is fundamental to *how a particular job is done*: either wholly or partially on-the-move. In what follows I preserve that distinction of labour and work.

The paper proceeds through four steps. First I scope out mobile work. I provide an overview of the literature before developing a typology of mobile work, grounded not in embodied movement but in movement in geographical space (Section 2). Second, the paper examines how this movement is achieved, through coordinating space and time (Section 3). In mobile work, coordination is produced through a combination of routing, or the path that is followed in space, and speed – or the time that is taken to achieve that path. I discuss each in turn, focusing on how two coordination devices (timetables and algorithms) produce and shape mobile work, and on how other devices monitor and evaluate that work. I then argue that app-mediated evaluation and the associated rise of dashboards of mobility are transforming forms of mobile work from mobile work to mobile labour. Having established the importance of coordinating devices to the production of mobile work and how a focus on these same devices enables a differentiation of mobile work and mobile labour, in Section 4 I turn thirdly to reintroduce mobilities concerns with embodied movement. There I examine how embodied movement relates to these coordinating devices, not as physical movement but as the affective experience of working on-the-move in time and space. I show how mobile work produced by timetables constitutes lateness as an effect of a network, whilst mobile work produced by algorithms and mediated by apps regards lateness as a quality produced by a mobile worker. This has implications for the experiential conditions of work and its enactment. Fourth, I conclude (Section 5). I argue that the sum of these arguments establish what mobilities perspectives can bring to wider debates in political economy on labour and work. The paper shows that mobile work coordinated through platforms, apps and dashboards has led to the emergence of mobile labour. This changes the relationship of mobility and labour from one of contingency to dependency. As it becomes a condition of more work that more jobs are done on-the-move, a further consequence is that labour activism needs to focus attention not just on employment rights but on the very conditions of mobility themselves.

2. Characterising mobile work

Mobile work differs from what we might think of as ‘moored’ forms of work. The most obvious key distinction is that it lacks a dedicated workplace with a built form, such as an office, a shop, an assembly plant, a factory or a home-office, which acts as the locus for performing a range of tasks. Rather, a characteristic of mobile work is that it is done by moving between places, or geo-locations. Mobile work is therefore defined by being enacted through movement in geographical space. A corollary of this is that types of work which might at first sight appear to be examples of mobile work, such as touring artists (e.g. musicians) or professional sports players (e.g. tennis players, athletes), are not. Rather, their work is yet another instance of occupational mobility which, in these instances, requires often repetitive, or at the very least predictable,

movement between various fixed sites of work (i.e. a workplace) at particular points in a year – specific stadia, concert venues and the like.

That quality of moving between places also defines the other key characteristic of mobile work: its location in technologically-facilitated movement. Moving around in geographical space involves multiple motive forces. There are a few forms of mobile work which continue to rely on walking, e.g. postal delivery, or house-to-house selling. Much more ubiquitous, however, are those forms of work for which motive force of one form of another is essential. There are the forms of mobile work which rely on workers on bicycles, or motorcycles. The meal delivery market (Deliveroo, UberEATS etc.) is the most widespread example of this (Veen, Barratt, and Goods 2020; Gregory and Paredes Maldonado 2020; Gregory 2021; Timko and van Melik, 2021), and is being accelerated through the growth of ‘dark stores’ and the 10-minute on-demand delivery market (e.g. Getir, Gorilla, etc.). Car-based courier work is another variant (Khan 2022). So, the delivery market is one of the prime sites of mobile work. Then there is mobile work involving the movement of capital assets – trains, planes, buses, coaches, trucks and vans, ships. This is work moving goods (freight) and people (passengers). It comprises much work in the transport, haulage and distribution sectors and it underpins all supply chains (Hollowell 1968; Belzer 2000; Belzer 2002; Sampson 2003; Sampson and Wu 2003; Borovnik 2005; McKay 2007; Markkula 2011, 2021a, 2021b; Bloor and Sampson 2009; Bloor 2011; Acejo 2012; Terry 2014; Nóvoa 2014; Steyn 2015; Loutit-Martinod et al. 2016; Gregson 2017, 2018; Turgo 2022; Hopkins and Davidson 2022).

The current moment is seeing further expansion in the potential for mobile work, beyond transport, distribution and delivery. The combination of the near ubiquity of the mobile phone, together with the rise of the gig economy, has rightly drawn much attention in the literature on work and employment to platform-mediated work – much of it anchored in the food delivery and ridesharing sector (Di Stefano 2016; Rosenblat and Stark 2016; Richardson 2020; Altenried 2021; Gregory and Sadowski 2021). As such, there is a tendency to equate platform-mediated work with delivery work. This runs the risk of suggesting that platform-mediated work is intrinsically mobile. That is only now being corrected, through research which emphasises the range of activities subsumed under the umbrella of crowdwork and on-demand work (Wood et al. 2019; Howcroft and Bergvall-Kåreborn 2019). It establishes, without highlighting, that, whilst some of this work certainly does entail a requirement to be mobile (examples would include the domestic services and gardening tasks listed on Taskrabbit), other types of ‘gig’ – for example, writing, translation, data analysis and web services – are more likely to involve home-working. What remains unacknowledged, however, in all the emphasis on platforms and the digital economy is that app-mediated work is becoming increasingly common within the wider economy.

In part this development is a reflection of a reliance on outsourcing. Just as platform-based firms rely on the ‘flexible’ labour market, so too do a myriad of other firms operating in the ‘real economy’ based on the production of goods and services. As with platform-based firms, here apps are increasingly the means to coordinating and monitoring outsourced work, and evaluating performance. The current technological conditions also point to the potential for more work to be organised such that it is done on-the-move. One only has to think of the rise of occupations such as the personal trainer, compared to the gym, or social care home visits, rather than day-care centres, to see something of a trend which replaces a service (often public) accessed at a central point by a privatised, customer/client-centred model reliant on a mobile worker travelling between classes, sessions or appointments. As app-mediated work intensifies so the potential for mobile work to increase and diversity will grow.

How might mobile work be analysed? One of the conundrums of much of the extant literature on mobile work is that it is not really about *mobile* work. Rather, and in a manner which demonstrates the central premise behind the emergence of the mobilities canon, its focus is on the task/s of work, with the connection to mobility all but lost, or absent from view. We see that

whether we look at typologies of mobile work, or at occupational studies which focus on particular categories of mobile workers. Cohen's (2010) characterisation of mobile work, for example, classifies work on two axes: time and place, with the degree of in/dependence used to differentiate between types of mobile work. However, she leaves tacit how time/place independence relates to movement. An early example of an occupational study would be Hochschild's pioneering and highly influential work on emotional labour (Hochschild 1983), in which air hostesses (or cabin crew, to use the current occupational terminology) figure as a primary case. Nowhere here is there reference to what many will have observed as passengers – namely the challenge of accommodating a work schedule with turbulence: for example, interrupted or more intense meal servicing due to anticipated turbulence, or an inability to service an aircraft due to seat belts being enforced by the flight deck. Cabin crew's planned work schedules for individual flights assume smooth flight conditions; when turbulence intervenes more gets disrupted than we passengers. Exactly the same black-boxing of mobility is to be found in the case of the mobile workers who have attracted most attention in the literature: seafarers. Here there are studies a-plenty which position seafarers as a case to speak to wider theoretical framings, from transnationalism to globalisation and postcolonialism, but in very little of this work does mobility get much of a look in. Yet, when it does appear, it is significant – as is shown by Turgo (2022), who highlights Filipino mariners' sense of incarceration in a mobile workplace where, in the interests of capital, more and more time is being spent at sea and confined to a vessel.

Through their focus on movement, mobilities perspectives have something distinctive to offer here: if we are to understand mobile work not as task oriented work, but as *mobile* work we have to think about this in relation to movement. How to think about that? At one level, of course, pretty much all forms of work involve embodied movement. Even the most sedentary of jobs involve a degree of bodily movement – typically of arms, hands and fingers. Then there are those occupations that keep workers in continual movement *within* individual workplaces. Institutional and office cleaners, hospital porters, nurses and doctors, warehouse and 'fulfilment centre' workers are all examples of this, where work entails much walking in and around a workplace. In these cases, however, workers continue to travel to a particular site of employment, i.e. to a *workplace*. That indicates that embodied movement alone is an insufficient determinant of mobile work. Further, whilst it certainly speaks to and illuminates the capacities of particular bodies to perform particular tasks, and thus to a wider corporeal politics of work, focusing on embodied movement alone, I contend, offers little to the wider analysis of mobile work. This is because it will inevitably conjoin forms of work with very different connections to mobility. A case in point is transportation workers, whose work, whilst certainly sedentary in embodied terms, is a very different enactment in geographical space to say the work of an equally sedentary call-centre worker. It is for these reasons, I argue, that the focus should be on mobile work as defined by work where movement *across and through geographical space* is a condition of doing the job.

Broadly, mobile work defined in this way can be seen to comprise three types, or categories. There is: (1) *Work that physically steers motive technologies in geographical space*. These mobile workers are transportation workers. Notable here are drivers of all forms: bus, taxi, van, truck, coach and train drivers, plus pilots and those responsible for steering ships. Delivery riders and drivers are also included here. (2) *Work which is done in a mobile workspace*. This category includes all those who service passengers (cabin crew, train managers and the like, but also the entire cruise ship hospitality sector) and those whose job is to monitor, maintain and repair these capital goods (and their cargos) whilst they are in motion. A large number of seafaring jobs entail this kind of work. (3) *Work done through movement, in which the performance of a job is conditional upon the mobility of a worker in geographical space*. Here a specific job or set of tasks is done in multiple geo-locations during a single period of work, be that a shift or contractually defined working hours. Mobility is required to get between these locations. Home-care

Table 1. Examples of the distinction between three types of mobile work.

| Modality of mobility | Type 1: Work that steers motive technologies | Type 2: Work done in a moving workspace | Type 3: Performance of job is conditional upon mobility of worker |
|------------------------|---|---|--|
| Velo/moto Auto | Gig rider (Deliveroo, etc.) Taxi driver, courier | Driving instructor | Health visitor, social care worker, home cleaner, large-animal vet, home tutor, paramedic, police, estate agent |
| Van | Courier, supermarket delivery driver | | Plumber, electrician, appliance repairer, electricity grid repairer |
| Bus/coach truck/HGV | Driver | Coach tour guide livestock transport | Waste/recycling collection |
| Train | Driver | Train manager; buffet & restaurant car workers | |
| Ship | Captain | Navigator, engineer, cook, entertainer, hospitality worker | |
| Plane | Pilot | Cabin crew | |

workers, tradespersons and paramedics would all be examples. Table 1 provides a typology differentiated by modes of mobility.

The categories of mobile work and the numbers employed in them are dynamic. They are shaped by the technologies of mobility and trends in the wider economy, which produce greater or lesser demand for certain types of mobile worker. Take the shift from a reliance on horse-drawn mobility in the nineteenth century, through the development of steam and the internal combustion engine in the twentieth. The rise of auto-based mass transit technologies and, in parallel, steam and then electricity powered rail networks produced huge demand for various forms of drivers (and crew, to manage passengers). It also rendered obsolete a large number of horse-drawn carriage drivers, and the occupations associated with the infrastructure of horse-based urban transport (stable staff, grooms etc.).

If we turn attention to the present, currently some types of mobile work are expanding relative to others for the same reason of changing patterns of demand. There has been an explosion of growth in work that falls under the first category of mobile work in Table 1, particularly of delivery workers and couriers.¹ Growth in this type of mobile work reflects the rapid expansion in online shopping and, more recently, in home-based, flexible or hybrid working amongst professional workers. Reduced mobility for some (in the form of a reduction in commuting) has created heightened demand for home-delivery forms of mobile work. At the same time as these forms of mobile work have expanded, others are contracting. The rise of home-based, flexible patterns of professional working has led to reduced demand for public transport, particularly in the big cities. In the UK, London is the exemplar case.² Regardless of the form of transport, reduced passenger numbers can only be sustained for so long before they start to have an effect on the sustainability of services, firstly through network density (the number of services offered per day and at particular times of the day) and ultimately through a reduction in jobs.

3. Coordinating mobile work as movement in time-space

Movement in geographical space requires the coordination of space with time. In mobile work, coordination is achieved through a combination of routing, or the path that is followed in space, and speed – or the time that is taken to achieve that path. I discuss each in turn, focusing on how coordination devices produce and shape mobile work. I then establish how the surveillance and evaluation of movement in space and time through dashboards of mobility transforms mobile work into mobile labour.

3.1. Routing and the coordination of space with time

For most forms of mobile work the coordination of routing is the result of using one of two devices: timetables and algorithms. Which is used reflects the types of routes required by different types of motive force and the spaces in which they occur.

Physical movement occurs in both geographical and relational space. Geographical space is defined by discrete, fixed places, located by geo-coordinates (latitude and longitude) and separated by distance. We can denote these sorts of places as A, B, C etc. Most places in the world are connected by infrastructure of some form or another, which enables movement between them. Roads of varying designations, from motorways, freeways and expressways to country lanes and dirt tracks, and railways (from high speed to freight lines) are just the most obvious of these connections. But tram tracks, waterways, cycle ways and footpaths are equally part of the infrastructure that connects places. The same principles of connection structured by conduits also apply to air and ocean travel, in the form of air corridors and shipping lanes respectively.

Geographical space is ordered as networks – as nodes and the connections, or paths, between them. It is held together by networked infrastructure. This is a fixed infrastructure with linear pathways of connection: A-B, A-D, D-G etc. Network capacity is finite, with pinch points which may be either nodes (e.g. station platforms; port quays) or pathways (e.g. the number of tracks). This matters, not least when we consider how thinking about movement tends to default to thinking in terms of the continuum of speed. What tends to get emphasised here is the relativities of the speed of movement between different modalities of mobility (walking, cycling, driving etc.). It is a style of thinking that has tended to be in awe to technological progress; where speed and the associated shrinking of distance has been used to develop notions of a shrinking world, or time-space compression, in which space (distance) is widely seen as annihilated by time. A focus on speed, however, negates recognition of the importance of network coordination, which is how fixed networks manage capacity constraints. It has therefore either missed the key device which coordinates much movement, or emphasised its connection purely to clock time.³ This device is the timetable.

At its simplest, the timetable is a device akin to a calendar or diary. It orders each individual's path through a fixed temporal period, typically a day or a week, using clock time (mostly hours or a fraction thereof) to allocate tasks or activities to particular time slots. All of us first meet this device in the education system, where it structures our patterns of learning over a decade and more. But timetables are not simply about the sequencing of activities through clock time. They are also devices which balance supply and demand by ordering space.

Take as an example railway timetabling. What appears and is publicised as the railway timetable in any country – the timetable which you or I would consult when wanting to get from A-B by train – is known as the public timetable. This itemises the departure times of each service from each station, and their scheduled arrival times at both the destination and intermediary stops. Behind this sits the working timetable. The working timetable is what coordinates the movement of trains through the rail network. Not only does it itemise the time when a train service is scheduled to be paused (its dwell time at a station); it also schedules the movement of a series of trains along each stretch of rail track. The working timetable is materialised as the public timetable through 'diagrams'. Diagrams are the means to creating schedules of work, for individual train units and then for crew – with a major complication being that only drivers who are accredited to drive particular routes can be assigned to work particular train services. Diagrams are central to railway timetable planning, as a given pattern of service provision will require particular diagrams to support it. This in turn determines the level of resourcing (trains, crew) required to run that service.

Timetables are scheduling and coordinating devices; not only do they coordinate networked movement, they also underpin the work schedules for all forms of mobile work ordered as a networked service. So, exactly the same sets of techniques that are used in railway timetabling are

used in the bus, coach and air industries. Slightly less complex are forms of transportation with less dense networks – tram and underground systems for example, where units share the same track and move along that at a controlled distance one-behind-the-other, or ‘liner’ shipping services or ferry services, many of which operate on a ‘yo-yo’ (out-and-back) principle, or with very simple rotations. But the same principles of converting these schedules to patterns of work apply. Mobile work here is governed by the diagrams that support timetables, and for much of history mobile work has been shaped like this. Indeed, diagrams and timetables underpin most examples of Type 1 and 2 mobile work. This is what shapes and produces the mobile work of train drivers and train crew, coach drivers, bus drivers, pilots and cabin crew and all seafarers.

Movement in relational space is different to movement in geographical space. This type of movement occurs in geographical space (A, B, C, D etc.) and it utilises connecting infrastructure but, crucially, it is not networked. Routes here are not defined by repetitive movements along the same pathways which connect the same nodes. Rather, each route – whilst it has the same start and finish points each day, in terms of depots or hubs – is comprised of a different pathway. We can think of this as a-b, or a-b-c, or a-b-c-d ... where a, b, c, d correspond to particular geo-coordinates. The geo-coordinates have a sequential relationship (a route) but they are a different b, c, d etc. each day. So, each route is not only inherently different, it is also transitory. This transitory, temporary connection is one of the hallmarks of relational space; it signals a space that is continually being made or brought into being. Pathways here continually need to be made.

The simplest types of non-networked mobile work are to be found in on-demand work, such as taxi driving or delivery work based on ‘riders’, be they on bicycles or motorcycles. In many instances, a hub (a rail station, for example, or a street corner) acts as the base from which rides are either picked up or accepted, with movement being a-b (and back to a), a-c (and back to a) and so on, with the occasional intermediary pick-up in-between. However, once we move beyond on-demand work, which in its specific locational contours cannot be planned in advance, coordinating movement in relational space requires computational calculation. This is because it faces what is known in general terms as ‘the vehicle routing problem’ – that is, it needs to find the optimal routes for a given number of vehicles to deliver to a set number of clients or customers. Finding the optimal route for a given set of deliveries is known in mathematics as ‘the travelling salesman’ (sic) problem. Very quickly this problem involves mind-boggling calculations: for example, a route involving 30 deliveries has ~265 nonillion (265, and then 30 zeros) potential route permutations (Yates 2019, p. 225). So it is no surprise that this is one of the earliest examples of an algorithmic approach in the field of operations research, where it was first used to find the optimal route for petrol deliveries to a set number of petrol stations. Whilst finding the optimal route makes sense for deliveries like these which are repeated regularly, it is less practical in circumstances where the given set of deliveries and customers or clients varies on a daily basis. Here optimisation routines rely on finding ‘good enough’ solutions. They focus on making the best local choice rather than finding the optimal global solution to a particular routing problem. A good example would be supermarket home deliveries. Optimisation routines are used to determine the order of drops which a driver follows on any given shift, whilst a ‘sat-nav’ system directs the driver between them using an algorithm which seeks to identify the shortest path between each drop. Whilst we might order our deliveries to occur in a given hour slot, when in that delivery window we receive these orders is determined partly by a combination of algorithms – the optimisation routine which produces the route for a driver’s shift and the sat-nav that orders routing between each delivery slated for that hour’s slot – as well as random factors like traffic.

Algorithmic calculation, mostly in the form of software packages tailored-to-the-client rather than specialised teams of operations researchers, sits behind all forms of van-based and light-goods delivery work where deliveries are multiple and sequential through a day. Algorithms are therefore the key devices that coordinate the movement of couriers. But algorithmic calculation

shapes way more than what is called ‘the last mile’ of logistics. It is also at the heart of coordinating movement through the supply chain, underpinning the flow of goods onto and off of ships, through ports, and into, through and out of warehouses and distribution centres (Gregson, Crang, and Antonopoulos 2017). It has a major effect therefore on work in the road haulage sector. Road haulage is not vertically integrated with either the global shipping industry or major retailers and manufacturers, for whom distribution (or logistics) is outsourced to a third-party logistics provider (a 3PL). Road haulage is also unlike other forms of road-based mobile work in relational space in that it is highly likely to involve trips of the form a-b (and back, via c – a port, or a regional distribution centre), where a and b are relatively distant in geographical space (Gregson 2017). All this combines to mean that truck driving is governed less by an algorithmically generated route but rather more by algorithmically generated *time windows*. These windows are time slots, when loads are available for collection (i.e. loaded onto a truck), and when they are scheduled for off-loading at a specified facility of the customer/client. Each window is created by differently owned algorithmically generated work plans: be that the scheduling routines of a port, moving containers in and out of port stacks, or the flow of goods through a distribution centre and out to supermarkets, which is controlled entirely by the supermarkets. Stuck firmly in the middle, the road haulage sector – specifically truck drivers – has to meet the time specifications of both, with the time windows being no more than an hour for collection at a port, or 15 minutes on a bay at a distribution centre (Gregson 2018). Movement here, then, is coordinated and calibrated to the tune of the sites of power in the supply chain: the shipping lines and port conglomerates on the one hand, and retailers and manufacturers on the other. At the same time, it necessarily must occur in an open network, utilised by multiple other road users, where congestion, delays and accidents can be anticipated but not accurately forecast.

3.2. Governing speed in time-space

The other dimension to movement coordination is speed. In many forms of mobile work this is achieved through devices which when used either separately or together (a) locate a given body (e.g. a train, ship or plane) in geographical space, (b) monitor, and in some cases limit, the speed of movement of that body, and (c) evaluate the performance of an individual mobile worker in the quality of movement they achieve in navigating any given route. Such devices can be seen to achieve what John Law long ago termed ‘control-at-a-distance’ (Law 1986).

Many forms of Type 1 mobile work have long involved the first two of these categories of devices. This is because here movement depends on the management of flow through a network. So, all forms of train driving involve the speed of movement being governed by the signalling system which, as well as setting line speeds, tracks and controls the movement of all trains in real time. Perhaps less obviously, given the apparently open space of the oceans, it is the same with shipping (Sampson 2003). The speed of ocean steaming on the freight liner routes is dictated by the shipping lines’ control centres, and is in turn mediated by considerations of fuel efficiency, freight and bunkering market rates and port congestion. Within ports, or in controlled passage points such as the Suez and Panama Canals, dedicated pilots and local control centres choreograph which vessels move when and at what speeds.

Then there is an array of devices which achieve control-at-a-distance either by directly limiting the speed of a body and/or by inscription, recording the speed of movement through a trace. There are devices which govern the maximum speed which any unit can achieve. These place physical limits on engines, for example by setting a maximum speed of a type of train, coach or bus or ship, or the ‘governing’ of trucks in distribution fleets, typically to 90kph (56 mph). Governing speed (literally limiting the capacity of an engine) is how operators seek to achieve maximum efficiencies from units in an industry where fuel is one of the major operating costs.

Then there are the devices which relate to compliance with regulatory working hours. Chief of these is the tachograph, which records truck drivers' driving and rest time through the working day and week. The original tachograph is a classic example of what Bruno Latour calls an inscription device – it's a piece of paper into which a trace is inscribed of the movement, and speed, of a vehicle in any given day. Contemporary tachographs are digital, but their purpose is the same; to regulate drivers and monitor their working time. More recently, the advent of tracking technologies in real time (GPS) has allowed operators to know exactly where any individual unit in a given fleet is at any one point in time. This is the means to keeping track of mobile assets in geographical space.

Most recently there has been the introduction of app-based surveillance technologies. These technologies can be adapted both to record task completions (e.g. the time taken to complete a delivery or the time spent on an individual client's visit) and they produce a *dashboard of mobility*. These devices, then, are the means to generating scorecards for individual mobile workers' productivity and for the quality of movement they achieve in mobility. Their use is becoming increasingly commonplace not just in the ride and delivery sectors but also in forms of mobile work which rely on auto-mobilities.

A case in point is 'Mentor', the tracking app used by Amazon and required of all its 3PL suppliers (Palmer 2021). Drivers log on at the start of each shift, and the app keeps a running tally of a range of issues including aggressive acceleration, hard braking, improper seat belt use, excessive idling, and mobile phone use whilst driving (texts, calls). This data is downloaded to the 3PL, where it is used to generate a weekly scorecard for each driver and an aggregated score for the 3PL provider, based on the scores of all their drivers. The scores are the means for 3PLs to rank individual driver performance and for Amazon to rank 3PL suppliers. The scores are the means to disciplining workers, to imposing pay reductions and, potentially, to contract termination. Drivers with poor scores are identified whilst 3PLs with greater numbers of poorly performing drivers are allocated less lucrative contracts.

The technological history of the governing of movement, then, is one in which control-at-a-distance has moved from governing the unit of mobility (train, truck, van, coach, bus, etc.) and its movement through time and space to include monitoring, and now evaluating and ranking, mobile workers. This is important on a number of levels. Beyond issues of data privacy and protection, two points matter profoundly. These are (1) how calculative evaluation relates to the skills and competences that are a defining feature of being certain types of mobile worker; and (2) how these technologies are reshaping mobile work. Although not restricted to these forms of work, these two points are particularly significant for forms of mobile work that rely on auto-mobility: driving.

The advent of app-based evaluations of driver performance and driving skills and competences has attracted considerable resistance from many professional drivers. This is in part because of the high levels of training and competence that are required to become a professional driver – notably in relation to HGV driving. HGV drivers, whose professional qualifications declare them to have passed what is the most stringent of all driving examinations, do not take kindly to their driving skills being continually scored by machine-based systems. They also object to capital's direct oversight of driving work in real time. What was once a form of work defined by (and attractive to many on account of) an absence of oversight (often expressed as 'the freedom of the road') is now rendered no different to office-based work on account of being evaluated by overseeing devices. But, overshadowing all of this is that the mobility data generated by dashboards of mobility has value in and of itself, beyond scoring individual drivers.⁴ Specifically, it enables algorithmic learning about driving. It therefore is of the utmost value to those trying to build autonomous vehicle futures. In the here and now, however, this mobility data is the means to extracting surplus value from driving work. It turns mobile work to mobile labour.

Having established the importance of coordinating devices to the production of mobile work and how a focus on these same devices enables a differentiation of mobile work and mobile labour, I now turn to examine how embodied movement relates to these coordinating devices. This requires an acknowledgement not of the physical movement of human bodies, but rather of the affective experience of working on-the-move with these devices, in space and time.

4. The condition of mobility and the experience of mobile work

How movement is choreographed in time-space is fundamental to the construction of working time for mobile workers and the affective experience of mobile working. This has long been recognised by transport workers' unions, who sought from their very earliest days to organise work on the same principles as within the factory, through the shift system. Shifts were, and still are, the means to limit working time. They recognise that, whilst certain forms of work either need to be or are organised on 24/7/365 clock time, this does not correspond to the capacity of a human body to work well. So shifts have been foundational to the creation of humane conditions of work.

Amongst mobile workers, a good example of the shift system is railway workers. UK railways operate a three-way shift pattern on a 3-week rotation: 'early' (with a start time between 04.30 and 07.30); 'mid' (09.30/13.00) and 'late' (13.00/17.00). Crew rotate through this pattern on three-weekly cycles, with their assignment to train diagrams being the task of roster planners. Train diagrams are also subject to 'hidden regulations' which insist on 12 hours between shifts and a maximum of 13 days' consecutive working. This means that train crew, whilst they might cover the same track on multiple occasions, experience a highly fluid pattern of working. It also means that shift length can vary day-to-day – from 5 to 11 hours, although most would be in the range of 7–10 hours. Sunday working has also long been a source of contention, lying outside the standard roster pattern for most train companies, but most crew are committed to working a specified number in any year.

Shift work coordinated like this has effects: on body time, through different sleep patterns, and on everyday life, where the problems of coordinating a flexible work schedule with other commitments, notably family time and schools, are considerable. But what mobile work organised by shifts does do is to regulate working time. Many forms of Type 1 mobile work, particularly those with a strong history of unionisation, operate similar systems to railways. Beyond this, however, in sectors with no history of unionisation and where there is no regulation governing working time, the pattern of mobile work is very different. Long shifts, with no scheduled breaks, are the norm here, with the working day only ending when the tasks are completed and the route is finished. In such a way, and as employers respond to demand by 'sweating labour', cramming more and more work into each shift, certain forms of mobile work particularly those involving auto-mobility have begun to be identified as the modern-day sweatshop on wheels.

It is the affective qualities of movement in time-space, however, which most define mobile workers' experience of their work and which most differentiate this type of work from work which is situated at a workplace. And, it is here that the effect of the various devices which coordinate movement in time-space is at its most invidious and inequitable. There is a key distinction here between mobile work produced through timetabled, networked mobility and that which is generated through algorithmic calculation and mediated by apps. This is that whilst both seek time-space coordination, materialised in the form of being on time, the first regards this as an *achievement of the network*, whereas the latter positions coordination as *the responsibility of the mobile worker*.

An example: if a train is late, this is not regarded as the fault of the driver; rather, it's seen as an effect of network disruption. And in terms of affective qualities it is passengers who feel the

effects of lateness most. Think of the panic that many will have experienced when disruption leads to being late for, or missing, a key event. But if a truck driver is late, or a social care worker is late, this most definitely is the worker's fault. This has consequences for work for *on-time as a quality has to be produced by the mobile worker*. In practice, what this means is that, in order to produce on-time, mobile workers are either frantically chasing time or (if their conditions of employment permit) scheduling-in waiting time or catch-up time. To continue with these two examples: what many truck drivers do to accommodate the inevitable friction in the road network with the precision required of their algorithmically calculated time windows is to expand their working day, if not their driving hours (Gregson 2017). This means that trucks overflow everywhere in the road network, parked-up waiting – as is manifested by the numbers in every available lay-by near any Amazon fulfilment centre, or on the roads near to ports. By contrast, a mobile social care worker, held up between visits by traffic and with a set number of clients, all needing compassionate, human-centred care, is continually put in the position whereby they must short-change the client in order to satisfy the time schedules and worker productivity demanded by their app. And then there are couriers: with just a route to follow, and with vans stacked to the brim and as tightly packed as possible with orders, couriers have no other option than to drive as fast as possible between deliveries. They experience a freneticism and intensity of movement in work like no other category of mobile workers, and on a daily basis. This, and its effects on workers, is only beginning to be recognised.

5. Conclusion

A focus on movement in mobile work demonstrates what mobilities perspectives can bring to wider debates in political economy on labour and work. It shows that mobile work coordinated through the combination of apps and dashboards has led to the emergence of mobile labour. Here the conditions of mobility not only create hyper-exploitative employment conditions; through the generation of mobility data they also create new forms of value from mobile work. This changes the relationship of mobility and labour from one of contingency to dependency.

For much of the history of capitalism, the relation of labour and mobility has been a contingent one. Nowhere is that clearer than in labour migration, near and far, where the movement of labour in and through geographical space has been conditional to realising employment. The contingency of labour and mobility is also manifest in those forms of mobile work which are coordinated by timetables. Public transport workers are no different to their counterparts in a spatially-bounded workplace such as an office or a factory. Although their work is done on-the-move and movement affects the rhythms of work, being on-the-move makes little difference to their conditions of employment whilst the effects of working-on-the-move are acknowledged in labour regulation.

The advent of mobile work governed by algorithms and apps, however, alters the relationship of labour and mobility. Capital has recognised the possibilities in these technologies for reshaping certain forms of work through mobility. Whilst certainly not ubiquitous, mobile work is to be found in a growing number of sectors. The result is hyper-exploitative employment conditions. Disputes in relation to Deliveroo and Uber have shown that capital is constituting a hyper-casualised pool of footloose, mobile workers, available to work not just 'anywhere/anytime' but whose job is defined by the 'here and now' of a booked task. That has been challenged and, in some instances, reversed by disputes which have sought to recognise workers as employees. As significant, however, is that the full force of 'sweating' is felt not just in the terms of employment but also in the conditions of mobility that characterise that employment – be that the intensity and freneticism which define courier work or the long periods of hanging around waiting encountered by truck drivers and gig riders.

Sweated labour in itself is not new but it is taking a new form in the twenty-first century, through the increasing ubiquity of the platform. What is profoundly different about platform-mediated mobile work, however, is that mobility (and immobility) is continually generating data, via the dashboard, not just about an individual worker's productivity, or the labour hired by a particular outsourced provider, but about mobility in general. The data generated in the immediacy of this type of mobile work describes individual, spatialized acts of driving, bike and motorcycle riding but, amalgamated as mobility data, it can be monetised. This is because mobility data has value - in terms of the collective sum of routes, or conduits, which mobile workers follow through a city; the networks and nodes which that data, once consolidated, make manifest; and for machine learning for an autonomous vehicle future, in which huge volumes of driving data are used such that algorithms can learn not just how to drive trucks, vans and cars but about the wider driving environment in these spaces. Mobility data, then, is the surplus value which is extracted from mobile labour: it is the means to shaping an autonomous vehicle future in which humans no longer drive for a living. Given the conditions which currently characterise driving jobs, it is an open question whether this is necessarily a negative development. Nonetheless, and at the very least, this needs to be recognised and debated for, since the advent of the internal combustion engine, driving has constituted one of the primary occupations available to many - particularly men (Hopkins and Davidson 2022).

More immediately, an urgent task for labour activists is to recognise the unique challenges posed by mobile labour and the location of these challenges not just in the familiar terrain of employment rights but in the very conditions of mobility in platform-mediated mobile work. Mobilities perspectives, then, lay down a challenge to a labour politics which continues to focus on employment rights, and on employment rights which operate with the default assumption that a workplace is 'moored'. Critically, they also offer routes to thinking through how employment rights might be reimagined in a world of work where a condition of an increasing number of jobs is that they are done on-the-move.

Notes

1. Estimating numbers is fraught with challenges given the nature of employment, however, in 2022, market analysts were estimating the annual UK postal and delivery market at £13bn; up from £3.6bn in 2018 and £5bn in 2019 (Ibisworld 2022).
2. See: Coronavirus (COVID 19) Mobility Report (London Datastore).
3. See Thompson (1967); Glennie and Thrift (1996).
4. In this regard dashboards of mobility illustrate the wider points made by Zuboff (2019) in her account of surveillance capitalism.

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