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Platforms, Markets, and Contingent Calculation:
The Flexible Arrangement of the Delivered Meal

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Abstract

UK online food delivery company Deliveroo has a platform that automates the coordination of meal delivery, creating a market for the delivered meal. This market indicates the necessity to examine the social arrangements produced through the platform beyond the labour of the delivery worker. Markets comprise heterogeneous actors that require their coordination to be calculated. Deliveroo, though, offers two competing view of markets. First, as interfaces in which supply and demand are represented as autonomous blocs that are articulated through the goods of the delivered meal whose constitution, including the labour of delivery, is black-boxed. Second, as agencement – formatting collective arrangements – in which the goods of the delivered meal are contingently calculated as a flexible arrangement of riders, restaurants and customers in which these actors have differing degrees of choice concerning their participation, and through which new service performances are emerging in the necessity for their contingent interaction.

Introduction

The UK has recently seen an expansion in takeaway prepared food choice thanks to the possibilities for meal delivery through companies such as Deliveroo and UberEats. These companies have what they call a "technology platform" that enables customers in certain urban areas to order and purchase a meal which is then delivered to their location, usually

within thirty minutes. The integration of delivery by these businesses extends the online service developed by the company Just Eat over a decade ago. Just Eat created an online ordering and payment portal for takeaway restaurants that eliminated the need for the customer to telephone or to go to the restaurant to place an order. When Just Eat began, the provision of the takeaway meal to the location of the customer in the UK was generally arranged either by the restaurant, via their existing delivery channels, or by the customer, through collection from the restaurant. In 2013, Deliveroo launched their platform, which not only enables customers to order and purchase prepared meals, but also provides the delivery of the food through a fleet of self-employed delivery workers who collect orders from restaurants and take them to the customer. The incorporation of delivery via the platform occurs through an algorithm that matches as quickly as possible delivery riders to restaurants. The coordination of the human labour of delivery is therefore automated through the algorithm, and in the process has enabled Deliveroo to make a market for food delivery in the cities where it operates. It is this market that provides a starting point for understanding the socio-economic arrangements produced through and producing this automated coordination of food delivery.

Interrogating this relationship between platforms and markets means firstly decentring the interface – the on-screen representation of the perfect meeting of supply and demand through the platform – and instead focusing on the material practices through which goods are constituted via contingent arrangements of buyer and seller. Secondly, examining these material practices of marketization through the platform requires attending to the algorithm's role in building contingency by putting specific demands on space and time, which paradoxically allow for and indeed enable flexibility. Therefore, emphasising *the market* for food delivery highlights how the social arrangements associated with the Deliveroo platform include but cannot be reduced to that of the automated organisation of human delivery labour. Such "gig economy" labour has received much critical attention both for its quality and its structural conditions (Aneesh 2009; Howcroft and Bergvall-Kåreborn 2019; Scholz 2016), raising vital questions concerning capacities for collective bargaining and social security arrangements (DBEIS 2017; The Independent 2018). However, beyond broad analyses of "platform capitalism" (Srnicek 2017), there has been little sustained inquiry concerning the particular form of markets to which (food delivery) platforms contribute, and which thus generate the requirement for a variably sized pool of, in this case, available delivery riders. By drawing on strands of economic sociology that extend arguments concerning the social embeddedness of markets through actor-network theory and science and technology studies

(Callon 1998, 1999), this paper begins with an approach to markets that sees them not as abstract determined forces, but as processes of *marketization* constituted by contingent material practices of coordination involving heterogeneous actors (Berndt and Boeckler 2009). Further, such contingency to the material arrangement of markets must be understood to derive from, rather than necessarily be resolved by, processes of calculation (Callon and Muniesa 2005).

To elucidate this, the article outlines how the delivered meal market can be viewed from two competing perspectives, the first (broadly) deriving from neoclassical economics, the second from economic sociology. The first view, at the level of the on-screen interface, explains how delivery labour is black-boxed as the calculation of goods is left out of the question, and the second view "on the ground" shows the ongoing flexible arrangement of actors involved in realising the delivered meal. The fourth section focuses on how this flexibility occurs through the contingent calculation of the delivered meal. This section draws upon data collected from November 2017 to August 2018 in Newcastle-upon-Tyne, England, during a six-month observation of and participation in Deliveroo's meal delivery system. For three months, I worked as a delivery rider carrying out deliveries one or two evenings per week, the primary purpose of which was to understand how the software application allocated shifts and orders. For the duration of the period, weekly evening observations were conducted, predominantly in restaurants popular with those ordering through Deliveroo, to examine the dynamics of interaction between riders, restaurant staff and customers. This data firstly shows how in the flexible arrangement of the delivered meal, different actors of riders, restaurants and customers have varying degrees of choice concerning their participation. Secondly, it illustrates using the example of the restaurant where "waiting" is displaced from staff to delivery rider, how different performances of service are emerging through the necessity for flexible interaction between these actors. The conclusion sets out some implications of the argument: how the focus on relations between platforms and markets, as well as labour, means decentring interfaces and algorithms to examine other material entities involved in platform arrangements. The article begins, though, by situating Deliveroo within the rise of online delivery in the food service industry in the UK.

Food Service Platforms

Through its technology platform, Deliveroo has incorporated and altered the relations between existing actors in the UK food service industry. This is the industry that organises the manufacture of prepared meals outside of the home, including canteens, restaurants and

catering operations, both for private and for public functionality (Edward 2013). In the UK, the emergence of the restaurant, later of fast food and most recently "casual dining" experiences are foundational conditions of possibility for Deliveroo. Casual dining can be broadly understood as restaurants with table service and a license for alcohol and have contributed to a rise in the frequency of "eating out" in Britain (Den Hartog 2003); from roughly 80% eating out less than once a month or not at all in 1989, to nearly 70% eating out once a month or more by 2015. However, 2017 and 2018 have seen a "crunch" on such casual dining, with closures of sites by several well-known brands of restaurant (The Guardian 2018). These closures are the result of a combination of factors including the overly ambitious expansion of restaurant chains, falling "consumer confidence", rising labour costs after the introduction of a "national living wage", and the requirements for multi-channel access including delivery (PwC 2017; cf. analyses of neoliberal urban planning and gentrification: Rousseau 2009; Tulumello 2016). Amidst this changing consumption landscape, Deliveroo have been able to combine three functions that have historically developed in the online mediation of meal delivery from restaurants, each of which differently reorganise aspects of labour in food provision.

The first is online ordering as a mode of self-service that removes customer interaction with a service worker. The placing of an order for takeaway food via the internet – rather than face-to-face or over the phone – builds on previous forms of e-commerce that were heralded as changing the geographies of retail at the turn of the millennium. This included the emergence of electronic non-store retailing through the internet and the attendant geographies of physical storage and distribution to support this (Currah 2002; Murphy 2007). There were two key e-commerce business models that are important antecedents to contemporary food delivery platforms. A first was the "pure-play" e-tailers, consisting of innovative companies using "disruptive technology" to "create new business models" that were perceived as a threat to existing retailers (Wrigley et al. 2002: 182). An example of this model is Amazon that eschewed retail store networks for warehouses. These businesses could circumvent and deconstruct the value chains of traditional retailers in ways echoed by the intermediary functions of contemporary food service platforms. The other were the "bricks and clicks" retailers that had an existing store network and were developing systems to enable consumers to purchase goods online (Murphy 2003). The UK grocery retailer Tesco were an early example of this model, building from an existing store network to offer home delivery through an online ordering system. A key challenge for both models was how to furnish the quick response demanded by online ordering through sufficiently sophisticated logistical

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systems of storage, picking and delivery of goods (Wrigley and Currah 2006). The relative combinations of online and physical presence, including the organization of delivery, has been central to the development of the prepared food delivery platforms.

This is apparent in the second function of the platform which is to centralise the choice of restaurants, removing not only physical visits but also condensing virtual visits to one mobile site. Prior to the launch of Deliveroo in the UK in 2013, aggregator platforms such as Just Eat and Hungry House (later bought by German-owned Delivery Hero) provided a portal for online selection, ordering and payment from existing take-away food establishments, with the delivery of the order to the place of consumption to be carried out either by the restaurant or by the customer. The Deliveroo platform similarly aggregated restaurants in one virtual place, but with two key differences that fed into the accelerated temporalities of consumption "on-demand" that tie together the logics of convenience and choice. One was that Deliveroo began life as a mobile app rather than a website, and the other was that it partnered (for a commissioning fee per order) with higher-quality restaurants that had previously not offered delivery. Deliveroo was providing options that diverged from the pizza, Indian and Chinese (and of course "fish and chips") meals that had previously dominated UK takeaway food; and were making it easy for customers to make that choice anywhere through the tap of a screen. To do this, the company not only provided technology for meal selection, ordering and payment but also for delivery, thereby moving much closer to the Amazon model. Given this convergence, it is no surprise that by 2016 both Amazon and Uber (the "ride-sharing" company) entered into the takeaway food delivery business in the UK, building on their existing logistical expertise.

The low switch rates between these aggregator platforms (i.e. customers are likely to use only one platform when they order food [McKinsey 2016]) meant that Deliveroo had to distinguish itself from its competitors to retain customers. The necessity for distribution resulted in the third function of the platform: a "virtual restaurant" in which there is no physical site for the staffed service of food. This virtuality developed in two steps, firstly by establishing in 2016 "dark kitchens" that Deliveroo initially called a "RooBox". The purpose of these was to supply areas in cities that were not serviced by existing restaurant networks. Deliveroo provided restaurant trained staff with a kitchen from which to furnish orders from their usual menu. Secondly, existing restaurants were encouraged to develop "virtual brands". These brands appear under a new "Deliveroo Editions" section on the customer app, providing menus separate from the existing (physical) restaurant and therefore offering a further revenue stream for a given restaurant. The preparation of meals for these brands could

either take place in the restaurant's existing kitchen (but only supply to customers ordering through Deliveroo) or in one of the separate dark kitchens. In 2017 these kitchens became known as Deliveroo Editions sites, supplying customers' homes and workplaces in a local area (mainly districts of London) with exclusive access to both existing and virtual restaurant food. Combined then, these changes to meal purchase, preparation and delivery associated with Deliveroo indicate complex networks of actors that include but cannot be reduced to the activities of a pool of delivery workers. Instead, as the next section will go on to outline, in order to understand how these networks operate and are articulated ensemble it is necessary to examine the role of the platform in markets.

Making a Market for the Delivered Meal

The purchase of delivered prepared food through Deliveroo can be understood as a process of marketization (Berndt and Boeckler 2009; Boeckler and Berndt 2013; Çalışkan and Callon 2010). Deliveroo has made – or at least has significantly extended – a market for the delivery of prepared meals in the UK cities where it operates. However, the arrangement of actors associated with the Deliveroo platform combine, following Callon (2016), two broad and competing views of markets and goods. In the first, labelled "interface-markets" by Callon[i] and drawing on neoclassical economics, the market operates to determine the meeting of supply and demand so that the constitution of goods (i.e. their value, how they are made) is black-boxed. In the other, "market-agencement" from economic sociology, the market is continually being remade through the contingent coordination of actors that also exposes the negotiation of goods. It is this second perspective that is vital to understanding firstly how the (black-boxed) configuration of human delivery labour comes about, including why it is important not to reduce its enactment to any straightforward notion of algorithmic control; and secondly what the platform is – how it manifests as a socio-economic arrangement – including but beyond the interface and algorithm. To draw out these competing views, it is necessary to return to a basic definition of a market, as that which involves the coordination of different actors, most notably the buyer, the seller and the goods. The terms of such coordination require processes of calculation to enable the buyer and the seller to meet (although not necessarily physically) to resolve their opposing interests, generally through the agreement of a price. Markets therefore involve agents of calculation that can account for the uncertainties involved in coordinating these different actors (Callon 1998). It is this issue of uncertain coordination that is important for understanding the competing views of markets manifest through Deliveroo's platform.

Interface-Markets: Articulating Supply and Demand

The first view of markets is at the level of the *interface*, or the screen that enacts through representation the coordination of different actors involved. This representation determines in advance the roles of actors as buyers and sellers, together with the occurrence of their coordination apparently removing uncertainty. Such a view of markets from the interface is distinctly different from one in which there is an adaptability to the actors involved, resulting from their position in wider networks (Granovetter 1985). In this latter type of market organisation, for the networked agents involved, their:

> identities, interests and objectives, in short, everything which might stabilise their description and their being, are variable outcomes which fluctuate with the form and dynamics of relations between these agents. (Callon 1998: 8)

In comparison, when represented via the interface, the number of buyers and sellers active at any one time might fluctuate (i.e. the volume of supply and demand), but the identity of these actors as buyers or sellers is fixed before any interaction, and so, therefore, is their intended coordination and the price for exchange. What is the market role of Deliveroo's platform then when viewed from the interface, if it is neither clearly buyer nor seller, nor necessary for the resolution of contingencies if representation means the coordination of these particular actors is already decided? The answer to this lies in an examination of the goods being exchanged. If the buyer ("eater") and seller ("restaurant") are relatively easy to identify, then the good for purchase is more complex. The buyer is purchasing the good of a "delivered meal", and the totality of that purchase lies not in the restaurant that produced the meal, but in the platform that combines the meal with its delivery.

Therefore, it is possible to understand the platform as a good, or what Callon (2016) terms a "platform-good". These platform-goods are both a link between blocs of supply and demand, and a service supplier. This is evident in the Deliveroo example where the platform-good of the "delivered meal" is the link between the supplier (restaurant) and the demander (consumer), but also a service of food delivery. Such a good does not of course have to be limited to the "digital platform"; Callon offers the daily free press as an example of a platform-good. These newspapers articulate three different groups to one another: the readers of the newspaper; the firm that produces and distributes these papers; and the advertising

agencies that buy the space. Thus the main function of the platform-good is to articulate supply and demand outside of it such that:

> the platform-good maintains the separation between blocs [of supply and demand], while keeping them linked. Conversely, when the blocs of supply and demand are independent of one another, they require platform-goods for a market to exist. This combination of blocs and platforms constitutes the structure of interface-markets. (Callon 2016: 21)

So the "interface-market" is the particular arrangement constituted through the good of the platform, and is thus the view of the market visible from the interface. In this type of market, supply and demand can be interfaced – made to meet physically or virtually – but remain autonomous blocs, and there is little or no contingency in terms of the valuation or definition of the good transacted. The market, and thus the calculation of goods, is separate from processes of market-making, or marketization.

The "delivered meal" is therefore defined and valued outside of the interaction it creates between supply and demand, outside of the market per se, so that:

> it is not essential to know how the good is maintained as a platform, through superficial or profound changes, and how as it changes it creates attachments, that is, how it constantly reproduces its function as a platform articulating supply and demand. (Callon 2016: 23)

Any modification of the goods is therefore aimed at redefining the supply and demand that it articulates, which in the case of Deliveroo involves accruing more customers and restaurants. The implication of this view of markets from the interface is a closure of questions concerning the goods themselves, including the labour constituting them. The volume of supply and demand that is articulated is of primary importance, rather than how the "platform-goods" are qualified as such to carry this out. For Deliveroo, such a prioritisation of the quantity of exchanges of the delivered meal therefore enables the labour (e.g. of delivery, of making the food) through which these exchanges occur to be bracketed off, or black-boxed. The platform-good, by definition, functions to connect supply and demand such that this can be understood as an automatic process. In the case of the newspaper, this platform-good can be conceived as a relatively stable physical object that comprises the

functions of link and service provider. However, the delivered meal, when examined beyond the interface, is less intuitively an object but rather a flexible spatio-temporal arrangement that occurs through the calculated coordination of the different actors, opening up the other view of markets.

Market-Agencements: Calculating the Delivered Meal

The second view of markets decentres the interface and widens the lens to take in the different entities that are collectively arranged so that the transactions of a good can take place. The market for food delivery is a fluid configuration of restaurants, riders, digital devices, vehicles and so on that acts to coordinate the goods of the delivered meal in their transaction from restaurant to customer. This configuration is simultaneously an action and a formatting of action that Callon (2016) terms a *market-agencement*. When viewed from this perspective, the discrete blocs of supply and demand, and their articulated goods of the delivered meal, appear substantially more messy and contingent than their representation through the interface. This is perhaps most apparent when focusing on the goods of the delivered meal themselves, that far from being "out of the question" as in the imaginary of the interface-market, are part of continuous processes of calculation and qualification necessary for the broader constitution of the market as such. For meal delivery to occur, the journey from the restaurant to the customer must be made calculable in order to guarantee the articulation of supply and demand through the platform. The solution to this problem of delivery involves not simply mapping the route, but ensuring that there is an available delivery rider for each order, which is the meal paid for by a customer from a specific restaurant. Given the perishability of a meal, this allocation of a rider to an order must occur as quickly as possible, which requires utilising a delivery rider who is close to the restaurant. This in turn means ensuring that there are sufficient numbers of riders on the road to meet the demand for meals.

Calculation to resolve these problems of delivery occurs through an algorithm designed by Deliveroo called "Frank". Frank has two roles, one of which is selecting the appropriately located rider to pick up a meal, and the other is:

> Matching the number of orders … [Deliveroo] expect customers will make (order volume) with the number of riders needed to deliver them … As well as order volume, the tool takes a number of others factors into account, such as seasonal trends and holidays, e.g. Valentines Day to help [us] determine the number of sessions to

make available in each zone, for every hour, in all [our] cities and countries around

the world! (Deliveroo Tech Round-Up, June 2018, from author's field notes)

Frank is therefore a calculative agent that formulates a problem and its solution (what is to be done), and combines this with the strategy and instructions for carrying it out (how it should be done) (Kitchin 2017: 16). Such calculative agency is greatest when it can establish a long but finite list of entities, among which rich and varied relations are allowed, and through which formal procedures for the classification of these entities are set out (Callon and Muniesa 2005: 1238). This means that, in order to identify and classify these entities, calculative agency is distributed across different human and non-human actors and their equipment (Hutchins 1995; Suchman 1987). Thus, to calculate the delivered meal requires the collation and manipulation of data, which concerns a variety of different actors and concerning which the actors have different degrees of agency in producing.

For example, in the allocation of orders to different riders, this data concerns:

The specific dish that is being prepared; the location of the restaurant; the time of day and the day of the week; the number of riders on the road; how many live customer orders there are; the distance from the restaurant to the customer. (Deliveroo Tech Round-Up, May 2018)

During the course of an order there are particular spatial and temporal points marking key moments to coordinate the meal, the rider and the customer. These are distributed switches – or exchanges – when two (or more) parties (including people and things) interact, such as the rider recording via a swipe on their phone that they have collected the meal from the restaurant (Ruppert et al. 2013: 35). More broadly, to ensure that there are sufficient numbers of riders on the road, data concerning other factors are accounted for such as the weather, events like large football games and so on. The possible implications of some of these elements (e.g. for volume of orders or availability of riders) can be predicted further in advance than others. So the closer to the present that different factors can be accounted for (i.e. the more immediate the production and communication of data), the more accurate is the calculation for each individual order and the matching of riders with order volume. This processes of "taking factors into account" is central to understanding the contingency of the calculation of the delivered meal, and to market-agencement more broadly.

For the market to be structured through ongoing collective action, it requires a series of framings that take particular factors into account and therefore enable specific formats for action, such as the movement of goods, or the roles of buyers and sellers at a given time (Callon 2016). In combining the competing perspectives of market as interface (from neoclassical economics) and as agencement (from economic sociology), the platform could be understood as an attempt to control the contingencies of these processes of framing: the representation via the interface seeks to control the smooth articulation of the delivered meal from restaurant to customer. Whilst this is in part true – insofar as the realisation of the delivered meal is the intended outcome – for the delivered meal to occur, Deliveroo nonetheless relies on degrees of autonomy of the rider, restaurant and customer to ensure that the goods are a flexible arrangement. Building on the distinction between the social *network* site and the social media *platform* (Helmond 2015), platforms decentralise their features through external networks – such as restaurants or delivery riders – and simultaneously recentralise content from these networks according to the platform's own formatting – such as online menu choices, or delivery slots. Through the decentralised generation of content then, the platform reflexively creates relationships between these differently networked participants in a recentralised projection based on their real time changing activities. This balance of decentralised networks of restaurants, riders and customers and their recentralised projection means that there is always a possibility that actors might escape the framings of the platform. Thus, to realise the delivered meal as such a flexible arrangement, the rider, restaurant and customer must perform together in concert. This is an orchestration that is achieved through calculations that require the incorporation of these different actors within particular spatial and temporal framings, in a performance that therefore is always contingent, as discussed below.

Contingent Calculation: The Flexible Arrangement of the Delivered Meal
The contingencies of calculating the flexible arrangement of the delivered meal emerge from the difficulties of framing an account. The frame is foundational to the possibility of a calculation because it brings together the particular entities needed for the resolution of a problem by calculative agents. It draws a clear and precise boundary:

> between the relations which the agents will take into account and which will serve in their calculations and those which will be thrown out of the calculations as such. (Callon 1998: 16)

However, the identification and incorporation of appropriate entities for inclusion in the accounting frame is by no means straightforward. This requires each entity to be detached or disentangled from its surroundings, and to take on a particular defined function, so that its role in different conceivable actions can be anticipated. For the calculation of the delivered meal, the potential delivery rider must be detached from their other activities, and available to ride, so that the calculation can be resolved into the completed delivery of an order. Yet, as this suggests, for whatever reason this separation of the rider from alternative commitments, and thus their availability to deliver, may not occur. So, inherent in the necessity to frame the account is the recognition of the instability of the world that it creates. This instability is enacted through processes of what Callon terms "overflowing", in which there is a leakage of acting entities beyond the frame:

> The fact of framing the transaction leads to overflowing because it mobilises or concerns objects or beings endowed with irreducible autonomy. Complete framing is contradiction in terms. (Callon 1998: 18)

It is for this reason that the calculation of delivery is contingent. The necessary capacity for the algorithm to reconfigure the accounting frame, combined with the possibilities for entities to overflow that frame, means that the delivered meal is a flexible arrangement rather than a fixed account. This is elaborated below firstly by showing how the delivered meal orchestrates an arrangement of riders, and to a lesser extent restaurants and customers, that is coercive in its requirements for flexibility, which secondly, produces new service performances through the displacement of waiting in the interactions between riders and restaurant staff.

Coercive Flexibility

Flexibility is central to Deliveroo ensuring volume of supply and demand, and for the realisation of the delivered meal as the platform-good through which they meet. It is that which enables restaurants to switch on or off the app to increase or decrease orders; customers to order when and where they want through the mobile app, and riders to decide when to work and whether to accept an order. In this way, flexibility is constructed through the choice of these individual actors, who decide if and how they will engage with the platform. However, the conditions through which this flexibility is produced

disproportionately accord choice in action to certain actors at certain times. These freer choices are realised, meanwhile, by the relative coercion into flexibility of other actors. This is most readily illustrated by the delivery worker, a figure that exemplifies the complexity of this flexible arrangement emerging from the contingency of the calculation of delivery by the algorithm. The requirement that prepared food is collected almost as soon as the order is placed means that a rider must be mobilized immediately to go to the restaurant to collect the food. Such a system relies on riders being "free" (i.e. from other orders through the platform) to pick up a meal, but also therefore creates a situation where if riders are "free" they could potentially be engaged in other activities (e.g. resting, delivering orders through other platforms). There is thus no guarantee that an order will be accepted by the rider to which it is allocated by the algorithm, meaning that a reframing of the account of the delivered meal must occur. However, despite this nominal choice, the possibility for riders to choose to accept an order only occurs through the volume of supply and demand, which is articulated as the (im)possibility for riders to work through the platform.

Riders are coerced into a threefold flexibility that enables the greater autonomy of the other elements in the arrangement of the delivered meal. Riders with the Deliveroo platform are firstly only contingently able to make themselves available to work, and secondly when they are available are not guaranteed the possibility to earn anything, and thirdly when they are offered earnings these are variable rather than fixed. Taking each of these in turn, the first is a foundational contingency concerning the possibility for an individual rider to be available to work. Riders have to be able to go "online" on the Deliveroo rider app so that they can receive orders (i.e. be able to work). However, riders can only go online when there is space available in an individual hourly slot on any given day. The purpose of the slots is to ensure both that there are the right number of riders on the road to meet demand for orders to be delivered, and that the riders that are on the road will receive orders to deliver, to avoid oversupply of delivery capacity. The least contingent method for riders to ensure that they will be able to go online is to book a slot in advance, when there are spaces available. This can theoretically be done at any time, but for most of the time slots remain full. Therefore, the time to book slots in advance is when the following week's slots are first made available, which is the Monday of the week prior. However, the opportunity to book slots in advance on Mondays is not equally distributed across riders. Some riders are given "priority" booking based on their "rider statistics" collated from the previous weeks.

These statistics are three measures calculated on a weekly basis: the percentage of attended sessions; the percentage of late cancellations; and the percentage of super-peak

sessions[ii] attended. Riders who have high overall and super-peak attendance, together with a low percentage of late cancellations, relative to other riders in the delivery zone, are given priority[iii] booking of slots. Therefore, apparently contrary to the rhetoric of flexibility, the platform rewards riders who are more reliable by giving them the opportunity for more choice over when they want to work. For the riders, the implication is that those who have priority booking tend to book all slots that they think that they will (or even might) work, with the possibility of cancelling later if necessary. The riders who are not able to book slots in advance when they are released can book slots when they become available, which is usually on the day (or at best the day before) of the slot. A notification can be set up on the app for each slot that will let riders know when spaces in the slot become available. In addition, it is also possible to go online without booking if there are spaces available in a slot at given time. The opportunity for certain "priority" riders[iv] to choose when to be available to work therefore demands greater flexibility from those who are unable to book as they scrabble to gain access to slots.

The second area of contingency arises when riders are able to go online. Once online, there is no guarantee that they will earn anything during any given hour slot. Riders are paid per "drop" (i.e. per order delivered). However, Deliveroo offers no guarantee that riders will be assigned an order when they are online. Although one of the reasons for the pre-booking of slots is to try to ensure that there will be sufficient orders for riders (as well as vice versa), riders still have no certainty about the number of orders that they may be assigned. This is compounded by the third dimension to rider flexibility which is the recent addition of distance-based fees in July 2018 which has changed the way the rider is paid. The distance-based fee is the total pay per order made up of a fixed pick-up and fixed drop-off fee, together with a variable fee for the distance travelled from the rider's location at the point of accepting the order to delivery at the customer. Previously there was a fixed fee per order, regardless of customer location. The implication of the new distance-based fee is that the rider does not know in advance of being allocated an order how much that they will receive for that order. This three-fold possibility for change in the rider's conditions of work therefore indicates the degree to which the calculation of the delivered meal occurs through the flexibility of the delivery rider (Shapiro 2018). Given the autonomy of each rider, the algorithm incentivises reliability to reduce contingency by ensuring that the riders statistically most likely to carry out orders are on the road. At the same time, the algorithm makes it possible for less reliable riders (i.e. those with inadequate or insufficient statistics) to meet short term spikes in demand.

However, the customer themselves – the autonomous choice-making agent – is not free from dependencies in executing their mobile eating habits through the platform. Such autonomy through mobility has underpinned the growth of fast food, particularly through American cultures of the car. The "drive-in" and "drive-thru" restaurant were orientated around individual mobility, with the convenience of service to the automobile forming part of the motivation for faster food production (Jakle and Sculle 1999). Whilst the UK has its own histories of the car, these American trends have nonetheless been significant in shaping tendencies towards convenience and speed in the British food service industry. As Urry (2004) argued, such mobility relies on and simultaneously produces flexibility. Rather than necessarily chosen, the freedom of independent movement forces:

> people to juggle with fragments of time so as to deal with the temporal and spatial constraints that … [independent movement] itself generates … Automobility develops "instantaneous" time to be managed in complex, heterogeneous and uncertain ways. (Urry 2004: 27)

The flexible arrangement of the delivered meal through the platform exemplifies this fragmentation and multiplication of individual instants, as customers must ensure that they are in the allocated delivery spot at the right time. Whilst this often requires no movement from their home on the part of the customer, from time to time they might have to leave their residence to go to the ground floor (e.g. if an apartment building or student halls of residence), and sometimes to leave the building to look for a rider. Although these are undoubtedly minor disturbances, they indicate more broadly that in accounting for each individual order, the possibility for flexibility for one actor depends upon the responsive of another actor. To a degree, this responsiveness can be coordinated, for example through the allocation of a rejected order to another rider. However, when a response is required through necessary points of interaction between two actors, such as during the delivery rider's presence at the restaurant, the exact outcome is uncertain, as discussed next.

Boundary Work and Service Performances

> My first order is at 7:15pm at a place called Smash Burger that I didn't know. This is located inside Eldon Leisure [the 2016 redevelopment of a part of a larger "mall" in central Newcastle, now housing primarily restaurants]. I lock up my bike on the other

side of the road and end up going into the wrong entrance of Eldon Leisure. There is no map inside, so I use my phone to navigate to the restaurant. By the time I get there, the order is ready. The waitress is not very busy and jokes that we should swap jobs when the man putting together the delivery orders mistakes her, out of the corner of his eye, for a delivery rider. (Author's field notes, 26/05/2018)

The delivery rider punctuates existing cultures of food service, as this episode indicates, with each order undertaken involving an interaction between them and the staff at a specific restaurant. The exact substance of such interaction falls outside the account of the Deliveroo algorithm, lying in between the data points marking the arrival of the rider at the restaurant, and their collection of the order. In part, the meeting of the delivery rider and restaurant staff can be understood as an extension of existing practices of "heteromation" in the food service industry aimed at routinizing food preparation and customer interaction, pioneered and deployed most extensively for "fast food" (Oddy 2003). Heteromation is used by Ekbia and Nardi (2014, 2017) to draw attention to the way that technical systems function through heterogeneous actors, and specifically how human labour fills gaps in computer systems. This has been a relatively recent addition in the food service industry which has a longer history of automation as a replacement or displacement of human labour, as is narrated by this industry executive in the 1970s:

> With unarguable certainty the saucier is being replaced by pre-processed fresh and frozen vegetables, the chef is being replaced by the waitress, the waitress by the cafeteria or fast food counter aide, the server by the vending machine, the executive by the food production manager. As the volume of public feeding increases everyday, the need for new technologies in food service management becomes increasingly urgent. Men [and women] are being replaced by machines for the first time in the history of our industry. (Restaurant industry executive, quoted in Reiter 1996: 111)

From the 1980s onwards though, computers were deployed to determine the most profitable workflows in kitchens through the specific placement of persons at any given time (Reiter 1996: 117). This also extended to customer service where waiting and till staff were not only scripted and so may appear "robot-like" (Leidner 1993: 7), but now are increasingly carrying out their tasks in conjunction with networked mobile devices or self-service stations.

However, although being momentarily incorporated via their order into the heteromation of food service in the restaurant, the delivery rider is primarily inserted into a separate computational system constructing the good of the delivered meal. The meeting of restaurant staff with the delivery rider is therefore a point of interaction – or "boundary work" (Downey 2001, 2002) – between separate networks, enabling the movements of goods and information across them. It is necessary because:

> No matter what automated protocols are in place in any given moment, they will be imperfect and incomplete; disparate information networks can only work together through the efforts of specific workers who maintain the links, transform the content, and police the boundaries between those networks. (Downey 2001: 225)

Boundary work between systems results in the emergence of new occupations and new spaces of work, as Downey illustrates through his example of the telegraph messenger boy. Such occupations "become involved in smoothing the transition from one network to another", with changes in these occupations helping to define the spaces of the network themselves, "especially those spaces where the networks present themselves to their users" (Downey 2001: 225). The presence of the delivery rider in the restaurant space then becomes such a site of transition between networks. The rider participates in an extension of "waiting" performances constituting service in the restaurant, disrupting existing practices that are organised around restaurant staff attending to the presence of eating customers.

Such disruption is most apparent in the positioning of the delivery rider when (s)he is waiting in the restaurant. Although for each individual rider this period is usually only a few minutes, at busy times there can be several riders waiting at once. The rider is neither restaurant staff nor customer and so does not have a clearly defined routine for their presence. The exact practices of the delivery rider therefore depend on adaptations of the specific service routines of each restaurant. This means that delivery riders may wait with customers picking up orders, which is typical in fast food restaurants; they may be directed to wait separately from customers who are (waiting to be) seated; or, in a minority of cases, be instructed to go to a back entrance of the restaurant to collect the meal directly from the kitchen. Thus in fast food restaurants, the presence of the delivery riders makes little difference to the performance of counter service staff whose role is to package different elements of an order and, once complete, to call out the number to waiting customers. In this case, the delivery rider is a proxy for another customer whose order must be assembled for

collection. However, in other restaurants, particularly those that had a "*maitre d*'" at the entrance, there would be a direct conversation between a member of staff and the rider about their order when they entered, and in one restaurant, an invitation to the rider to take a seat at a table with some water.

The absence of a specific role for the waiting rider within the existing organisation of service of restaurants can result therefore in forms of miscommunication. These mainly concern whether the order is ready and if it is indeed the correct order. For example, there were instances of being instructed to wait incorrectly:

> At around 8:25pm I receive the fourth order of the night which is … [restaurant name] in China Town, just for some rice. The restaurant seems to be empty and looks a little bit like a warehouse; there are a lot of random objects around on the surfaces near the door, including a Hungry Panda leaflet. The two women at the door tell me it will be a moment, as I see a small bagged box with an order receipt on it near them. I stand around waiting for somewhere in the region of five minutes before two men emerge from the back of the restaurant, presumably the kitchen, and ask me which order I am. I tell them the number and they point to bag I had spotted earlier and say it's already there. (Author's field notes, 10/06/2018)

This and other nuances concerning the presence of the delivery rider in the restaurant indicate the difficulties in articulating the boundary between two separate networks, falling outside of both the account of Deliveroo's algorithm, and of the protocols for management of restaurant staff. These interactions provide both constraints and possibilities for the workers involved, as both restaurant staff and rider are able to perform in ways that alter, as well as move within, existing performances of service (Tsing 2009).

Conclusion

Deliveroo and other similar online food delivery businesses must be understood through the markets, and processes of marketization, in which they operate. These combine two competing views of market activity: interface-markets from neoclassical economics and market-agencement from economic sociology. One view is at the level of the interface that tends to present a smooth meeting of supply and demand in which the goods themselves – the delivered meal – are out of the question. The other takes the perspective of the actors on the ground that are collectively arranged to calculate the delivered meal. This latter view

indicates the contingencies inherent to the algorithmic calculation of the goods, and thus demands focusing on how the delivered meal is produced as a flexible arrangement. Two broader points regarding the social and economic role of platforms emerge from this discussion. The first is the necessity to focus on the role of market making when considering labour through platforms. The visibility of the delivery rider as a boundary worker within a heteromated system, has encouraged social scientists to ask questions about aspects of platform operations, namely those concerning the conditions in which these workers perform. Whilst such questions concerning labour are undoubtedly critically important, the market activity in which the goods produced through this labour participate is equally significant, and challenges any straightforward understanding of automation (Bissell 2018; Bissell and Del Casino 2017). An examination of markets explains how these conditions of labour occur, and further, how they are productive of and dependent upon broader social arrangements.

The second point is the necessity to understand the platform as including but extending beyond the interface or algorithm. Platforms provide a space for the articulation of different networks – namely those of riders, of customers and of restaurants – to assemble in "good" such as the delivered meal. The interface and the algorithm are therefore only one element in approaching platforms as spaces that express together different networks as socio-economic arrangements. Indeed, if as Guyer (2016) argues, the "platform economy" is replacing the "market economy" as the primary mode of socioeconomic organisation, exactly what constitutes a platform and how it builds upon but may be distinct from understandings of markets, are vital questions for social scientific investigation. Platforms, as interface and algorithm, are inserted into a somehow abstracted world beyond their technical architectures, requiring interrogation of the "placed" performances of the platform. For food delivery, such a shift away from the interface could mean examining in more detail sites of interaction that enable the articulation of different networks, for example the restaurant space through interviewing restauranteurs, or considering how the orchestration of delivery is organised around, and sometimes augments, the spatial and temporal pressures of customers. As alluded to above, there are also questions for the ways in which these sorts of markets are changing the role of restaurants as "leisure spaces" in urban areas. This both implies transformations in the classification and valuation of urban landscape – as documented in cases of Airbnb's effects on rental markets (e.g. City Metric 2018) – but also the changing economies of time shaped by the demands for coordination through platform-goods that affect urban spatio-temporal rhythms (Schwanen et al. 2006; Sharma 2011).

References

Aneesh A (2009) Global labor: Algocratic modes of organization. *Sociological Theory* 27(4):347-370

Berndt C and Boeckler M (2009) Geographies of circulation and exchange: Constructions of markets. *Progress in Human Geography* 33(4):535-551

Bissell D (2018) Automation interrupted: How autonomous vehicle accidents transform the material politics of automation. *Political Geography* 65:57-66

Bissell D and Del Casino V (2017) Whither labor geography and the rise of the robots? *Social and Cultural Geography* 18(3):435-442

Boeckler M and Berndt C (2013) Geographies of circulation and exchange III: The great crisis and marketization "after markets". *Progress in Human Geography* 37(3):424-432

Çalışkan K and Callon M (2010) Economization, part 2: A research programme for the study of markets. *Economy and Society* 39(1):1-32

Callon M (ed) (1998) *The Laws of the Markets*. Oxford: Blackwell

Callon M (1999) Actor-network theory – the market test. *The Sociological Review* 47(s1):181-195

Callon M (2016) Revisiting marketization: From interface-markets to market-agencements. *Consumption Markets and Culture* 19(1):17-37

Callon M and Muniesa F (2005) Peripheral vision: Economic markets as calculative collective devices. *Organization Studies* 26(8):1229-1250

City Metric (2018) Regional English cities are suffering from the rise of short-term rental services like Airbnb. 4 September https://www.citymetric.com/business/regional-english-

cities-are-suffering-rise-short-term-rental-services-airbnb-4177 (last accessed 15 December 2018)

Currah A (2002) Behind the web store: The organisational and spatial evolution of multichannel retailing in Toronto. *Environment and Planning A* 34(8):1411-1441

Den Hartog A (2003) Technological innovations and eating out as a mass phenomenon in Europe. In M Jacobs and P Scholliers (eds) *Eating Out in Europe: Picnics, Gourmet Dining, and Snacks since the Late 18th Century* (pp263-280). New York: Berg

DBEIS (2017) "Good Work: The Taylor Review of Modern Working Practices." Department for Business, Energy, and Industrial Strategy https://www.gov.uk/government/publications/good-work-the-taylor-review-of-modern-working-practices (last accessed 28 June 2018)

Downey G (2001) Virtual webs, physical technologies, and hidden workers: The spaces of labor in information internetworks. *Technology and Culture* 42(2):209-235

Downey G (2002) *Telegraph Messenger Boys: Labor, Technology, and Geography, 1850-1950*. New York: Routledge

Edwards J (2013) The foodservice industry: Eating out is more than just a meal. *Food Quality and Preference* 27(2):223-229

Ekbia H and Nardi B (2014) Heteromation and its (dis)contents: The invisible division of labour between humans and machines. *First Monday* 19(6) https://firstmonday.org/ojs/index.php/fm/article/view/5331 (last accessed 18 April 2019)

Ekbia H and Nardi B (2017) *Heteromation, and Other Stories of Computing and Capitalism*. Boston: MIT Press

Granovetter M (1985) Economic action and social structure: The problem of embeddedness. *American Journal of Sociology* 91(3):481-510

The Guardian (2018) The casual dining crunch: Why are Jamie's Italian, Strada, Byron (and the rest) all struggling? 22 February https://www.theguardian.com/lifeandstyle/2018/feb/22/casual-dining-crunch-jamies-italian-strada-byron-struggling (last accessed 25 June 2018)

Guyer J (2016) *Legacies, Logics, Logistics: Essays in the Anthropology of the Platform Economy*. Chicago: University of Chicago Press

Helmond A (2015) The platformization of the web: Making web data platform ready. *Social Media + Society* 1(2) DOI:10.1177/2056305115603080

Howcroft D and Bergvall-Kåreborn B (2019) A typology of crowdwork platforms. *Work, Employment, and Society* 33(1):21-38

Hutchins E (1995) *Cognition in the Wild*. Cambridge: Harvard University Press

The Independent (2018) Union defeats Deliveroo in latest round of gig economy rights case. 15 June https://www.independent.co.uk/news/business/news/deliveroo-riders-rights-job-employment-union-case-gig-economy-iwgb-a8400336.html (last accessed 11 July 2018)

Jakle J and Sculle K (1999) *Fast Food: Roadside Restaurants in the Automobile Age*. Baltimore: Johns Hopkins University Press

Kitchin R (2017) Thinking critically about and researching algorithms. *Information, Communication, and Society* 20(1):14-29

Leidner R (1993) *Fast Food, Fast Talk: Service Work and the Routinization of Everyday Life*. Berkeley: University of California Press

Murphy A (2007) Grounding the virtual: The material effects of electronic grocery shopping. *Geoforum* 38:941-953

Oddy D (2003) Eating with effort: The rise of fast-food industry in 20th century Britain. In M Jacobs and P Scholliers (eds) *Eating Out in Europe: Picnics, Gourmet Dining, and Snacks since the Late 18th Century* (pp301-315). New York: Berg

PwC (2017) "Restaurants 2017: Food for Thought." https://www.pwc.co.uk/services/business-recovery/insights/restructuring-trends/restaurants-2017-food-for-thought.html (last accessed 23 June 2018)

Reiter E (1996) *Making Fast Food: From the Frying Pan into the Fryer* (2nd edn). Montreal: McGill-Queen's University Press

Rousseau M (2009) Re-imaging the city centre for the middle classes: Regeneration, gentrification, and symbolic policies in "loser cities". *International Journal of Urban and Regional Research* 33(3):770-788

Ruppert E, Law J and Savage M (2013) Reassembling social science methods: The challenge of digital devices. *Theory, Culture, and Society* 30(4):22-46

Scholz T (2016) *Uberworked and Underpaid: How Workers are Disrupting the Digital Economy*. Cambridge: Polity

Schwanen T, Dijst M and Kwan M (2006) The internet, changing mobilities, and urban dynamics. *Urban Geography* 27(7):585-589

Shapiro A (2018) Between autonomy and control: Strategies of arbitrage in the "on-demand" economy. *New Media and Society* 20(8):2954-2971

Sharma S (2011) The biopolitical economy of time. *Journal of Communication Inquiry* 35(4):439-444

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

Suchman L A (1987) *Plans and Situated Actions: The Problem of Human-Machine Communication*. Cambridge: Cambridge University Press

Tsing A (2009) Supply chains and the human condition. *Rethinking Marxism* 21(2):148-176

Tulumello S (2016) Reconsidering neoliberal urban planning in times of crisis: Urban regeneration policy in a "dense" space in Lisbon. *Urban Geography* 37(1):117-140

Urry J (2004) The "system" of automobility. *Theory, Culture, and Society* 21(4/5):25-39

Warde A and Martens L (1999) Eating out: Reflections on the experience of consumers in England. In J Germov and L Williams (eds) *A Sociology of Food and Nutrition* (pp116-134). Oxford: Oxford University Press

Wrigley N and Currah A (2006) Globalizing retail and the "new e-conomy": The organizational challenge of e-commerce for the retail TNCs. *Geoforum* 37(3):340-351

Wrigley N, Lowe M and Currah A (2002) Retailing and e-tailing. *Urban Geography* 23(2):180-197

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i   In putting forward this type of market, Callon (2016) is broadly caricaturing (and critiquing) understandings of markets and the role of market competition in strands of neoclassical economics. His own notion of "market-agencement" is a variant of economic sociology that seeks to conceptualise and understand the social construction of markets.

ii   The super-peak slots can vary by location, but they tend to include 7pm-9pm on Friday, Saturday and Sunday night. These not only regularly have high volumes of orders, but also as "weekends" are less desirable slots for riders to work. The inclusion of a measure of attendance during these hours within the currency of the "rider statistics" is therefore an incentive for riders to work, although the pay remains the same.

iii   Priority means the rider is given access to booking earlier on the Monday, such as 11am rather than 3pm or 5pm.

iv   This priority status is shifting, a cumulative measure over a past few weeks, meaning that if a rider's performance declines, they will eventually lose access to early booking.