On the last mile: logistical urbanism and the transformation of labour

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ABSTRACT
In recent years, the last mile of delivery has become a crucial focus of logistical operations in urban contexts due to the rise of online shopping and the spread of platforms including Amazon to Foodora, Deliveroo and others. This article claims that the increasing importance and time-sensitivity of delivery reconfigures both urban spaces and labour relations. Through an analysis of labour relations in different segments of last mile delivery it argues that we are observing profound changes driven most importantly by digital technologies and the hyper-flexible employment relations facilitated by online platforms. Labour on the last mile is increasingly characterised by intense time pressure, standardisation, algorithmic management and digitally enabled surveillance on the one hand, and platform-driven precarisation and flexibilisation on the other. These developments can also be observed in other areas of logistical labour and across different industries. Hence, labour on the last mile might be understood as a specific but important expression of a broader tendency of the transformation of labour in digital capitalism. At the same time, the new importance of the last mile also signals changes in the production of urban space in the context of platform-driven forms of production, circulation and consumption, that are discussed as an emerging logistical urbanism.

KEY WORDS
delivery, labour, last mile, platforms, gig economy, digital Taylorism, logistics, urban space
Introduction: delivery from the air

If one wants insights into the future plans of secretive corporations such as the retail and logistics giant Amazon, it is sometimes surprisingly helpful to analyse the patents filed by these corporations. One of the most spectacular filings by Amazon is a patent for an ‘Airborne Fulfilment Centre utilizing unmanned aerial vehicles for item delivery’ (US Patent 9305280 B1, 2014). The patent describes a flying distribution centre, designed as an airship, that hovers at an altitude of approximately 45,000 feet. This airship takes over the function of the infamous warehouses run by the company on the outskirts of many bigger cities. As a flying distribution centre, it is designed to circle over populated areas and function as a base for autonomous drones, delivering to private customers in the area below. Smaller airships (‘shuttles’) are to be used to replenish the flying Fulfilment Centre (FC) with inventory and transport workers to and from their airborne workplace.

While further steps to implement this spectacular idea remain to be seen, the development of delivery drones is in full swing. On 7 December 2016, Amazon delivered its first commercial package via drone to a customer on the outskirts of Cambridge, UK. According to Amazon, the delivery by the autonomously operating drone took 13 minutes ‘from click to delivery’ (Hern, 2016). It was part of a private trial only open to two customers in the Cambridge area, where Amazon had been testing drone delivery since the summer of 2015. Besides high costs, legal aviation restrictions are currently amongst the biggest obstacles to automating the last mile through commercial drones in most countries. These restrictions, however, have not prevented Amazon and a range of other corporations, such as Wal-Mart, DHL, Maersk and Google from investing heavily in the development of such systems.

The reasons for this are not hard to comprehend. With the increasing importance of online commerce and the app-based ordering of almost everything, the requirements of capacity, speed and flexibility on the so-called last mile of delivery have grown exponentially in importance. The last mile of deliveries to customers has become a site of extreme competition between a number of companies and the focal point of a far-reaching transformation that does not only include patterns of consumption but also profoundly impacts labour and the production of (urban) space.

This article focuses on labour on the last mile in the context of a developing logistical urbanism. In spite of all attempts at automation, the last mile remains one of the most labour-intensive sections of logistical operations. Labour on the last mile is situated at the intersection of an expanding logistics industry and the so-called gig economy, and therefore provides a crucial entry point into the analysis of the current transformation of production, circulation and consumption. Situated at one of the most important and most expensive points of supply chains, labour in the delivery sector has increasingly become subject to intense pressure and been characterised by flexible and precarious labour arrangements for decades. At the moment, however, it is subject to dynamic changes. The contribution highlights two central aspects. First, it concentrates on new forms of the organisation and control of labour by means of digital technology. As in other areas of work, delivery labour is increasingly characterised by forms of algorithmic management and new technologies for standardising and measuring labour...
as well as intensified surveillance. This development will be analysed as part of an emerging labour regime analysed as digital Taylorism. Second, while the labour process is increasingly standardised, the contractual and legal parts of the labour relation have become subject to further flexibilisation. The logistics sector, and delivery in particular, has increasingly become a sector characterised by outsourcing, subcontracting and flexible labour contracts. With the emergence of the gig economy, however, this process has been amplified and intensified. As many important corporations of the gig economy such as Uber, Deliveroo or Foodora operate in the sector of delivery and transportation, platform labour has become an important tool in a sector that is already transforming labour relations in the industry.

I will argue that these tendencies – the digitally enabled standardisation and intensification of the labour process, as well as the platform-driven flexibilisation and precarisation of labour relations – need to be understood as interrelated processes that can be analysed in the delivery sector as a paradigmatic and advanced example of a transformation of labour that can be seen in many areas of logistics as well as within the broader social division of labour. Furthermore, I argue that an analysis of the delivery sector does not only provide insights into current transformations of labour but also into the city as a space of production and reproduction. The army of bike and car couriers is one very visible expression of a new logistical urbanism, whereby logistical operations move from the industrial parks on the city’s outskirts into their centres. Same-hour delivery and app-based ordering are re-calibrate the city ‘as integrated service platform’ (Lyster, 2016:13), whereby time becomes the most critical attribute of spatial production.

To start, the next section explores the rise of logistics to a position in which it has become a central discipline of contemporary capitalism and sketches its digitally driven saturation of urban spaces as the expression of a new logistical urbanism. The following section moves on to the last mile and describes the increased importance of this part of the supply chain in the context of online commerce and the rise of digital platforms. The analysis of labour on the last mile starts with a description of the impact of the digital technology used to standardise, control and intensify labour using the example of the drivers who navigate United Parcel Service of America’s (UPS) famous brown vans. The following section concentrates on the flexibilisation of labour and the new possibilities emerging through the platform-based organisation and control of work in companies such as Deliveroo and Amazon Flex. In conclusion, I will argue that the developments observed on the last mile might provide insights into broader transformations of the world of labour.

The rise of logistics and the emergence of logistical urbanism

In recent years, logistics has become the subject of a broad critical debate spanning disciplines including sociology, geography, architecture and political economy (see e.g. Bonacich & Wilson, 2008; Neilson, 2012; Cowen, 2014; Grappi, 2016; Lyster, 2016; Rossiter, 2016). A starting point of these debates, which I share, is the argument that logistics has moved into the centre of global capitalism over the last 70 years (Altenried, 2016). The ‘logistics revolution’ starting in the 1950s and 1960s – ‘the most
underinvestigated revolution of the twentieth century’, as geographer Deborah Cowen puts it (Cowen, 2014:23) – is understood as the advent of a development which is not only a transformation of an industry but, more importantly, of capitalism itself.

In the context of this transformation, the physical circulation of commodities is growing in strategic importance for capital. Replacing the notion that transportation is a necessity following production, logistics comes to be understood as a paradigm referring to the integrated management of the whole supply chain, encompassing the entire cycle of production, circulation and, increasingly, consumption as something to be planned and analysed. This shift in perspective elicited the principle of modern logistics and set the changes in motion that are subsumed under the term ‘logistics revolution’ (see Bonacich & Wilson, 2008:3). The further integration of production, circulation and consumption can also be identified as a central practical effect of the logistics revolution.

This process entails, among many other things, a shift of power from producers to retailers. The most striking examples of this are corporations such as Amazon or Wal-Mart, both amongst the biggest and most important companies of our time. Wal-Mart’s market power stems to a large extent from the fact that it is not only itself a logistics giant, but, perhaps more importantly, that its strategy is also logistical (see LeCavalier, 2016). The company’s spatial planning revolves around its distribution centres, its tight control of the entire supply chain, and innovative computerised inventory management, as well as the precise forecasting of customer behaviour based on huge volumes of data warehoused in the company’s own data centres and analysed by over 2,000 data experts hired to predict and model customers’ desires and preferences. Everything is designed to accelerate the turnover of goods and minimise storage costs – crucial factors in making Wal-Mart by far the world’s largest company in terms of revenue.

The rise of Amazon (whose founder Jeff Bezos took Wal-Mart as his inspiration), however, is also the story of the rise of e-commerce. Having started as an online book store, Amazon offers today a wide range of further services and products and is, amongst other things, one of the most important providers of cloud computing services. Its business model, however, continues to revolve around the e-commerce platform. The platform’s strength derives from the huge assortment of products including almost all thinkable commodities, hundreds of millions of which can be ordered online. Amazon is continuously trying to speed up the delivery of these products. Through this, Amazon hopes to mitigate one of e-commerce’s biggest disadvantages in relation to brick-and-mortar stores: the time between the act of buying and receiving the goods. Its important Amazon Prime subscription service has always promoted next-day delivery as a major selling point. In many areas, this has already changed to same-day delivery, and under certain circumstances even same-hour delivery.

In order to offer these services, Amazon needs to move its distribution centres closer to its customers and has complemented its larger distribution centres, usually located at the outskirts of major cities, with smaller distribution centres located in inner-city areas. These provide the starting point from which customers can receive deliveries within hours. By this means, Amazon is competing with a range of other businesses selling all kinds of products from food to electrical appliances. A major factor in this competition is speed.
Logistical urbanism: cities as timescapes
While ‘logistical cities’, understood as logistics parks, ports or special economic zones and their particular form of spatial and urban planning are most of the time situated at the margins of urban agglomerations (Cowen, 2014; Rossiter, 2016), this imperative of speed tends to further merge the space of logistical operations with city centres. A glance at the streets of these cities brings to light the ubiquity of logistical operations: These streets are swarming with delivery vans of all sorts, bicycle messengers, food delivery drivers on scooters and many others trying to deliver all kinds of products to customers with maximum speed. Architect and urbanist Clare Lyster, who engages with the way logistics reshape contemporary cities, argues that cities can no longer be understood primarily in relation to static objects (as it is common for architects) but increasingly through their logistical systems and procedural flows, claiming that time is now ‘the most critical attribute of city making’ (Lyster, 2016:13). ‘Logistics’, she writes, ‘calibrates space according to time and thereby renders the city a timescape’ (Lyster, 2016:3). The idea of cities as timescapes resonates very much with the business of same-hour delivery and the labour of the drivers navigating the city in vans and on bicycles. Logistical flows of goods, information or people are continuously reconfiguring contemporary cities.

The production of space is thereby increasingly driven by algorithmic mobility systems that are a crucial infrastructure of today’s ‘global cities’ (Sassen, 2013).

In the contemporary city, the last mile constitutes a focal point at the intersection of the rise of logistics that increasingly becomes a rationality of the integrated management of flows, and the rise of digital platform reconfiguring patterns of production, labour and consumption. Showcasing its importance, an industry website describes the last mile as the ‘the final frontier of logistics’ (Lopez, 2017). This is because the last mile is a highly complicated terrain, involving constantly changing routes and destinations. It is both cost- and labour-intensive and increasingly important in the context of the rapidly escalating demand for doorstep delivery. In 2016, a McKinsey report estimated the global cost of parcel delivery (excluding pickup, line-haul and sorting) at €70 billion, with China, Germany and the USA accounting for more than 40% of the market. The same report also showed explosive growth rates (expecting markets such as the USA and Germany to double within the next 10 years) and a high volume of venture capital, invested especially in food delivery services (Joeriss et al., 2016). The largest share of this growth is due to e-commerce. In Germany, where approximately three billion parcels were sent in 2017 (Bundesverband Paket & Expresslogistik, 2017), one in seven of these parcels is sent by Amazon alone, according to estimations by industry experts (Tönnesmann, 2016). This explosive growth, the intensive price competition, in combination with the new demand for speed are the framework in which labour on the last mile takes place.

Labour on the last mile
Employment arrangements in the delivery sector vary widely. In the parcel delivery industry, we find a number of old postal monopolies and transnational corporations (sometimes the same entities) fighting for market shares with each other and a range of smaller providers, start-ups and lateral entrants. Starting from these big corporations,
there are normally subcontracting chains with different providers and contractors reaching down to individual self-employed drivers. Recent times have seen the entry of platform-driven corporations, especially in food delivery but also for parcel delivery and messengers. Naturally, this leads to a highly fragmented employment landscape with drivers encountering very different situations even within the same city. In spite of these differing arrangements (contractual and otherwise) there are a number of developments that can be observed in different locations and among different providers, most notably long working hours, high performance pressure and the intensification of work, as well as the growing surveillance of workers (Haidinger, 2012).

For the purpose of this article, I will address two crucial issues concerning labour on the last mile. First, I look at the impact of digital technology on the organisation, control and intensification of the labour process. The example here is UPS, a huge transnational corporation in parcel delivery. Second, I examine the question of labour relations with regard to new and old forms of flexibility and, specifically, the impact of digital platforms such as Amazon Flex and Deliveroo. While platform labour allows for different methods to maximise surplus value, there are also important similarities to companies such as UPS concerning, for example, the labour process and the digital organisation and surveillance of work.

Digital Taylorism: the case of UPS

UPS is among the largest private-sector employers in the USA, where it employs 374,000 of its over 450,000 global workforce. While UPS is today a differentiated logistics provider with its own cargo airline and freight-based trucking operation, package delivery remains its core business. In 2017, UPS delivered an average of 20 million pieces a day, or a total of 5.1 billion packages, and generated revenues of over US$65 billion (UPS, 2018). Its iconic brown vans have become a major cultural symbol of the US economy, featured in a variety of media formats. These vans are driven by more than 50,000 drivers in the USA (and even more in the peak period before Christmas). A particularity of UPS (at least in the USA) is the high number of directly employed drivers, a fact that is not least due to the degree of union organisation and militancy amongst UPS workers (Allen, 2017). This fact has continuously limited strategies for maximising profits by increasing flexibility in terms of labour contracts. Wages (and benefits) are also relatively high compared to industry standards, a fact that is also due to a great extent to the degree of unionisation and long histories of struggles at UPS. Compared to corporations such as FedEx or Amazon, where unions have little momentum, the nearly 280,000 workers organised by the Teamsters union are an astronomical number. In the light of these particularities, it becomes clear that the intensification of work is of the outmost importance to UPS in order to remain competitive. The sophisticated technologies employed by UPS for this purpose provide a prominent example for what can be described as digital Taylorism, a labour regime that is spreading across a number of industries.

While almost all full-time drivers at UPS have relatively few complaints about wages and benefits, long hours and the fast-paced, standardised and disciplined nature of the work are a common matter of discontent amongst drivers. UPS drivers have been working
according to standard operating procedures for a long time. In training, future drivers learn a huge number of protocols relating to how to save time, such as how to start the truck with one hand while buckling with the other. The guidebook handed out to drivers to maximise delivery efficiency is 74 pages long. Based on time and motion studies, these guidelines regulate the smallest details of drivers’ labour, including questions such as where to put their pen (in the left pocket for right-handed drivers) (Bruder, 2015).

With the introduction of its ‘telematics’ system, UPS has further radicalised the standardisation and intensification of its drivers’ work routines. Each delivery van is equipped with over 200 sensors, while the driver’s handheld scanner (‘Delivery Information Acquisition Device’ – DIAD) produces additional data. The system collects a massive amount of data from the trucks (variables such as speed, braking, etc.), GPS data, customer delivery data and driver behaviour data. The system also monitors things such as seat belt use, idle time and how many times a driver backs up. Each time the driver stops, scans a package or does any other thing the system records these details. A continuous flow of information is transmitted to UPS data centres where it is collected and analysed and, in part, provided to supervisors.

The company knows precisely how much even small efficiency gains in their labour processes will benefit them: ‘Just one minute per driver per day over the course of a year adds up to $14.5 million’, according to the company’s senior director of process management, Jack Levis, speaking to the National Public Radio network (NPR, 2014). In public presentations, UPS stresses the savings it can make in fuel and maintenance as a major benefit from telematics but labour is clearly also a major issue. In a language both euphemistic and frank, UPS describes how the telematics system is used to manage labour:

To maximize the benefit of telematics, we bring our drivers into the process. We give them and their managers detailed reports on how their behaviours stack up against the results we strive for, such as accelerating and braking smoothly to conserve fuel.

Having concrete data empowers them to optimise their behaviour behind the wheel and make their ‘rolling laboratory’ even more efficient (Staples, 2014:96).

The software establishes performance indicators, which are in turn used to apply pressure on drivers. ‘We have the driver data; we know how fast they’re driving, how hard they’re stopping,’ the director of automotive engineering at UPS, Dave Spencer said, more frankly, in an interview with a business magazine. ‘That driver will change bad habits before it costs us money’ (Frank, 2014). The strength of the union has helped to reach an agreement that forbids UPS from firing workers based on low performance as evaluated by the telematics software, although UPS has found ways to work around this agreement and many workers report how the metrics are used to pressure them. UPS drivers report managers showing them printouts with details of their performance and asking them to increase their number of deliveries. Sensors installed inside the truck allow managers to scrutinise every break and even the style of driving; a printout of all the data generated by one driver during a shift can reach 40 pages (Kaplan, 2015). Drivers are often forced to justify toilet breaks and even minor deviations from the rules to their managers.

Another important feature of the technologies of algorithmic management employed by UPS is its navigation and route planning system called ‘On-Road Integrated Optimisation and Navigation’ (ORION). The ORION software addresses a
problem which appears straightforward at first, but is in fact incredibly complex: finding the shortest route to connect a number of points in space. Even when the number of addresses is fairly low, the number of options rises very quickly. The formalisation of the optimal solution to this problem, which came to be known as the Travelling Salesman Problem (TSP) in the nineteenth century, has become an important object of complexity theory, applied mathematics, algorithm theory and computational geography. A brute-force computation of a route with more than 20 stops would require more computer-years than there are particles in the universe (Burnett, 2012). ORION, however, stores more than 250 million address points, and a typical day tour of a UPS van includes more than 100 stops. This is why even the ORION algorithm, whose code would cover roughly 1,000 pages if printed, does not attempt to solve the TSP. Rather, it is a learning algorithm that works with automated feedback generated by the vans to provide a temporal map of its territory (UPS, 2016). Such maps are key for an understanding of the city as timescape, exhibiting the importance of algorithmically driven logistics in the production of urban space.

Like the entire telematics system, ORION is focused on details and small efficiency gains, such as reducing left turns. However, efficiency for UPS is related not only to routes, but also to driver performance. An important issue to UPS is backing up. UPS prefers its drivers to back up as little as possible, citing the increased risk of accidents. The telematics system monitors not only how often a driver backs up, but also the distance and speed with which this is done. If the software determines that a driver backs up too often, managers ask him or her to change their driving style. As one worker reports, ‘Our max backing speed is supposed to be 3 mph. I got a message saying my backing speed was 3.7 mph on average and to please slow it down. I told them I would as soon as they installed a digital speedometer for me.’ Like him, many drivers find the ORION software inefficient and patronising and many workers question the efficiency of algorithmic management compared to their pre-digital routines. Notwithstanding the question of which routine is actually more effective, such forms of algorithmic management take even the smallest decisions concerning how work is performed out of the workers’ hands.

Software such as ORION is a tool to logistically map urban and rural space according to variables such as speed, distance and fuel use, but it is also a tool to increase pressure on labour and raise productivity with a multitude of targets and indicators. UPS workers report that with the introduction of ORION, targets have risen without the software managing to raise the efficiency of their routes, making it necessary to sprint or ignore safety concerns in order to reach the new targets. Quotas, targets and other systems of key performance indicators (KPIs) are crucial to the management of labour in logistics (see e.g. Rossiter, 2016:40ff). Just like Amazon’s infamous distribution centres, the brown vans are nowadays part of a system of real-time granular surveillance of every movement, while KPIs constitute seemingly objective parameters by which labour can be measured and analysed. KPIs play a decisive role in the micromanagement of labour, functioning as part of the seemingly neutral, abstracting and quantifying logic of

1 Post in an independent online forum run by UPS workers, January 2016.
algorithmic governance and standardised procedures. In reality, however, quotas are often unrealistic and always shifting and thus become accelerating technologies rather than objective measurements of good performance.

The digital strategy to increase efficiency and further intensify labour works for UPS. Within the first 4 years after the roll-out of the telematics system, the company was able to handle 1.4 million additional packages per day while the number of drivers had slightly declined (Kaplan, 2015). The way digital technology allows for the measurement, organisation, intensification and surveillance of labour at UPS, as well as in other areas of the logistics sectors and digital capitalism more generally, can be analysed as an emerging digital Taylorism. In recent years a small but growing number of academic and journalistic work has begun using the terms ‘Neo-Taylorism’ or ‘digital Taylorism’ to describe developments in the world of labour, mostly referring to new modes of workplace surveillance, control and deskilling (e.g. Head, 2005, 2014; Brown, Lauder & Ashton, 2012; Nachtwey & Staab, 2015). I am using the term to describe how a variety of forms and combinations of software and hardware as a whole allow for new modes of standardisation, decomposition, quantification and surveillance of labour – often through forms of (semi-)automated management and control (see Altenried, 2017). By invoking Taylor, I do not argue that a simple rebirth of Taylorism is occurring, but rather seek to emphasise how digital technology allows for the rise of classical elements of Taylorism such as rationalisation, standardisation, decomposition and deskilling, as well as the precise surveillance and measurement of the labour process in often novel and unexpected ways. However, it seems important to underline how digital technology is often merely extending and radicalising logics that have been at work for centuries. The way companies such as UPS or Amazon use time and motion studies to increase efficiency is clearly rooted in pre-digital times. However, while Taylor, Gilbreth and others faced a back-and-forth between their studies and improvements in the production process, digital Taylorism’s horizon is a system of real-time control, feedback and correction. In this sense, the growing importance of algorithmic management based on sensors, networked devices and integrated software architectures can also be interpreted as a form of a real-time or cybernetic Taylorism (see also Raffetseder, Schaupp & Staab, 2017). The example of UPS shows also how digital technology in the form of networked devices, sensors and apps has moved Taylorist discipline as well as time and motion studies outside the enclosed spaces of factories and into the urban space of the logistical city.

Urban spaces, however, are reconfigured by these processes. Following Michel de Certeau, space ‘occurs as the effect produced by the operations that orient it, situate it, temporalise it, and make it function in a polyvalent unity of conflictual programs or contractual proximities’ (de Certeau, 1984:117). The sheer presence of these logistical operations and their manifold consequences in terms of, for example, traffic, pollution or infrastructural development profoundly reshapes the contemporary city. The example of UPS and its digital infrastructures shows, furthermore, how almost all movements that constitute such logistical operations and contribute to the making and remaking of urban space are nowadays mediated by software, hence showcasing the importance of digital technology for the production of the city as a space of movements.
Radical flexibility: the emergence of platform labour

Unionised drivers employed full-time at UPS represent one end of the employment landscape of the last mile. Over recent decades, however, UPS has been trying constantly to add further segments of part-time and fixed-term drivers. In spite of resistance by the Teamsters, these attempts have been, at least in part, successful. Amongst the latest attempts in the direction of flexibilisation is the company’s idea to contract people using their own vehicle as delivery drivers, predominantly to respond to increased workloads in peak times. The idea itself is not original. Platform-based labour that is outsourced to independent contractors is becoming increasingly important on the last mile. Not only are there a number of corporations that have started as typical gig economy platforms but, at the same time, many older corporations have started to experiment with forms of hyper-flexible, platform-based employment.

Speaking of the uberisation of delivery, or logistics, is still misleading to a certain extent as it suggests that such labour relations have come into existence only through digital platforms. Rather, it seems necessary to reverse this narrative and to situate the gig economy within the genealogy of the logistics industry. In many ways, the logistics sector has always been a site of experimentation using hyper-flexible forms of labour in order to find lean and cheap answers to the contingencies of global supply chains. Labour relations that are characteristic of the gig economy were around in the logistics sector long before the advent of digital platforms. One example is the trucking sector in US ports. In the late 1970s, the deregulation of the industry started opening it up to the entrance of ‘owner-operators’ or ‘independent contractors’. These terms describe individual drivers who own or lease their truck and contract their services to bigger freight firms (Bonacich & Wilson, 2008:103ff). In practice, these drivers are employees of those bigger corporations in almost all aspects except for their legal status. Contracting drivers as owner-operators who are often paid by the piece made it possible to reduce wages and push many of the entrepreneurial risks onto the drivers, who are not entitled to insurance, other benefits or overtime pay. Today, approximately 49,000 of the nation’s 75,000 port truck drivers are independent contractors (Smith, Marvy & Zerolnick, 2014). These employment relations in the port trucking sector are in many respects an exact blueprint for the labour relations we find in what today is described as the gig economy. It seems important to me to acknowledge such prehistories of today’s gig economy, in order to gain a better, historically founded understanding of the continuities and transformations that characterise the current rise of platform labour.

Clearly, the logistics industry was an important site of experimentation with hyper-flexible labour regimes, long before the advent of digital platforms. Parcel delivery in many countries, such as Germany, is characterised by subcontracting chains at the end of which we often find self-employed individual drivers working under very precarious conditions (Haidinger, 2012; Holst & Singe, 2013). With these historical continuities in mind, I will now turn to platform-based employment on the last mile, which is currently growing in size and relevance.

While Amazon is the best customer of most big providers in parcel delivery, such as UPS or DHL, the relations between the retail giant and many of its delivery providers are nevertheless uneasy. While Amazon continues to downplay its push into last mile
delivery, its intentions to control the entire supply chain are clear. In the USA, Germany and other countries, Amazon has already started operating its own delivery to customers from its distribution centres, mostly run by subcontracted enterprises. With the Amazon Flex programme, the company has furthermore copied the model with which Uber is disrupting the taxi market, and introduced it into delivery. Rolled out in the USA in 2015, the programme has expanded continuously and has also been introduced in countries such as Germany or the United Kingdom.

‘Be your own boss, set your own schedule, and have more time to pursue your goals and dreams. Join us and see how you can put the power of Amazon behind you’, reads the advertisement with which Amazon is trying to recruit individuals as ‘delivery partners.’ The core of Amazon Flex is an app allowing people to register as courier drivers using their private vehicles. Following a background check, successful applicants can start working as independent contractors. The whole process is organised by the app which needs to be installed on one’s private smartphone and also provides a number of instructive videos (instead of a training period). Once accepted, drivers can sign up on the app for shifts of one to five hours (so-called ‘delivery blocks’). Before the shift, it tells drivers where to go to pick up packages. At the distribution centre, drivers get in line behind other cars, check-in on the app, receive their packages, scan them and start their delivery route, organised by the app. Deliveries need to be confirmed on the app, sometimes including pictures of packages left at a doorstep. The app is not just a tool for navigation and scanning of packages, it is embedded into a software architecture that not only manages the labour process but is also designed to create a wider range of metrics (including customer feedback) to evaluate performance. These forms of algorithmic management of labour allow for the substitution, to a considerable degree, of direct managerial control over workers.

Workers, formally regarded as independent contractors, are promised earnings of at least US$18 to US$25 per hour, and equivalent amounts in other currencies. While the pay seems good to many drivers, it becomes clear that the US$18 minimum is not the real wage. A Flex driver summarises it in these words: ‘You think you’re making $18 an hour and tips but it all goes to gas and car maintenance. You put lots and lots of miles on your car.’ Many also complain about the number of packages assigned for one shift. Should drivers fail to deliver them in the time designated, overtime is, most of the time, not remunerated. It is the same with the time it takes to drive from one’s home to the various distribution centres. While the technology would be able to precisely account for these extra working times, Amazon is strategically foregoing these possibilities in order to save money. Furthermore, insurance, taxes and other costs, such as social security, are also to be covered by the drivers. In general, real wages vary according to a number of factors but are, most of the time, far below the promised US$18 and not infrequently below minimum wages. Using the legal construct of the independent contractor therefore helps Amazon to lower wages while pushing extra costs, such as for equipment or insurance, as well as entrepreneurial risk onto the workers.

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2 Entry by user identifying as an Amazon Flex driver on an online job review website, March 2017.
The first drivers began to sue Amazon in 2017, claiming they ought to be considered as employees rather than independent contractors, given that they were fully integrated into the business and the way Amazon organised and controlled their labour. The plaintiffs also argued that, after expenses, their earnings generally fell below the minimum wage. Some of the lawyers representing plaintiffs against Amazon Flex were also involved in a class-action suit against Uber along similar lines.

Precarity is exacerbated by strong fluctuations in the availability of work. Many Flex drivers complain about the insecurity. It seems that Amazon permits more drivers than needed, which often leads to bitter competition for shifts. This is highly typical of the app-based algorithmic management of independent contractors and is also a major problem for Deliveroo workers, for example. In an online forum, one driver reported that ‘they [Amazon] continue to hire more and more people so competition has only increased. It has gotten to the point where the only way to acquire shifts is to obsessively be swiping one’s offers screen all day’. Many drivers use auto-tap applications trying to gain an advantage in securing themselves shifts over workers using only their fingers.

In case of complaints or problems, Amazon can dismiss the independent contractors far more easily than regular workers, a fact that is also a disciplining tool across the gig economy where workers try to avoid complaints and go out of their way to keep customers and platforms happy, get high rankings and thus obtain more work, and avoid having their accounts closed – the gig economy equivalent of a dismissal letter.

For Amazon, platform-based employment of independent contractors allows the creation of a highly flexible and scalable on-demand workforce with very low fixed costs. For the drivers, however, these employment arrangements are also flexible, which is valued by many drivers, especially those with additional jobs, but at the same time highly precarious in a number of aspects. Nonetheless, their number is growing. While it is hard to obtain exact numbers, there are clear indicators. The company-run closed Facebook group for Amazon Flex Drivers already had over 27,000 members at the time of writing. At the same time, a spokesperson for Amazon gave the sketchy number of ‘thousands of delivery partners’ driving for Amazon Flex in the UK alone (Kramer & Frisse, 2017). To Amazon, these drivers are important for keeping pace with customer demand and increasing flexibility. In many ways, the employment model of Amazon Flex is not very different from the employment relations that have existed in parcel delivery at the end of subcontracting chains for a long time. The digital platform, however, cuts out intermediaries and allows for an intensification of flexibility. While it is clear how platform labour with its short ‘gigs’ allows the flexible reaction to customer demand, an often-neglected aspect is how platform labour also depends on the digital organisation and surveillance of work in order to be effective and cheap. The various technologies of standardisation and algorithmic management reduce training times and increase (automated) organisation and control of the labour process, enabling flexible

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4 Entry by user identifying as an Amazon Flex driver on an online job review website, April 2017.
and short-term solutions in the recruitment of labour. It is precisely the new possibilities for algorithmic organisation and digital control that make hyper-flexible labour at the scale of Flex efficient, manageable and scalable.

It is clear that the rising importance of the last mile signifies important transformations in consumption patterns concerning activities such as shopping and eating. These activities play a crucial role in determining the ways that cities are built and navigated. Inner-city shopping areas or restaurants, and corresponding practices of consumption and everyday mobility – hence urban spaces as such – are subject to change as a result of the rise of platforms. A very visible sign of this development is the growth in platform-based delivery of food. The urban landscape of Berlin, London and many other cities is populated by an army of couriers on bikes or scooters working for food delivery platforms like Deliveroo, UberEats or Foodora. Many of these drivers are also independent contractors. Here, we encounter similar contractual arrangements and forms of app-based algorithmic management of the labour process. Some are paid by the hour, others based on their number of ‘drops’ (deliveries), yet another form of reducing fixed cost for corporations and another tendency across the gig economy that might be described as the return of piece wages (see Altenried, 2017). Many of Berlin’s bike couriers are migrants, often from crisis-ridden European countries, who can be integrated into delivery labour via apps easily even if they do not speak German, hinting at the importance of migrant labour across many logistical operations as well as the way platforms are reconfiguring the stratification of the labour market.

In spite of difficult conditions, it is also the workers in food delivery who have shown that resistance in the gig economy is possible. Recent years have seen a wave of struggles and strikes all across Europe, driven by inventive forms of organising and striking and thereby also showcasing the challenge platform labour poses to unions, as well as hints towards the successful organisation of platform workers (Woodcock, 2016; Tassinari & Maccarrone, 2017).

Conclusion: the last mile and beyond
Looking at the infrastructures of transportation and communication, which today we call logistics, Marx speaks of ‘the annihilation of space by time’ (Marx, 2005:524) vividly characterising the logic of logistical operations. The last mile is currently a focal point of such operations. On one hand, it represents the ‘logistification’ of production, circulation and consumption, and, on the other, the rise of platforms. These two trends meet at this ‘final frontier of logistics’. In the context of a ubiquitous ‘on-demand’ logic, the last mile has become an important factor in the time- and flow-driven remaking of urban geographies that can be described as an emerging logistical urbanism. This is not only a matter of new transportation infrastructures, urban warehouses or streets congested by delivery vans but also, for example, the future architecture of retail and public spaces in cities that are already changing because of the rise of online retail and ever faster possibilities of doorstep delivery.

In spite of all attempts at automation, living labour remains crucial to the last mile. Labour on the last mile is being transformed by two important and interrelated developments. First, possibilities are opened up by digital technology to track, trace, measure and even automatically manage workers, which result in a labour regime
that can be described as digital Taylorism. Second, the last mile is changing through the platform-driven further flexibilisation and casualisation of labour relations. While it is necessary to be cautious with generalisations, it seems that many of these developments are not limited to the delivery sector. The forms of algorithmic management and surveillance that can be observed at UPS, for example, appear in many other areas of logistical labour, most famously in Amazon's distribution centres. While it is not easy to measure, it is also clear that platform-based forms of hyper-flexible labour are increasingly important (Huws, Spencer & Joyce, 2016; Kässi & Lehdonvirta, 2016). While there are of course many specific characteristics of work and across the last mile, it is safe to say that the major tendencies observed in this article correspond to similar developments in other areas of the logistics sector, and digital capitalism more broadly. In accordance with many of the findings of this article, Ursula Huws speculates that we are observing the emergence of a new paradigm of work she calls 'logged labour' by which she means labour that is increasingly standardised and made measurable, subjected to continuous surveillance and increasingly managed via online platforms (Huws, 2016). While the world of labour is maybe more fragmented than ever, it seems clear to me that those are indeed patterns that can be observed across a number of industries and locations. These are crucial factors in transforming labour relations, in the recomposition of living labour as well as crucial conditions for the struggles that will accompany this transformation.

Arguably, the last mile, and logistics more broadly, are crucial sites for analysing this transformation. The brown vans of UPS are in that sense not only 'rolling laboratories' in terms of the technology employed; they are also laboratories for the labour conditions of the future. With this, the last mile has also become a laboratory for workers' organisation and struggle.

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