Journal of Ethnic and Migration Studies

ISSN: (Print) (Online) Journal homepage: www.tandfonline.com/journals/cjms20

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To cite this article: Kristina Zampoukos, Olivia Butler & Don Mitchell (2024) Who's got time for social reproduction? Migrant service workers as embodied infrastructures of the algorhythmic city, Journal of Ethnic and Migration Studies, 50:15, 3805-3821, DOI: 10.1080/1369183X.2024.2379647

To link to this article: https://doi.org/10.1080/1369183X.2024.2379647

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Published online: 25 Jul 2024.

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JOURNAL OF ETHNIC AND MIGRATION STUDIES
2024, VOL. 50, NO. 15, 3805–3821
https://doi.org/10.1080/1369183X.2024.2379647

Who's got time for social reproduction? Migrant service workers as embodied infrastructures of the algorhythmic city

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ABSTRACT

This article, working within the 'infrastructural turn', combines social reproduction and Lefebvrian rhythm analysis to examine the everyday labour and life of migrant cleaners and delivery service gig workers in Stockholm. Using in-depth interviews, we demonstrate how this highly mobile and flexible workforce makes the city 'tick' by keeping its inhabitants clean, fed, healthy and cared for. Specifically, we highlight a contradiction: workers extricating free time for others through reproductive labour, are themselves systematically deprived of the (paid and unpaid) time necessary to meet their own reproductive needs. The conditions of work in the urban on-demand and just-in-time service economy, we show, produce spatiotemporal (dis)orders of living and labouring in the *algorhythmic* city, as workers are required to be both on standby, waiting, whilst also fulfilling customer orders at an ever-increasing speed. Migrant gig workers who appear on the doorstep, on demand and just in time, form a kind of human infrastructure, serving the urban population whilst nonetheless being subject to disinvestment – unrepaired and unmaintained. This article, then, contributes to the literature on gig work, migration and social reproduction, by theorizing the *algorhythmic* city as reliant on the constant transformation of gig labour into an urban infrastructure for social reproduction.

KEYWORDS
Rhythmanalysis; city; migrant; gig workers; service work

Introduction

Valentina waits. She is a woman in her mid-30s who has entered Sweden on a temporary work permit and sustains herself by performing on-demand cleaning work mediated via a platform company. She waits in the metro station to go to her next booking, scheduled to start in two hours in another part of the Stockholm metropolitan area, and she waits for another two years to pass, since that will allow her to apply for a permanent residency. Valentina is part of the mobile, flexible workforce that makes the city 'tick'. It is people like Valentina who keep the city clean, fed, healthy and ultimately liveable, by showing up at the doorstep just in time to cater to the social reproductive needs of the city's

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inhabitants. Migrant gig workers, such as Valentina appear as a kind of human infrastructure of reproductive labour, geared to satisfy spatiotemporally shifting demands for services such as cleaning and deliveries. Meanwhile, Valentina's ability to reproduce herself depends on the temporary migration regime in place, but it is also dictated by the rhythms and temporalities of the urban, algorithmically managed, on-demand and just-in-time service economy, where competition (between platform companies as well as among workers) forces workers to fulfil customer orders at an ever-faster clip, whilst also making them wait for those needs and wants to surge. Essentially, this is what living and labouring in the *algorhythmic* city[1] is about.

Drawing on in-depth interviews with migrant gig workers in cleaning and delivery services, this article examines how people like Valentina experience everyday labour and life in the algorhythmic city. Specifically, we unpack the conditions of *doing* reproductive work as well as the conditions of social reproduction *for* this workforce, with a particular eye to the exploitations and injustices involved. For analytical purposes, we link theories of social reproduction to Lefebvre's rhythm analysis and work associated with the infrastructural turn. Indeed, while feminist scholars have pointed to how the institutional times of migration regulate migrant mobilities and everyday life, 'only a few studies have explicitly focused on how migrants themselves […] negotiate their mobility and secure their own social reproductive needs through temporal strategies and practices' (Yang 2022, 3). Furthermore, and as emphasized by Chacko and Price (2021, 4598), the migration literature says very little about the relationship between migrants and cities, even though the mere presence of migrants in urban settings raises questions about 'who belongs in the city and under what conditions'. Accordingly, this paper contributes to the literature connecting migration and social reproduction (Kofman and Raghuram 2015; Lee and Pratt 2011; Yang 2022), as well as to debates on temporary migrant workers' role in urban settings (Buckley 2014; 2018; Chacko and Price 2021). By bringing these literatures and analyses together, we also advance existing knowledge on migration and gig work (Altenried 2021; Orth 2023; van Doorn and Vijay 2021), and more precisely so by exploring the everyday life experiences of migrant gig workers through the lens of rhythm analysis. Ultimately, the paper contributes to extant scholarship by theorizing the *algorhythmic* city as both relying on migrant gig workers and transforming their labour into an urban infrastructure for social reproduction.

As pointed out by Fraser (2017), present financialized capitalism has resulted in a dualized organization of social reproduction, one which is commodified for those who can afford it, and privatized for those who cannot. Like many countries in the Global North (Fraser 2017; Kofman and Raghuram 2015), Sweden depends on an influx of migrants to meet the demand for reproductive services (Calleman 2013; Rickne 2021). According to a recent report by Landsorganisationen (2023), two-thirds of those working in domestic services are of foreign background and of those a large portion are migrants. Meanwhile, the same report states that the demand for domestic services is geographically concentrated in the Stockholm metropolitan area, followed by the other major cities in Sweden. A more fine-grained analysis further shows that the demand for domestic services is particularly pronounced in the more affluent parts of Stockholm. At the same time, two recent studies focusing on gig workers performing food deliveries in Stockholm (Weidenstedt et al. 2023) and in Sweden and Norway (Newlands 2022) also indicate a high presence of migrants.

By way of their reproductive, low-paid labour, such migrant gig workers may very well free up time for those consuming these services, allowing them to grow their wealth through work that is financially more rewarding. But because capital knows to capitalize on our humanity and human needs, and because capital inevitably runs in and through bodies (Harvey 1989; 2000), existing divides may become even more pronounced *through social reproduction itself* (Andersen et al. 2024). Crucially, while the migrant gig workers at the focal point of the present paper – cleaners and couriers – carry out tasks normally referred to as reproductive work for others, at the same time they also need to reproduce themselves. This, we will show, is one of the central contradictions of everyday life in the *algorhythmic* city.

The rhythms of social reproduction and/in the city point to everyday life, thus implying a certain element of repetition and reoccurrence. Rhythms are important because they tell us something about how society and everyday life are temporally and spatially ordered, and the role played by technology in the creation, continuity and change of social rhythms (Lewis and Weigert 1981). Here, we draw on the work of Lefebvre (1999) and specifically his understanding of space and time as intrinsic to each other, so that space (whether the space of a city or a body) is reflected in and through time, and vice versa. Furthermore, we adopt the view put forward by Reid-Musson (2018, 885) that the

> [d]aily work-life schedules, and the flows, frictions, and stasis associated with the boundaries between leisure, work, and employment, provide an empirical foothold for studying […] how power differentials are organized through rhythms, and how risk and vulnerability are borne at the level of rhythms.[2]

In this paper, we will argue that everyday rhythms of the city, such as peaks in demand for certain services, are interlinked with, and reinforced by, the algorithms of the apps, dictating the intensity, scheduling and hours of work. Both couriers and cleaners are essential to the (re)production of the city precisely because they are subject to whilst also sustaining, the ebb and flows of the city's everyday rhythms. As we will show, there is however also a real risk of *arrhythmia* (Goyette 2024; Lefebvre 1999; Reid-Musson 2018) within which the clash of everyday rhythms that shape gig workers' work and lives make pursuing their own needs extremely difficult leading to a kind of 'slow violence', enacted through long-term exposure to economic stress.

To understand the formation and (dis)order of these rhythms, we argue that conceptualizing labour itself as 'infrastructure' is vital (Buckley 2014; Strauss 2020). Indeed, how migrant gig workers negotiate arrhythmia is of particular interest, since the very reproduction of these workers and their labour is effectively what allows them to 'work' as a human infrastructure facilitating the social reproduction of others. Migrant gig workers (particularly those performing service work such as cleaning and deliveries) comprise an essential part of the contemporary urban infrastructure. Whilst couriers have become a highly visible part of this urban infrastructure, other categories of workers (e.g. cleaners, baby sitters and care workers) who perform their work in the private spaces of other people's homes are also integral to the urban fabric. This is a workforce required to be mobile not only in performing their work, but also in crossing national borders to be available in the first place. Under current historical circumstances, there is simply no other way to satisfy the urban on-demand service economy, where labour is supplied just-in-time and just-in-place (Wells, Attoh, and Cullen 2021). Analysing the spatiotemporal practices of the algorhythmic urban economy calls attention to

how the socio-material privileges and disadvantages of the service gig economy are both felt and constituted, how they add up to a world wherein gig workers *become* a part of the urban infrastructure, and therefore what these divides represent in terms of social reproductive justice.

The remainder of the paper is organized as follows: We begin by revisiting the three strands of literature noted above to produce a fuller theory of how the algorhythmic city both relies on gig workers and transforms their labour into infrastructure – and what that means for workers' abilities to attend to their own needs for self-reproduction. This discussion is followed by three empirical sections where, through the words and insights of gig workers themselves, we explore the rhythms and contradictions of gig work in the algorhythmic city. The empirical sections examine (1) how the presence of migrant gig workers is conditioned by the migration policies in place and how this means often accepting substandard work conditions; (2) the experience of labouring in the algorhythmic city in which the rhythms of consumer demand for social reproductive services (and instant gratification) clash and combine with imperfect algorithms to create re-occurring arrhythmias in workers' lives and (3) how migrant gig workers, while performing reproductive tasks and freeing up time for others, are systematically being deprived of time, and ultimately, how the conditions of the on-demand service economy constitute a barrier to their own reproduction. We conclude by revisiting the main theoretical claims of the paper to examine more explicitly what it means for gig workers' labour to *become* part of the (social reproductive) infrastructure of the city.

The algorhythms of social reproduction: music of the city[3] or singing out of tune?

Social reproduction theory places human labour at the core of the creation and reproduction of society, meaning essentially that in capitalist societies, labour and life, paid employment and unpaid domestic labour, are interdependent (Bhattacharya 2017; Harvey 2000; Katz 2001). As Fraser (2017, 23) puts it: 'Unwaged social reproductive activity is necessary to the existence of waged work, the accumulation of surplus value, and the functioning of capitalism as such'. In the simplest of terms, then, and at the utmost local, geographical scale: A migrant worker in Sweden sells her capacity to labour, her time and by extension a non-negligible portion of her life, in exchange for a wage with which she purchases the necessities to support life, and whatever else she desires to produce and transform herself (although always within the confines of her disposable income). To maintain life, she must also, at regular intervals, get some sleep, prepare a meal and eat it, do the dishes, wash her clothes, and clean her apartment. Because she is human, she cares for her loved ones – her children, her partner, and possibly her parents. Furthermore, she wants to see her friends once in a while, perhaps for a coffee or to see a movie. To improve her language skills and eventually be able to resume her studies, she needs to take Swedish classes. All these activities and acts of care require time to *take place*. In fact, they are imbued with social and biological temporalities and rhythms of varying duration – sometimes daily, sometimes intergenerational.

Historically, reproductive work has been unpaid and largely carried out by women in the private sphere of the home. As such it has been construed as 'women's work' and by extension as low-status, low-skilled and consequently also low-paid (Fraser 2017;

McDowell 2009; Wolkowitz 2006). However, reproductive work is not just gendered, but also racialized (Glenn 1992). For example, in the growing market for domestic and caring work, migrant women and women of colour are overrepresented. Creating and maintaining a home and servicing the bodily needs of others represent tasks requiring large numbers of workers ready to perform physically demanding and dirty work (Glenn 1992; McDowell 2009). Whilst the societal organization of reproductive work has shifted over time, from being organized at the level of the household, to state-managed social welfare and onto more market-oriented forms of welfare services (Fraser 2017), certain patterns persist when it comes to those performing the work. To ensure the provision of services aimed at reproducing the nation, richer countries increasingly rely on temporary (and sometimes irregular) migrants from poorer countries (Fraser 2017; Kofman and Raghuram 2015; Lee and Pratt 2011), meaning that reproductive work is still predominately carried out by feminized and racialized workers.

Since service economies assume the co-presence of providers and consumers, the local scale of the city matters (McDowell 2009). It is here that the demand for social reproductive services in the Global North and the influx of migrant workers from the Global South coincide. Essentially, then, contemporary urban economies are highly dependent on a migrant workforce, who comprise what Strauss (2020, 1218) has termed a 'social infrastructure of care', and what van Doorn (2017, 901) labels 'workforce-as-a-service' when speaking of the racialized, classed and gendered gig workers catering to the urban, on-demand service economy. Workers who are mobile at various geographical scales are key to both the functioning of the gigified service economy and the social reproduction of cities.

This is chiefly what compels us to think more in-depth about migrant labourers as infrastructure (Buckley 2018; Parker 2017; Strauss and Xu 2018), and more specifically about their role in and for urbanization, not least in the sense of making cities liveable. We will get back to this topic by the end of the paper, but for the moment, let us return to the issue of labour mobility which, for workers themselves, appears to be paradoxical: It is by crossing national borders that they hope to improve their overall situation, including their opportunities to reproduce themselves as human beings, but once 'in service', the frantic mobility of biking across the city to deliver food, or trying to finish the cleaning of one house before the next booking begins, as well as the many hours of unpaid commuting – and waiting – that they endure on a daily basis, effectively constitute a barrier to their own social reproduction. Obviously, rushing through traffic entails danger to one's health and safety, but because these workers are deprived of both time and money while traversing the city and/or waiting for the next booking or order, they are also stripped of the basic means through which people normally attain social reproduction. Moreover, to stay and to settle in Sweden is very much dependent on their ability to find work, meaning that they oftentimes must put up with substandard, and even detrimental, conditions of work.

Labour relations in Sweden are governed by a model stipulating that labour conditions are negotiated and largely policed by collective agreements between labour unions and associations of employers – the so-called *Saltsjöbaden* agreement – and with comparatively little direct state involvement. Platform companies have proven adept at 'disrupting' (or evading) this expectation (Palm 2018), with the result of being able to operate

under suboptimal conditions for workers that are standard in other sectors. Since migrant workers typically must work to stay in Sweden, they are relatively easily recruited into this work, which can be 'flexibly' scheduled, repetitive, poorly remunerated, and even as dangerous as it is necessary to the social reproduction of the city and the people in it. It is a form of social reproduction, as Fraser (2017) notes, that is largely privatized, but what becomes apparent when we understand migrant gig workers as infrastructure is that it is the workers *themselves* who bear the costs for this privatized social reproduction (while concomitantly representing a significant subsidy to capital and to those who purchase the gig workers' services).

How these costs are borne, and subsidies are reaped is closely related to the rhythm of the city. As already indicated, *everyday* social reproduction corresponds to a myriad of activities that people do for themselves or for others. The rhythms of the city point to everyday life, thus implying a certain element of repetitiveness (Lefebvre 1999). In Lefebvre's understanding, all things material are necessarily imbued with time, and consequently time and space must be thought of as inseparable entities: 'concrete times have rhythms, or rather, are rhythms – and every rhythm implies the relation of a time to a space, a localized time, or if one wishes, a temporalized place' (Lefebvre 1999, 230). Furthermore, time is linked to the rhythms of the people who occupy a particular space, creating the polyrhythmia of cities:

> If one attentively observes a crowd during peak times and especially if one listens to its rumour, one discerns flows in the apparent disorder and an order which is signalled by rhythms: chance or predetermined encounters, hurried carryings or nonchalant meanderings of people going home to withdraw from the outside, or leaving their homes to make contact with the outside, business people and vacant people – so many elements which make up a polyrhythmy. The rhythmanalyst thus knows how to listen to a place, a market, an avenue (Lefebvre 1999, 230).

Other than encouraging us to think about space and time (or rhythms) simultaneously, Lefebvre (1999) also perceives space as scalar, from the body to the city and beyond. There is an obvious connection, then, between the rhythms of the city, and the rhythms of bodies inhabiting the city.

In the context of gig work perhaps one of the most evident demonstrations of this is when we visualize couriers, driving, biking and running through the city in accordance with the daily, weekly and sometimes seasonal rhythms and peak demands for food deliveries. The rhythm of the city is reflected in the heartbeat of the courier, and vice versa; his heartbeat contributes to the pulse of the city. However, Lefebvre goes on to ask whether, among the many rhythms of the city, there is one that is determinant and primordial to the others:

> The essential and determinant factor is money. But money does not make itself obvious as such, even on the façade of the Banque de France. This centre of Paris carries the imprint of what it hides, but hides it. Money goes through circuits (Lefebvre 1999, 224).

Thus, there is also a less obvious side to the rhythms of the city in connection to the lives of migrant gig workers as '[w]age revenues circulate out of production only to enter back into production as a living labourer, fed, housed, rested, and ready for work' (Harvey 1989, 140). This circulation or rhythm – which evidently also runs through bodies – is essentially what ties production to reproduction (Bhattacharya 2017). As Harvey

(2000) notes, bodies are differently positioned in relation to capital circulation and accumulation, meaning also that they reproduce themselves *differently.*

This brings us to a final observation made by Lefebvre, which addresses the issue of incessant struggle to make place (and time!) for the self amid the polyrhythmy of (unequal) powers constituting urban life:

> how does each (individual, group, family etc.) manage to insert its own rhythms of 'the self' into the rhythms among those of (different) others, including the rhythms imposed by authority? In this insertion of rhythms of 'the self' into the rhythms of the other, what is the share of radical separation and that of compromises, of tolerance and violence? […] Polyrhythmy always results from a contradiction and also from a resistance to it – of resistance to a relation of force and eventual conflict (Lefebvre 1999, 239).

In other words, we are always both the subjects of our own needs and desires, as well as the objects to the desires and needs of others. This dual position is particularly evident in the lives of migrant gig workers. Both cleaning and the deliveries of food (or other goods) are carried out in consonance with clients' needs and labour-and-life rhythms. Cleaners and couriers, however, oftentimes find themselves subjected to the *algorhythms* of the gigified urban economy. For instance, both groups spend a lot of time waiting, and even though the waiting time is unpaid, it is still not their own time to be spent as they like. This waiting, then, is also part of what makes the rhythm of the city, and part of how the city is experienced by different groups of people. Concurrently, while these workers carry out tasks usually referred to as reproductive work, they may not enjoy the same opportunities to reproduce *themselves*, because the amount, distribution and intensity of work, as well as the size and regularity of income, is difficult to predict.

Exploring gig workers' lived experiences

This paper is part of a larger research project aimed at understanding the ways in which gig workers – in a range of industries – struggle to achieve a work-life balance or fail to do so. Our research is explorative in nature and grounded in workers' lived experiences. Thus far we have conducted 30 in-depth, semi-structured interviews with gig-working cleaners, delivery workers, nurses, translators, web designers and others, who have been recruited through company Facebook profiles, Facebook groups where gig workers are active, LinkedIn profiles, and the authors' own social and professional networks.

This paper focuses particularly on the experiences of five cleaners and three deliverers located in the Stockholm metropolitan area. All cleaners were women of migrant background and they all worked for the same platform cleaning company. Cleaners' migration status included both recent migrants on temporary visas and those who already had obtained permanent residency. Two of them arrived from outside the EU, two from another EU country and one arrived in the EU on her partner's passport and later moved to Sweden. By contrast, the sample of deliverers includes both men and women who entered Sweden on student visas (one within the EU and two from outside the EU). One of the deliverers arrived from another EU country, and the other two from outside the EU. Two deliverers had experience doing delivery work for several platform companies.

Interviews were semi-structured and revolved around participants' experiences of doing gig work, whether they manage to combine gig work with life more broadly; whether they manage to juggle life and several jobs (including gig work) and/or studies; to what extent they combine various sources of income; how they perceive their present as well as their future; and so forth. Interviews have been conducted both in person and online as Covid restrictions in Sweden have allowed and lasted between 60 and 90 minutes. All interviews with workers in the abovementioned segments were conducted between October 2021 and April 2022. Interviews were recorded upon the informed consent of each participant and then transcribed verbatim. All participants have been anonymized and have been given pseudonyms.

Data has been analysed through an iterative and comparative process, essentially meaning that comparisons are repeatedly made between data and data, data with codes, codes with codes, etc., to systematically and continuously refine both our interpretations of the data and the theoretical claims and concepts. Interview transcripts have been thematically analysed to draw out key insights relating to the extent to which labour migration regulations impact gig workers and their likelihood to comply with substandard work conditions; the experiences of migrant workers in the algorithmic city where consumer demand for social reproductive services create recurring arrhythmia in workers' lives; and the ways migrant gig workers are deprived of time while performing reproductive tasks for others.

Working to stay – staying to work

Permission to stay in Sweden is increasingly connected to migrants' ability to work or study. Different visas and permits obviously involve particular and in various ways conditioned spatiotemporalities, which often contribute to these workers' precarity (in this issue, see Andersen and Spanger 2024; Goyette 2024; Maury, Hakala, and Näre 2024). As pointed out by other observers (Altenried 2021; van Doorn and Vijay 2021), the barriers to entry for offline service gig work are usually quite low, thus presenting migrants in desperate need of a job with a quick solution to their most urgent financial problems.

One of our interviewees, Lukas, came to Sweden on a student visa from another EU country. He has experience doing both food and parcel deliveries. Lukas explains how one of the platform companies uses the promise of a three-month contract (which thus needs to be renewed to attain a prolonged visa) to 'weaponize' themselves vis-à-vis migrant gig workers:

> Because [Platform delivery company] has a habit of using terminated contracts against the workers. I would put it this way. [Platform delivery company] contracts can help workers to get migration approve them as residents, or give them a work permit, and they use, very often, a lot of that money that they make, to send home or start their life here. Or get their families here, 'cause of course, you know, migration - they're looking for a better living and all that. But, since the contracts are terminated, and they can, whenever they want, choose to not prolong them. And they don't even need to really say reasons (Lukas).

Raisa, who entered Sweden on a student visa from a non-EU country, adds to this by explaining the terms of student visas more in detail:

> [W]hen you are outside of the EU the situation is the following: you stay here for the time of your masters. And then after you graduate, you're eligible to apply for a one-year extension

> to look for a job in Sweden. Everyone who finished master's can do that. But then after that, if you haven't found a contract [you are forced to leave] (Raisa).

She continues by clarifying how the recruitment of gig delivery workers in many instances is channelled through ethnic networks and domiciliary spaces – both formally and informally – illustrating the 'flows' of different ethnic groups in gigified service work. Meanwhile, Beatriz arrived in Sweden from a non-EU country on a temporary work permit which ties her to the cleaning company for two years. After two years have passed, she is free to change employer if she wishes, but she is still restricted to cleaning work for an additional two years before she can apply for permanent residency:

> I came to Sweden for this job. I got a work permit here through the job. […] And I was looking for … a job that would give me a work permit. And then I found this company and they … accepted me. So here I am. […] I can only work for [Cleaning company] […] during my first two years here. And then I have to renew my visa. If I renew it, I need to have the same job, but not necessarily with [Cleaning company]. For my first two years I cannot work for anyone else. If I want to, I need to reapply and then leave the country again. Start over. […] I'm in this country because of this job, I need to keep this job, so I'll just do it (Beatriz).

Such migration policies are no doubt efficient to 'keep people in place' for as long as their 'services' are needed, and a forceful tool to make workers comply with substandard work conditions.

Limited choice, temporary permits, and an atomized and competing workforce with limited knowledge of worker rights thus intersect so as to produce subservient and compliant gig worker subjects (Maury, Hakala, and Näre 2024). Beatriz explains:

> Most of them are so naive and, at the same time they are like me, they are very grateful for the job, and they know that it is very important. But most of us, all of us – I haven't met a Swedish cleaner – all of us are foreigners. And normally our backgrounds are, you know, we come from countries where you don't have a choice. You cannot fight for your right, you just have to work 'cause there is someone, somebody else waiting for your job […] They come here with this mentality "Okay if I don't … if I'm not the best cleaner, if I don't keep it, if I don't take all the abuse … ", I'm not saying they're abusing but if I don't take the abuse, they're gonna kick me out and somebody else is gonna come in. And it's not really like that because not everyone here also is willing to do the job (Beatriz).

That their presence on Swedish soil is conditioned is effectively what makes these workers accept degrading and low-paid work. This is also how precarity comes to forcefully permeate their existence overall, their labour-and-life geographies in their entirety. Alejandra, who entered Sweden on her boyfriend's European passport, clarifies why newly arrived migrants are often worst off:

> You can't rent, because they ask your personal number, so you have to rent an appart … uh, illegally. Very expensive. Or a room. And it's very stressing (Alejandra).

During the interview, this worker explained that she moved seven times in seven months upon her arrival in Stockholm. Without a job and a personal identity number, she was prevented from having a bank account, and without a personal identity number and a bank account, she could not have a first-hand contract for an apartment. The only option left open to her was to find temporary, and ridiculously over-priced second-hand/third-hand apartments on the non-regulated housing market. In essence, then,

people who are worst off financially are the ones ending up paying the most. Undoubtedly, this also has repercussions for their social reproduction, since having a place to call home is part of what makes a living. The forced vagabonding between apartments underscores how the conditioned temporariness of being a newly arrived migrant can permeate migrant workers' entire existence.

Labouring the *algorhythmic* city

As noted, the ebb and flow of on-demand, offline services in the *algorhythmic* city occurs in accordance with certain cyclical rhythms, whether daily, weekly, or seasonally. Lukas describes the peaks in demand for food deliveries: 'Every day, you can see two clear peaks: Lunch. Dinner. Dinner peak is, of course, bigger. And with the pandemic, it has been inflating, rapidly (Lukas)'. He continues by explaining the seasonal peaks of e-commerce, driving the demand for deliveries of parcels:

> I would say, from my opinion, that seasonality comes from people's willingness to engage with e-commerce, over how nice it is to be outside. […] So, we see a clear correlation between uptick, huge uptick, in the winter season. And down, downstream in summer season. Then, there is seasonality in terms of holidays. […] There's always a huge, huge uptick in Christmas. There's a pretty big uptick in Easter. Right now, for example, we notice that things were very, very low. The amount of parcels in every shift is low. But Easter's coming … steep rise (Lukas).

Pawlina tells us about similar peaks when it comes to cleaning:

> So, [in] December, I actually worked a lot, because people really wanted the homes cleaned for Christmas, so I worked a lot of overtime … (Pawlina).

The rhythms of consumer demands intersect with the algorithms of the apps governing the organization, distribution and assessment of the work. These intersections are characterized by re-occurring arrhythmias (Lefebvre 1999; Reid-Musson 2018), that is to say, rhythms that clash, creating what Lefebvre terms 'fatal disorders' (Reid-Musson 2018, 884; drawing on Lefebvre 2004), as illustrated, for example, by the everyday risks that riders encounter in traffic. Here, we can also think of the everyday, gradual wearing down of a person experiencing constant economic stress, or the strain experienced by cleaners trying to satisfy every little whim of their clients to obtain a rating that will enable them to stay in the 'job' but also in the country.

The mechanisms behind these arrhythmias include all the extra and unpaid work that gig workers are forced to do because of the unholy alliance between consumer demand and imperfect algorithms. As Beatriz explains, algorithms consider neither contextual nor human factors, leading gig workers to compensate for these deficiencies by doing extra, unpaid work themselves:

> [It is] the algorithm that organizes our bookings and then it is reviewed by a manager. It happens a lot that we have overlapping bookings, *not enough travel time between them or even not a moment to have lunch for example*. […] It is very disappointing to see my schedule some weeks. When that happens, I feel *they don't see us as human beings, but more like robots*. […] Plus, we end up kinda doing office work too because we keep having to dedicate our time into organizing our schedule and communicating with the managers explaining why it doesn't work (Beatriz, emphasis added).

Here, then, is a vivid illustration of the dehumanizing practices involved, and the power structures at play where the worker is subordinated to the consumer-and-algorithm. Beatriz continues by explaining that cleaners are pretty much left at the mercy of the consumer and algorithm to decide what the conditions of work will look like, including the *pace of work* imposed on the cleaner to keep everyone happy:

> I think the main thing at this job, at least for me, is the time. Because … you know, *they judge by square meters. But every house is different. You don't know how long it's gonna take*. The customer can book … you know they, when you go to the website to book, they suggest you a time based on how many square meters your house is. But they can choose to give you one hour more, two hours more, whatever. But, you know, the time they give us is the time we have to do everything. […] And then if we get late, we get late for the second, for the third [booking] … (Beatriz, emphasis added).

Raisa adds to this by pointing to algorithms not being possible to override, even though the order that the human rider receives from the programme does not make any sense from a practical or geographical point of view:

> [T]he route is not planned by a human being. It's planned by the programme. So sometimes the programme doesn't take the elevation into account. Also, as we know, from Google Maps, and if you like, want to go by bike, sometimes it leads you to a staircase, it leads you to like the water, many things. […] And, so most important for this job to get paid better is productivity. So, the more you deliver, the faster. And then when it doesn't take the elevation into account, you cannot change the order of stops, you need to follow the orders. [… S]ometimes it's completely like crazy, you need to go down the hill and then up again, just because for the programme, it was really close. But actually, you cannot go down because there's a rock or – (Raisa).

In gig work, it is the worker who is an appendage of the machine, not the other way around. The consequences of this subordination of the human being to the machine are evident, since it is the worker, not the machine, who is forced to ride longer distances, faster, to compensate for the flaws of the programme, and it is the worker alone who carries the financial risk.

Since many workers are migrants on temporary and conditional visas, they feel compelled to fulfil every little whim of the consumer in exchange for a good rating. As Beatriz explains, a high rating ensures her job security, her income and, ultimately, her right to stay in Sweden:

> Okay, you need to be good. You need to have a good rating, because if you don't, you're not gonna keep your clients. If you don't keep your clients, you have less hours. If they have less hours, they have less money. So, it's kind of an implicit … threat, you know. "Be good. Do your job really, really well. Otherwise, you're not gonna have work" (Beatriz).

Alejandra adds to this by describing the fickleness of consumers, the unreliability of the rating system, and how the pressure of the latter often translates into her doing tasks normally not included in the service:

> But for example, a week, I remember I went to an actress. Swedish, very famous, but I don't know who is she. And she put five. And suddenly, I was –the best. It's not real, that rating. […] The other week, someone put three, and I was the worst in the company. So, you're always like … [breathing heavy] […] And, and for example, they [management] tell you "Okay, we pay you for this. You don't have to wash inside the [oven]. That is extra. You

> don't have to do a few things. […] But, at the same time – you do it! For the rating. You know, they manipulate it from that side. […] So, you start being "Okay, I do everything you want. I'm, I'm your slave. Please, put me five stars" (Alejandra).

Another interviewee added to this by sharing a story about clients offering coffee and initiating small-talk with time-pressed gig cleaners waiting to be rated on their behaviour, thus obliging workers to comply with consumer expectations extending well beyond cleaning. This means that cleaners are sandwiched between finishing their work within the allotted hours for each house or apartment, and the requests from consumers to obtain extra services. Many of the delivery workers also testify that they regularly perform tasks which are unpaid, such as fixing their bikes or washing their uniforms. Obviously, they reconcile with these demands because of the different layers of precarity at play here, including the fact that they are temporary 'guests' in Sweden.

Ultimately, these migrant gig workers are deprived of not just their time but also their humanity due to their subjugation to the social reproduction needs/desires of others: The pressure stemming from the power structure of consumer-and-algorithm means that workers need to pace up the work (straining themselves in the process); they are doing extra and unpaid work, meaning that they lose both time and money; they are facing difficulties to have even the most basic, human needs fulfilled, such as having time to eat. This, in turn, has clear implications for their ability to reproduce themselves as human beings, since to do that, they need both time, money and the recognition of being humans, not robots.

Being deprived of time while freeing time for others

Clients in need of cleaning and/or delivery services obviously make bookings/orders suitable to their own rhythms in life. Having others to clean the house, cook one's food and deliver it to one's doorstep, frees up time to be spent on other activities, including more income-generating work. Meanwhile, workers need to stand by (cf. Axelsson, Malmberg, and Zhang 2017), in case their services are needed: 'I have had multiple times where I'm sitting for half an hour, or one and half hour, without any deliveries (Lukas)'. As Beatriz points out, the waiting time, even though unpaid, is still not her own to use as she likes:

> They ask me – when you sign the contract – they ask, what is my availability. So, I normally say Monday to Friday, 7 am to 6. But if I do not have a booking from seven to one, but I said I'm available, if they call me, I need to go anytime […] I cannot plan to go to the shops for example, do anything. Because I need to be on call. But I don't get paid for that time (Beatriz).

Alejandra stresses the unpredictability regarding the scheduling and workload. She explains that if someone calls in sick, another cleaner needs to cover for the absentee. Normally this means that the cleaner must additionally travel to collect the client's key at the head office:

> It was like, for example, 7 pm. I'm home. You have always to see the app. Always, because changes can be all the time. Okay, I have a cleaning tomorrow at 2 pm. And I have to go to the office to look for the key. But I have a cleaning at the morning. […] I have to go to the office after my, my booking, get the key, and go to the other booking. That may be in, I don't know, it was in [the distant neighborhood of] Tumba, whatever. Liljeholmen–Tumba. And then home [laugh] (Alejandra).

Being on call thus represents a major impediment to workers' own social reproduction and making of even short-term plans, whether that means doing one's laundry, seeing friends, or taking Swedish language classes:

> But like, how can I plan my weeks, how can I plan the things I'm gonna do? […] So, it … that's the biggest, to me, the biggest stress is that. *You're not able to plan anything, but at the same time they* [Cleaning company] *can plan things for you* (Beatriz, emphasis added).

Being on call is not the only way that cleaners are being stripped of time (and consequently also of money). If the break between cleaners' bookings exceeds two-and-a-half hours, the cleaning company does not have to pay workers, because that counts as a 'split shift'.[4] Accordingly, the strategy of the cleaning company is to either schedule cleaners for 'split shifts' or with just enough time between bookings to allow them to travel from one house to the next:

> So … the only time that they paid for us, was the time between the bookings. But sometimes, they would … manage to give us more than two and a half hours between the bookings, so they don't have to pay us for that time [laugh]. […] Either small enough to just pay us very little for those gaps, or big enough to not pay us at all. [laugh] Uh, and the problem was quite often that I never had any time for a lunch break. They would send me somewhere where I would have to go, like 40 minutes to. And then 40 minutes back to another booking, and I would have like maybe one hour between those bookings, so I never had any time to eat. Usually. So, most of my lunch breaks were on the bus [laugh] (Pawlina).

Several interviewees testify to this meaningless waiting and the unpaid hours spent on travelling and/or on waiting for the next order or for the next booking to start (see also Andersen and Spanger 2024; Attoh, Wells, and Cullen 2024; Maury, Hakala, and Näre 2024, in this issue). Again, these practices make it difficult for workers to reproduce themselves, not just because of the deprivation of time and money, but also because of the deeply dehumanizing practices involved. Ironically, then, they are being deprived of time, while freeing time for others: While these workers carry out tasks usually referred to as reproductive work, the conditions of the on-demand service economy stand as barriers to their own self-reproduction.

Conclusion: waiting and labouring infrastructures of social reproduction

Valentina waits. One of the hallmarks of urban infrastructure is that it is just *there*, as it were, waiting to be used. Storm sewers are built in anticipation of their eventual need but much of the time just sit there, waiting. Trolley tracks likewise mostly lie patiently waiting to guide a tram on its way. Pulses through the electrical wires are more continuous, but the switching stations, that allow those streams to be directed – these days by complex algorithms – according to surplus or need, the circuit breakers ready to be tripped when the system is overloaded, and indeed, the very capacity of the system itself all wait in anticipation of their eventual use. Each also contributes to the rhythm of the city. Gig workers' labour is, it seems, not much different. Gig workers wait. Algorithms direct their movements, though as with the electrical grid or the tram lines in a snowstorm, not always particularly efficiently or effectively. Gig labour too, can – and very frequently does – suffer from arrhythmia.

Gig labour serves as an embodied urban infrastructure of social reproduction. By taking on the burden of others' social reproductive needs, and perhaps most importantly,

by being available and waiting to serve those needs, gig workers create conditions of possibility for those others to free up their time for other pursuits. Yet like any other infrastructure, gig labour comes in a particular form. As wealthy societies like Sweden have structured themselves, such labour now typically comes in the form of a migrant, whose very status, given how immigration laws and policies intersect with labour laws and policies, means that they are both 'willing' to take on this infrastructural work of social reproduction and often unable to do much to shape or resist the conditions of their employment.

But of course, gig labour is *not* like other forms of infrastructure, just as labour power is not like other commodities. Labour power (in this case the ability to do gig work) is, of course, embodied (in this case in the bodies of migrant workers). Such workers wait not only for work assignments, but also for their visas. And both kinds of waiting, as we have shown, mean that gig workers, whose task it is to free up time for others to pursue their interests by assuming their reproductive chores, confront significant barriers to their own self-reproduction. *Their* time and the rhythms of *their* everyday lives are constantly being shaped and reshaped by the combined demands of needy customers and unthinking algorithms, quite possibly in ways that enact a kind of slow violence on them. Such are the conditions of work and life in the *algorhythmic* city.

What needs to be understood, therefore, is not just that gig labour is urban infrastructure, but that it is a particular kind of infrastructure of the city. Urban policy-makers, attentive perhaps to the need to repair and maintain the infrastructure of bike lanes too often fail to attend to what might be needed to maintain the health and well-being of the gig workers who ride on them. Attentive to the need to maintain sewer systems to ensure that residents' waste is swiftly flushed along to the waste-water treatment plant, policy-makers tend to pay little attention to the conditions under which the same residents' toilets are cleaned.

Indeed, when labour is considered within the domain of urban policy making, it is typically a certain kind of worker that is considered, one who is masculine, fit, sustainably minded, often creative and consumption-oriented. To bring social reproduction and the low-paid, often feminized and racialized workers performing reproductive tasks into descriptions and theorizations of cities is pertinent simply because of how such sociohuman infrastructures make cities liveable in the first place. Reproductive labour both enables and is a part of urbanization. In the case of the gig workers, it is quite evident how these mobile, on-demand infrastructures of reproductive labour are essential to the reproduction of the city. Cleaners clean windows whilst last-mile delivery riders reduce pollutants in the city centre; both quite literally keep the city clean. Cleaners clean the kitchen table and gig-working deliverers drop off the pizza; both quite literally keep the city fed. Cleaners wash the sheets and couriers deliver the prescriptions; both quite literally keep the city healthy. And they wait to do so, accommodating their own selves to the rhythms and arrhythmia of the *algorhythmic* city. Valentina is still waiting.

Notes

1. The notion of the *algorhythmic city* refers to the empirical context of Stockholm on the one hand, and to the more abstract idea that certain rhythmical flows of capital, information, goods, and people (flows that are economically, politically, socially, and

technologically *ordered)* come together to produce the socially divided algorhythmic city as lived experience.

2. To be clear, we are not suggesting that just about any rhythms create power differentials in and by themselves, but rather that hypercapitalist societies may produce rhythms that both play up and bring to the fore already existing power relations and power structures.
3. The expression 'music of the city' stems from Lefebvre (1999, 227) and more specifically from the essay 'Seen from the window'.
4. 'Delad tur' (split shifts in English) denotes the practice to divide shifts as to meet peaks in demand, usually meaning that care workers' are scheduled to work in the morning and in the late afternoon and evening. This practice is much debated, not least by the union: https://www.kommunal.se/kommunals-arbetstidspolitik

Disclosure statement

No potential conflict of interest was reported by the authors.

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