Dormant vehicles: inverting urban mobility futures

Nicola Spurling*, n.spurling@lancaster.ac.uk

Sociology Department and Institute for Social Futures, Lancaster University, UK.

*Correspondence address: Sociology Department, Lancaster University, Bowland North, Lancaster, LA1 4YD.

Abstract

The paper proposes and develops an original concept, *dormant vehicles,* which refers to vehicles that are stationary while waiting to be used again, such as current parked cars. The concept involves several types of vehicles (cars, bikes, vans, automated vehicles), durations, temporal locations and rates of recurrence that, with the emergence of new mobility futures, would have diverse forms with significant implications for land use, space and place. New forms of dormant vehicle include shared electric vehicles, dock-less bikes and delivery vans that besides parking would present new in-between use situations such as dropping-off, picking-up, delivering, charging and awaiting repair. The paper highlights that without thinking clearly about these aspects of the future, plans for sustainable, smart cities could fall into a similar trap as in historical versions of automobility and parking, that is, of overlooking dormant vehicles and the ways they shape and are shaped. Rather than parking conveniently disappearing from cities, it is instead likely to change in various respects. The paper sets out to put this research agenda at the forefront, drawing on social theories of practice to propose and develop this new concept, highlighting its potential contribution to urban futures thinking. Ultimately, the paper argues for inverting urban mobility futures to identify the new forms of dormant vehicles associated with them, and consider their implications for land use, space and place.

Keywords

Dormant vehicles, Parking, Urban Mobility, Practice Theory, Social Futures.

1. Introduction

The implications of parking policy for achieving sustainable urban futures is a topic that is gaining traction in cities around the world (City of Melbourne, 2018). At a time when increasingly stringent regulation for decarbonisation is coming to ground (While, 2014) the demand for space in urban areas is increasing. The emphasis on building the car into the city, which pervaded urban design throughout the second half of the 20th Century, means that a vast amount of space is allocated for parking; estimates suggest there might be up to eight spaces per car in some US cities (Ben Joseph, 2012). Such land currently has little potential for alternative public use. In this regard, a reduction in private cars holds a dual promise. Firstly, a shift away from fossil-fueled cars will reduce the carbon associated with travel (Department for Transport, 2018). Secondly, repurposed parking space makes possible the development of green, people-friendly spaces; cities that are sustainable but also desirable places to live for present and future generations[1]. In this paper I take issue with these assumptions, not by questioning the potential for car reduction per se, but rather by exploring the future of parking and its implications for land use, space and place.

---

[1] There are also overlaps between these two ideas, for example the prospect of reducing car ownership and use through reducing the availability of parking space (Engel-Jan et al, 2007; Guo, 2013; McCahill and Garrick, 2010).

To do so, the paper proposes and develops a new concept *Dormant Vehicles* which refers to vehicles that are stationary while waiting to be used, such as current parked cars. Dormant vehicles are a significant aspect of the future that are currently overlooked. Future forms of dormancy include those exhibited by shared electric vehicles, autonomous vehicles, delivery services, bikes and dock-less bikes, that besides parking will present new in-between use situations such as dropping-off, picking-up, delivering, charging and awaiting repair. Dormant vehicles can therefore be usefully conceptualised as consisting of a variety of durations, temporal locations (times of day, week, year) and rates of recurrence. New forms of dormancy are not simply determined by emergent vehicle technologies and services, although that plays an important part. When, where and for what purpose a vehicle is dormant is an outcome of the end use activities to which it relates, the manner in which such end use activities are sequenced in everyday life, and the transformational changes currently occurring in these end use domains (such as online shopping and third space working). Finally, and equally as significant, forms of dormancy are shaped by the infrastructures that are planned and provided.

That emergent forms of dormant vehicles require such multi-faceted analysis and explanation is evidenced in the challenges currently faced in cities around the world. Throughout China dockless bikes are gathering in huge quantities on the kerbside and at entrances to public parks (Haas, 2017) creating obstructions, damage (to other bikes and the urban realm), and new forms of waste. Meanwhile, various commentators are attributing the failure of dockless bike schemes in cities across Australia to the lack of bike parking (Fuller et al, 2018). In San Francisco, Uber and Lyft (when combined) average over 220,000 pickups in the inner urban area, just on Fridays (SFCTA, 2017) and new e-rickshaw's sit charging on the streets of Bengaluru (The Hindu, 2017; Devaneyan, 2016), these emergent mobilities contribute to congestion and a new politics of space. Most recently this is evidenced in the 'Guide to Stopping' that Uber have found it necessary to write for their drivers in London (Uber, 2019). Finally, in the UK, reports since 2015 show that delivery drivers are suffering a disproportionate number of parking fines (Simpson, 2015). This is undoubtedly related to transformations in online shopping, and the related growth in van and fast food deliveries as people change the way they shop, eat and provision the home.

These emergent dormant vehicles exist for complex combinations of reasons, which are explored in this paper, but in the context of land use and parking policy the outcome is clear: they are inconsistent with embedded parking practices. For land use policy and other domains of urban design, new knowledge and tools are needed to understand the future of dormant vehicles and how new vehicle technologies, infrastructures, practices and places shape each other. The paper sets out to put this research agenda at the forefront and propose some ways forward.

In the next section I discuss current transitions in travel in the UK and around the world which underpin the particular approach to the future of parking (dormant vehicles) which the paper argues for. This includes a brief discussion of some of the reasons why current parking policy and practice cannot be transferred into these emergent contexts. Starting from the definition that dormant vehicles are *vehicles that are stationary while waiting to be used* the rest of the paper explores how dormant vehicles might be perceived, theorized and researched. Key concepts from social theories of practice are introduced and developed. These ideas are relevant to the task in hand because of their understanding of the relationships between everyday life, end use practices, forms of mobility, infrastructures, built environments and technologies. I argue that drawing on selected aspects of these theories provides an original conceptual framework with which to conceive of dormant vehicles in the present and future. In the final section I discuss the insights and implications of the approach for researching uncertain and emergent futures of urban mobility and propose a new

research agenda. This agenda would focus on dormancy instead of flow, and would thus be capable of identifying some of the dormant vehicles of urban mobility futures and their potential implications for urban design and land use policy.

2. Background

2.1 Travel transitions and the future of parking

Futures of urban intensification, smart transportation and changed travel demand are not some distant time horizon, but rather they are emerging and underway (Hodson and Marvin, 2014; Marvin et al, 2015; UN, 2018). The recent report of the Commission on Travel Demand (Marsden et al, 2018) shows that in the UK we travel substantially less today than we did twenty years ago, these reductions amount to 16% fewer trips per annum than in 1996, 10% fewer miles than in 2002 and 22h less travelling than a decade ago. Whereas trends in falling trip rates appear to apply across the UK, the shift away from the car is more concentrated in cities. Existing transport models are unable to explain these shifts, but a recent review of the evidence suggests that they are an outcome of '… a changing relationship between how much, how often, when and how we travel and the activities we take part in…' (Marsden et al, 2018: 5). Such shifts have implications for parking, because parked cars form the interfaces of such activities with road networks. If patterns and overall quantities of trips are changing, there are likely parallel changes in parking too.

The latter point is worth noting. Core to ideas of transport planning is the concept of derived demand – that travel occurs in order that we can take part in activities. Some changes in travel demand are an outcome of changes to how such activities are organised. For example, online shopping now represents almost 17% of total UK retail sales and it is growing at around 10-12% per year (Marsden et al, 2018:25). Following this logic, such a shift might result in reduced car trips and a drop in the demand for parking, however to take such a limited view would be to blinker our perspective. The point to note in this paper, is that changes in how shopping is organised and practiced most certainly has related shifts in mobility and dormancy, but it does not eradicate them. Rather online shopping disrupts the sequence and spaces of traditional shopping trips with browsing and purchase taking place online (instead of a trip to the city centre), and goods being delivered to home, work or other location. Mobile and dormant vehicles are still part of shopping, all-be-it in altered configurations.

Following a similar logic, emergent travel trends likely point to shifts in end use practices not yet recognized. For example, since 2006 there has been a 23% rise in van traffic in the UK, although there is little understanding of what this is for. A study commissioned by the RAC Foundation (Braithwaite, 2017) estimated that just 10% of this traffic was related to online shopping raising questions about the other 90%. Such understanding is important, not just for managing mobility but for understanding emergent forms of dormancy and demands on city space.

Alongside these trends towards urban living, and the reorganization of end use practices (accelerated by the digital economy), the development of vehicle and transport technologies, underpinned by the policies of city councils, further contributes to the transformational change that is already underway. Mobility as a service (MaaS), the vision of seamless transportation enabled by smart technologies, is gaining traction through the development of new journey planning apps, and the emergence of new services, for example uber, lyft and ola. MaaS, which is explicitly part of the transport strategy in cities including Hannover (UITP, 2016) and San Francisco (SFTCA, 2017), promises an urban mobility future in which public and private modes of travel can be woven in limitless ways, enabling people to make the journeys they want without the need for a privately owned vehicle (KPMG, 2017). The vision emphasizes the shift away from privately owned vehicles to

the consumption of the 'service' i.e. the mobility provided. Such alternatives will certainly reduce the quantities and patterns of parked cars currently found in urban areas. However as they intersect with new lifestyles and reorganized end use practices they will still require places to pick up, drop off, charge, park and await repair. In this sense, to assume the parked car is the only form of dormant vehicle is to create a blind spot in planning, and in futures thinking.

2.2 The transferability of parking research to new contexts

Research and policy related to parking is not in short supply, however it has several limitations when it comes to understanding the dormant vehicles of the future. A brief history of parking policy in the UK can help to explain why. For those unfamiliar with the UK context, from 1950 to the mid 1970s car ownership rose from 20 to 50% of UK households, and today 74% of households have at least one car (Marsden et al, 2018). Different approaches to parking planning did exist in the past. For example, archive work in Stevenage new town (Spurling, 2018a) shows that through the 1950s the planning approach shifted from envisioning car-free lifestyles and low parking standards, to survey and provide and then predict and provide, with parking standards increasing at each step, to 2.3 per home by 1970. In the process, the assumptions underpinning standards shifted from a concept of the car as embedded in everyday life, end use activities and particular places, to parked cars as quantified patterns extracted from the social lives they were part of, with plans for future parking demand based on these abstractions.

Such findings resonate with Shoup's analysis (2005:75) which shows that minimum parking standards (i.e. the number of off-street parking spaces to be provided with new developments) were typically copied from one jurisdiction to another; were invented based on rules of thumb; or, based on demand surveys with low predictive power. Shoup's general message is that the resulting 'pseudo-science' is unsuitable even for the purpose of planning for parked cars. As such existing policies, and the methods underpinning their creation, are of little use in understanding and analyzing the emergent futures outlined above. New knowledge and new tools are required.

3. Dormant Vehicles: development of a concept

An important emphasis of the paper is that in alternative and emergent systems of mobility, both forms or dormancy (including durations, temporal locations and rates of recurrence), and vehicles themselves (their size, quantity, carrying capacity, and how they are accessed) will combine in new ways. Such combinations will have implications for the interfaces provided for them. To begin I briefly delve into some of these varieties, which might constitute the future.

3.1 Conceptualising dormancy

In proposing that parking is just one form of dormancy, amidst a much broader range (dropping off, picking up, delivering), dormancy is framed as a temporal (as well as spatial) phenomenon. It is beyond the scope of the paper to offer a detailed discussion of concepts of time, however, a simple framework of temporal concepts from the sociologist Zerubavel (1985) is adequate to initially unpack varieties of dormancy. In particular, ideas of temporal location, duration and rate of recurrence are pertinent for this paper, as explained below.

The idea of *temporal location* relates to calendars and schedules. It refers to when something happens, but also captures the idea that such occurrence is not simply one off, rather it has a temporal pattern. In the context of this paper we might imagine temporal locations of dormancy – in other words, that vehicles are dormant at different times of the day, week and year – and that such temporal locations have social origins.

Duration refers to the period of time that something endures for – the duration of an undergraduate lecture is two hours, or of a weekly team meeting is 45 min. To some extent the idea of duration is already embedded in parking policies, with provision for 'up to 20 min waiting' (e.g. at railway stations); short stay and long stay car parks, and 'no return' zones of 30 min or an hour near town centres. My reason for introducing the concept in this paper is that it draws attention to the range of forms of dormancy, especially relevant for a near future where long durations of dormancy may no longer be the dominant form.

Rate of recurrence refers to how often something happens – in the context of the paper – how often a vehicle is dormant. For example, we might reflect on the fact that although a taxi is generally dormant for shorter durations than a private car, the rate of recurrence of its dormancy will be greater. Taking the concepts together shifts the focus of debate of parking futures, for example, perhaps rather than focusing on how to plan for less parking, we might instead focus on new and transformed temporal locations, durations, and recurrences of dormancy. As noted, some examples already exist – dropping off, picking up, loading, delivery – which offer potential sites of research for futures thinking.

3.2 Conceptualising vehicles

In addition to temporal qualities, dormant vehicles have material, social and legal qualities too. Material qualities relate to the physical entity of the vehicle itself and the quantities of such vehicles which constitute the system of mobility. Social qualities relate to the fact that dormant vehicles are at the intersections of mobility and end use practices, and that patterns of dormant vehicles can be transformed because end use practices change. Legal qualities relate to the rights to space of different vehicles that exist within a culture, and which are reified in parking or stopping regulations and laws. These points are further outlined below.

3.2.1 Material qualities of dormant vehicles

Vehicle technologies (the car, the bike) have material characteristics, most notably (in terms of planning space for dormancy) they are specific sizes and dimensions. For a system of mobility to be possible, adequate space for these vehicle technologies when they are dormant is needed, and likewise, revoking such space is one means of managing mobility. Though important, this point is somewhat obvious and is already central in parking policy and research. More interesting for this paper, and for turning to the future is to extend our concept of 'the vehicle' to cut across the human and non-human divide. This is because, aside from the more speculative long-term visions of automation, in practice vehicular technologies do not provide mobility of their own accord, rather movement is achieved by a human-technology hybrid - a cyclist-bicycle, a driver-car (Dant, 2004).

This is significant for understandings of dormancy, and how dormant vehicles are planned for. Conceptualising vehicle-human hybrids brings the human body and its needs into the frame. Re-imagining the boundaries of a vehicle also forces us to revisit definitions of dormant vehicles too. In some ways this concept already exists in the field of transport and land use planning. For example, think about the motorway service station (Merriman, 2007), this is itself an acknowledgement that drivers need to rest and refuel, even when cars might not, and that long journeys might thus require periods of elective dormancy. Likewise, think of new provision for cycling that has emerged in workplaces in recent years, which not only provides storage for bicycles, but also showering and changing facilities for cyclists. Such provision acknowledges the implications of driving and cycling, not simply for the car or bike, but for the human too. As new forms of mobility – and new kinds of human-vehicle hybrids emerge – different kinds of spaces and interfaces will be needed. Such considerations apply in different ways to walking and cycling (and associated resting, refuelling and

changing[2]), but also to new service-based models which in their vision of less dormancy, potentially ignore the drivers and operators that are essential for these mobility services, and the places and spaces which they require for rest breaks (see Pitas,2018).

It is not controversial to state that the size of vehicles varies. Perhaps less discussed are the quantities and accumulations of such vehicles, which create challenges for planning and controversies over use of public space. The vast areas of urban space needed for accumulations of stationary cars was a significant unanticipated outcome of automobility. Such issues of accumulation do not simply disappear with the decline of the car, but rather emerge in new forms. For example, the rapid increase in Uber and Lyft pick-ups and drop-offs in San Francisco urban core and their implications for congestion and other modes such as cycling have been the focus of much debate (SFCTA, 2017). In Beijing and other cities in China, the implementation of dockless bike schemes have resulted in problematic geographies of dormant dockless bikes accumulating in large piles at the entrances to parks and railway stations (Haas, 2017). Including such sizes and quantities of vehicles within future visions – alongside possible cumulative patterns (revealed by thinking through temporal and spatial locations of dormancy) has the potential to make visible some of the unanticipated consequences of new forms of mobility.

A final point to note in this part of the paper, is that vehicles afford different carrying capacities (DEMAND, 2015) – for passengers and goods – and as such when they are dormant they require additional space to make this access possible. Once again, such considerations have played into parking policy and design for a long time, with standards including access for drivers and passengers, wheelchair access and so on (e.g. HMGO, 2015). Yet these considerations are much less visible in parking for cycling – which might require areas for loading children or panier bags before setting out. A final point on cargo is to acknowledge that on occasions, rather than being 'out of use' dormant vehicles are actively storing goods. A pertinent example of this phenomenon is an emerging practice of delivery drivers who use their vehicles as mini-warehouses within the city, parking the vehicles in legitimate locations, and then moving goods by foot for the final part of their journey (Cherrett, 2017). In this example, understanding what dormant vehicles are for, how they are used in practice, could inform thinking on last mile delivery.

The comments above delve into some of the transformations in dormant vehicles, which might constitute the future, mainly focussing on emergent technologies. Opening up the category of dormant vehicles is a useful first step towards inverting urban mobility futures. However, the discussion so far provides few clues as to how we might conceptualise and research patterns of dormant vehicles. It is to this task that I now turn.

3.2.2 The social and legal qualities of dormant vehicles

It is widely agreed that travel is central to participation in society (Marsden et al, 2018). Mobility makes it possible to engage in a whole range of activities from work to caring for a family, to social and leisure activities. In a society that is underpinned by a system of automobility (Urry, 2004) participation in such activities is often dependent on access to and use of a car. From this perspective, parked cars (and by extension other dormant vehicles) are an unanticipated side effect of such social participation. Turning this on its head, we might also say that dormant vehicles have social lives. The quantities and patterns of dormancy associated with the car are an outcome of

---

[2] For example, books and information on countryside walking and cycling routes are rich with suggestions of places to rest and refuel, however such considerations are much less common in urban walking and cycling contexts.

temporal and spatial patterns of social participation. This is the first sense in which dormant vehicles have social qualities.

Dormant vehicles have social lives in other senses too. Notably, they are perceived and planned for in different ways at different times (Barter, 2015; Marsden, 2006; Taylor and Van Bemmel-Misrachi, 2017), being viewed sometimes as problems, sometimes as necessity and priority. The extent to which dormant vehicles are planned and provided for shapes how different modes of mobility are embedded in everyday life. For example, planning for parked cars can further embed and perpetuate car dependence, whilst at the same time evidence of the potential for planning against the car, in certain places and situations, is gaining ground. Similarly, the uptake of emergent forms of mobility, such as cycling, can be limited through a lack of planning for dormancy (e.g. Aldred and Jungnickel, 2013; Larsen, 2015).

At the intersections of social participation and planned space are the concepts of private space and private rights which circulate in society. Car parkers have typically asserted a right to parking as though it were their own personal space in the city. This is accompanied by the special legal and social status which private cars have to be dormant in many places, in stark contrast to the status of bicycles, which as discussed by Aldred and Jungnickel (2013) are more likely to be framed as 'matter out of place'. City policies of car reduction, such as Melbourne's 2018 parking review (City of Melbourne, 2018) are challenging this legal and social status of the private car, by highlighting that kerb-side parking is actually inhibiting the development of alternative forms of mobility. Likewise, Kent and Dowling (2013) raise similar points in relation to car-sharing practices. Such research and policy point towards the legal qualities of dormant vehicles, and the new politics of space that is on the horizon, and to which research and analysis on emergent dormant vehicles could contribute.

4. The social lives of dormant vehicles: a framework

The paper, up to this point, has outlined how dormancy and vehicles can be conceptualised, with the simple aim of making visible the fact that all mobility systems – even those which promise movement and flow – have an associated dormant materiality. This observation highlights thenecessity of opening up debates on futures of parking. The paper also emphasises that although dormant vehicles are material technologies, they are also social phenomenon. To understand and analyse futures of dormant vehicles, thus requires a way of conceptualizing how dormant vehicles and everyday life are interwoven. It is to this task that I now turn. In the sections that follow I introduce a set of interrelated concepts from social theories of practice, which together provide a framework for understanding the social lives of dormant vehicles. When combined with the ideas already discussed in section 3, this framework provides original starting points to research emergent dormant vehicles in the present and to envision their futures.

By way of brief introduction, social theories of practice, as their name implies, seek to understand practices – the activities done each day. Within this approach, all actions (even seemly individual or private activities) are social; in other words they are practiced in ways characteristic of a culture or social group. The explanations for such similarities across society is a point of empirical research and debate. In the context of this paper, theories of practice have already been brought to bear on understandings of urban mobility and travel demand in two key ways. These are outlined in the following sections as a way to introduce these theories to the topic of dormant vehicles.

4.1 Vehicles as materials of mobility practices

Forms of mobility, such as driving and cycling, can be usefully conceptualized as practices (Shove et al 2012, Spurling and McMeekin, 2015). In 2012, Shove, Pantzar and Watson introduced a three elements model of a practice. From this perspective, mobility practices such as driving are

constituted of meanings (convenience, independence, freedom), skills (operating a car, interpreting road signs and signals) and materials (the car, roads). Each instance of driving involves the integration of elements from these categories. Aldred and Jungnickel (2013) draw on these ideas to note that the materials of mobility practices – especially the vehicles - are 'at rest' in between performances, or in other words they are dormant. These dormant vehicles make demands on space, including requirements of size and scale, location and access.

This conceptualization, of vehicles as the materials of mobility practices, helps to identify that parked cars are just one form of dormant vehicle – associated with car based mobility practices of driving (and we might also add passengering and transporting, Dant, 2004). It highlights that other mobility practices (e.g. cycling) also involve vehicles that are stationary in-between practice performance. Moreover, as discussed earlier, such a conception highlights that the performance of the practice has implications for the human as well as the vehicle technology. It broadens our view beyond the parked car to alternative and emergent forms of dormant vehicle. However, this notion does not assist our understanding of why vehicles are dormant when and where they are, for the durations that they are.

4.2 End use practices and dormant vehicles
A second, and contrasting conceptualization shifts the focus from mobility practices to the end use practices that travel is for (Spurling and McMeekin, 2015; Hui, Day, Walker, 2018). Here we might think of the sequences and schedules of activities that constitute everyday life – working, socialising, leisure, shopping, caring for a family. From this point of view overall amounts of travel, and patterns of travel are an outcome of where and when such activities take place. Parked cars (and other dormant vehicles) then form the interfaces of these end use practices with transportation infrastructures. This idea resonates with the idea of derived demand that will be familiar to transport planners – that travel is not undertaken for its own sake, but to accomplish end use activities. The benefits of bringing concepts of social practices to bear on this existing idea are twofold.

First, although ideas of derived demand recognize that travel is for end use activities, no attention is given to transformations in these activities over time. Contemporary developments in shopping (discussed in the introduction) are a case in point. Shopping is not simply happening more or less, but rather the practice itself is transforming. Likewise, the shift from 9-5 work at specific premises, to flexible hours, working from home and working in third spaces (UKCES, 2014), demonstrates a change in work which has implications for the commute. These examples convey an important conceptual point in practice theory, which moves beyond thinking of practice simply as an alternative word for action (e.g. doing shopping) - and instead recognizes that such actions are socially shaped and organised, and can be conceived as *entities* (e.g. a practice of shopping) (Schatzki, 1996:89; Warde, 2005:133). As the entity changes, so performances (observable actions related to the practice) are transformed, and vice versa. To state that end use practices change across time is to recognize this point. This is significant in the context of this paper, because with a shift in shopping (and other end use practices) the demand for travel, and associated patterns of dormancy, does not simply increase or reduce, rather it is entirely reconfigured. For those familiar with concepts of relational space, another way to put it is to say that performances of practices shape time and space; changes in practices have temporal and spatial implications. By extension, when shopping (as an entity) changes, the times and spaces in which shopping interfaces with travel infrastructures also shifts. In other words the types, quantities, places and times of dormant vehicles related to online shopping and delivery will be quite different to those of a trip to the shops in the car.

Staying with the topic of end use practices, there is a second concept pertinent to the current discussion: that end use practices are connected – 'bundled' - together in particular patterns in time and space (Shove et al, 2012; 2015). To explain this idea it is necessary to think about the idea of 'location' in two ways. A practice performance will have both a temporal location (Zerubavel, 1985) which refers to *when* a particular practice is performed in the day or week. This performance will also have a geographical location – *where* it take place. Temporal and spatial locations of practice do not exist as static time-space coordinates of activity, rather such performances are relational; changes in the temporal and spatial location of one practice has implications for other practices.

For example, think for a moment of a specific individual who changes job and thus works in a different place, with a lengthier commute. This change in work (an end use practice) will effect how other practices (shopping, taking children to school, exercise) are scheduled into that individual's day or week. Now move a step further to imagine the impacts of such changes for the daily lives of vehicles which make such schedules possible; these vehicles would have observably different patterns of mobility and dormancy.

The focus on the individual in the preceding paragraph helps to convey the idea, however, the more significant point involves shifting thinking from this individual scale, to the scale of practice entities. In an era when digital economy is transforming shopping and working at a societal scale, it is not simply the case that changes in individuals' lives shift how end use practices are woven together. Rather transformations in end use practices are reconfiguring individuals' everyday lives on a societal scale. Indeed there is an argument to be made that much more resource should be allocated to understanding futures of social practices as a starting point for envisioning future travel demand (Marsden et al, 2018), and I would add their associated patterns of dormancy.

The idea of dormant vehicles as interfaces of mobility with transforming end use practices helps to explain why cars and all other vehicles are dormant when and where they are, for the duration they are, and why these patterns change. It also points to the fact that futures of end use practices are significant for futures of dormant vehicles. However, still lacking from this conceptual scheme is an understanding of how mobility practices (i.e. practices whose end goal is movement) and end use practices shape each other. It is to this topic that I now turn.

4.3 Conceptualising connections of mobility and end use practices
The two approaches to understanding parking outlined in 4.1 and 4.2 build on developments of social practice theory as it has been brought to bear on decarbonizing travel. Though useful, these concepts risk creating a false dichotomy in which end use practices are viewed as connected to and shaping of each other, served by mobility practices. Recent developments, (Watson, 2012; Shove et al, 2015) take steps to overcome this dualism, arguing that car travel – as a dominant mobility practice in the latter half of the twentieth century – had huge influence on the patterns of connection of end use practices, as well as their temporal and spatial locations. In other words that mobility practices and end use practices shape each other. For example, Watson (2012) notes that:

'the shifting character of grocery shopping is inseparable from shifting patterns of personal mobility , with out of town supermarkets co-evolving with patterns of personal car mobility, and with broader restructuring of the temporal rhythms of daily life that are enabled by, and make necessary, the convenience of provisioning a household with a single shopping trip to one destination' (2012:491).

Such developments in theories of practice correspond with the two-way interaction between mobility patterns and the location of activities or patterns of land use that have been studied since

the 1950s in the US (Hansen, 1959) and the 1960-70s in Europe (e.g. Wegener, 2004 ; Wegener and Fuerst, 2004). Shove et al (2015) further develop these observations by conceptualizing road infrastructures as the interconnections of end use practices in material form. In other words, as planning seeks to keep up with demand, the built environments it creates partly reflect the web of end use practices of which travel is the outcome. At the same time such built environments make new places of practice possible, shaping patterns of demand, and ultimately making the car a necessity to engage in social life.

In the context of the current discussion there are several points to note. First of all, travel is not simply a derived demand, in other words it is not simply an outcome of how end use practices connect in time and space. This is because travel – the mobility practice itself – shapes how these end use practices are, or might connect. We can therefore expect that cycling or MaaS will not simply replace the car, connecting end use practices as they might be mapped today. Rather, performances of these mobility practices will inevitably result in such webs of end use practice being reconfigured too. At the individual level the temporal and spatial locations of practice in daily life will change as we navigate through transformed worlds. At the scale of practice entities, changes in mobility will contribute to their reorganization, such that new patterns of mobility and dormancy emerge. Not from mobility practice, and not from end use practice, but from their inter-relational, interwoven, mutual shaping.

Given the discussion above, the task of understanding and analyzing emergent dormant vehicles, and of envisioning futures of parking, might begin from three different starting points: i) By considering the types of dormant vehicles that alternative and new forms of mobility will require and produce; ii) By exploring the futures of end use practices such as shopping and working, and the associated reconfigured patterns of mobility and dormancy; iii) By envisioning how such transformed mobility and end use practices might shape each other.

5. Insights and implications

5.1 Summary of concepts

The paper has introduced a framework through which dormant vehicles might be perceived, theorized and ultimately researched. I begin this concluding discussion by providing a summary of the concepts discussed and reflect on the potential contribution of the approach in fields of land use and urban mobility. I also touch on the original contributions for theories of practice, which have emerged from their discussion in relation to this novel topic. The paper concludes with some thoughts on an original 'dormant vehicles' research agenda, including key research questions and possibilities for a research design.

The key concepts of the paper are summarized in table one below. This forms an initial framework for analyzing emergent dormant vehicles in the present, and envisioning parking futures.

Table 1: A proposed framework for the analysis of dormant vehicles

Concept	Definition
Dormant vehicles	Vehicles in-between use. Vehicles that are stationary, but waiting to be used again.
Dormant	The different qualities of time, including duration (the length of time, from minutes to hours that a vehicle is stopped), temporal location (the time of day, week, that a vehicle is stopped) and rate of recurrence (how often a vehicle stops).

Vehicle	The technologies and bodies that make mobility (and dormancy) possible. Cycling – requires a cyclist-bicycle, driving and passengering require a driver-car.
Material qualities	The physical characteristics of such vehicles including quantity, size, cargo capacity, entrances/exits.
Social qualities	Refers to the fact that dormant vehicles are at the intersections of mobility and end use practices, and that patterns of dormant vehicles can be transformed by changes in end use practices.
Legal qualities	The concepts of private space and private rights which circulate in society, and which are sometimes reified in policies and laws.
Mobility practices	Practices that enable the movement of people and goods e.g. driving, cycling.
End use practices	The end use activities that travel is for, recognizing that these activities themselves change across time, with implications for travel.
Mobility-end use practice bundle	The relationships between forms of mobility (mobility practices) and end uses (end use practices).
Interface	The location-specific intersections of mobility and end use practices (in time and space). In the paper, dormant vehicles are conceptualised as interfaces; the instantiations of *mobility-end use practice bundles* in physical form.

Dormant vehicles are therefore vehicles that are in-between use because of interfaces between specific mobility practices and specific end-use practices. Different varieties of such interfaces will exhibit different types of dormancy (rate of recurrence, temporal location, duration) and different vehicular qualities (material, social, legal). To understand futures of parking requires the consideration and analysis of all these aspects.

Theories of social practice are at the core of the ideas outlined. For example, travel (viewed as the performance of mobility practices) is conceptualized as an outcome of end use practices (i.e. the activities and commitments that we travel for) (Watson, 2012; Spurling and McMeekin, 2015). Dormant vehicles are perceived as the interfaces of mobility and end uses; as materials of mobility in-between performance. As such, looking at dormant vehicles – how many, when and where they are - has the potential to reveal how mobility systems are embedded in social life; and, how travel enables social life to happen in specific times and places.

Temporal and spatial locations of dormant vehicles, are viewed as co-developing across time. The informal geographies which emerge in everyday use are reified as formal geographies – as planners try to provide for the demands of society - such that bundles of practice are (partly) materialised in the infrastructure (Shove et al 2015). However, planners also take a special role in shaping social practices – and ultimately demand too (Schatzki, 2010), for example zoning for parking, and maximum (instead of minimum) standards. Given this iterative relationship, in the paragraphs that follow I reflect on the potential contributions of this paper to the fields of land use policy and urban design, in particular the proposed reframing of parking which the paper proposes.

5.2 Contributions to land use and parking research

It is easy to assume that as policy and urban design increasingly emphasise a shift away from private car that planning for parking will become a thing of the past, leaving tracts of freed up land in their wake. However, this is not the conclusion that should be drawn.

Rather, the points to take away from this paper are:

- that all forms of mobility are accompanied by patterns of dormancy, though the precise instantiation of such dormancy remains a topic of empirical research.
- Transformations in urban mobility will produce equivalent changes in forms and patterns of dormant vehicles.
- A new politics of space is on the horizon, as interfaces of mobility and end uses morph and change.

The concepts developed in this paper offer an initial starting point from which such futures, and knowledge about them, might be developed.

The analysis above has been framed in a specific way, as such other significant aspects remain outside the frame. Most notably, planning for land use always involves a weighing up of priorities, needs and demands. For example, planning the parked car into neighbourhoods throughout the 1950s and 1960s resulted in a re-purposing and re-categorisation of land uses including the transformation of gardens, back streets, playing fields and allotments (Spurling, 2018a). As cities intensify, non-commercial uses of space become more difficult to justify. Politics of space are not simply about one form of mobility (and dormancy) or another (as is covered in this paper), but whether mobility (and associated dormant vehicles), or other uses entirely should be given priority.

5.3 Contributions to urban mobility futures

There are also some significant messages for those concerned with futures of urban mobility:

- Futures of sustainable travel and transportation have, to date, focused on vehicles in use. Little attention has been given to vehicles when they are in-between use, stationary but waiting to be mobile again.
- Much of the innovation in travel technology has focused on cleaner energy and vehicle technology. As these imagined futures move closer, other aspects including the interfaces of new travel technologies with infrastructure and everyday life become more pressing.
- Undertaking research on dormant vehicles can help define the parameters of this challenge, and contribute a sustainable and ethical approach towards it.
- To achieve this goal requires a new approach which inverts the more common focus on the movement of people and goods to focus on patterns and trajectories of dormant vehicles related to them.
- Developing knowledge about dormant vehicles will enable their inclusion in future visions and scenarios, contributing insights on their possible implications for land use, space and place.

The uptake of the ideas in the paper has potential to reshape practice on the ground. For example, to undertake new empirical research on dormant vehicles could directly contribute to the aims of city regions such as Greater Manchester, UK. The most recent strategic plan of Transport for Greater Manchester (2017) has the ambitious goal to establish a fully integrated, high capacity transport system across Greater Manchester, whilst creating places which feel safe and welcoming. Inverting the focus of their existing visions, to explore futures of dormant vehicles across the city promises a significant additional layer of knowledge towards achieving this aim. Likewise, urban design specialists, such as IBI Group, are channelling their efforts towards the creation of 'resilient, connected, smart cities' (IBI, 2018), yet they are doing so with a sparsity of evidence, or tools to envision the interfaces of everyday life with new vehicle technologies. The conceptual scheme, and new research agenda proposed in this paper provides a starting point for such innovations.

5.4 Contributions to practice theory

In bringing theories of practice to bear on this novel topic, several new insights have emerged. Firstly, whereas much of the work in this field focusses on materials in practice performances the paper draws attention to materials that are in-between performance, an aspect that has as yet received little attention (for exceptions see Jalas and Rinkenen, 2016; Mylan and Southerton, 2017). In this sense the paper contributes to an emergent strand of theoretical thought, concerned with opening out 'materials' in practice (Schatzki, 2010; Maller et al, 2016; Shove, 2017; Spurling, 2018b) specifically by conceptualizing materials in-between performance and exploring how such dormant materials shape the social world.

Secondly, the paper breaks down an emerging dualism in practice theoretical understandings of mobility and travel. On the one hand, the conceptualisation of 'mobility practices'; and on the other hand, a focus on end use practices. The paper shows that the concept of practice bundles (Shove et al 2012) can usefully overcome this dichotomy, emphasizing that mobility practices and end use practices shape each other; with change in one inevitably resulting in change in the other. The concept of mobility-end use practice bundles (Spurling and McMeekin, 2015) reveals the possibility of analyzing alternative and emergent forms of mobility, and how they bundle with transforming end use practices in new and innovative ways. Such bundling and re-bundling is already underway, and potentially observable in the informal geographies of dormant vehicles which emerge as individuals weave new mobility practices into their everyday lives.

6. A new research agenda

How then, might we proceed to research these dormant aspects of emergent and uncertain futures? There is not the space in this conceptual paper to outline a fully argued research proposal, however, to find new answers often requires new questions. Following the framework discussed in this paper to its conclusion leads us to ask:

- What formal and informal geographies, and temporalities, of dormant vehicles exist in cities around the world? What kinds of vehicle, and what are their associated geographies?
- How do these dormant vehicles connect to social practices, what daily routines are they part of?
- How do they connect to urban design and planned space? What rights are dormant vehicles assumed to have? Which dormant vehicles are given priority, and which ignored?
- How might end use practices (such as working, shopping) change in the future?
- How might vehicle technologies and mobility practices change in the future?
- How might such transformed end use and mobility practices bundle together? what might be the resultant daily routines?
- Through considering the above, what are the futures of dormant vehicles? and how might formal geographies and interfaces be planned and provided for them?
- Which futures are preferable, and for whom? What roles does land use planning and urban design have in shaping these futures?

I note at the start of this paper that transformed futures of urban mobility and travel demand are not some distant horizon, they are already emerging in the present. Such alternative and emergent futures – and their associated dormancy – can thus be studied, offering insights and material with which to envisage emergent and uncertain worlds. Manchester, in the North West of the UK provides a pertinent example. Since the 1990s, trajectories of growing car travel and relocations of residential and economic activity to the urban periphery have reversed. Instead, motor vehicle

kilometres declined between 1996 and 2013, with the greatest declines in the inner urban area. The largest population growth in the city region has been within this area too, such that there has been an increase in the proportions of city centre workers who live within 6 km of the urban core. As such, economic and traffic growth have become decoupled (TfGM, 2017) – so what is happening to mobility, end use practices and patterns of dormancy?. Likewise, cities in other parts of the world are becoming test-beds for the embedding of new mobility forms – Uber and Lyft in San Francisco; dockless bikes in Beijing; Ola and auto/e-rickshaw in Bengaluru. Moreover, other parts of the world have relied on alternative systems of provision, such as mobility services and ride-sharing, for decades (Kasera et al, 2016).

Such cities provide rich sites to research possible futures of dormant vehicles. With creative GIS mapping combining emergent sources of data (docking stations, mobility as a service and ride share apps, council car park data), and walking surveys in inner urban areas, formal and informal geographies of dormant vehicles might be documented. Diary methods might be combined with ethnographic interviews to trace the social lives of varieties of dormant vehicles, to log times and places of dormancy, and create in-depth understandings of such patterns. Interviews with urban planners could reveal the relationships between dormancy and planned space. Photography could be used to survey and analyse the new kinds of interfaces emerging in urban environments as vehicles, lives and end uses combine in new ways.

It is not possible to predict the future, which is inevitably emergent, uncertain and dynamic. Neither is it possible to create envisioned futures precisely to plan. Nevertheless, to develop visions of possible and preferred futures is a valuable exercise (Urry, 2016), offering insights on alternative trajectories and how they might be achieved, as well as to anticipate unseen outcomes. It is to this endeavor that the dormant vehicles agenda might contribute; identifying, making visible and developing resources, which offer tangible starting points to develop a new layer of futures thinking currently absent in the mobility futures debate. An inverted future, which reveals the dormant vehicles of urban mobility transitions and their implications for land use, space and place.

References
Aldred, R. and K. Jungnickel (2013) Matter in or out of place? Bicycle parking strategies and their effects on people, practices and places. *Social and Cultural Geography,* 14(6): 604-624.

Barter, P. A. (2015) A parking policy typology for clearer thinking on parking reform. *International Journal of Urban Sciences*, 19(2), 136-156.

Ben-Joseph, E. (2012) *Rethinking a Lot*. Cambridge, MA; London, England: MIT Press.

Braithwaite, A. (2017) The Implications of Internet Shopping Growth on the Van Fleet and Traffic Activity, RAC Foundation. Accessed 29/08/2018. Available at: https://www.racfoundation.org/

Cherrett, T. (2017) Trends in Travel Demand: Last-mile logistics, Presentation at *The Commission on Travel Demand Evidence Session 3,* 13th June 2017, University of Leeds*. Accessed 08/02/2019. Available at: http://www.demand.ac.uk/wp-content/uploads/2017/07/Cherrett-Last-Mile-Logistics.pdf

City of Melbourne (2018) Transport Strategy Discussion Paper: Car Parking. Accessed 29/08/2018. Available at: https://participate.melbourne.vic.gov.au/transportstrategy/car-parking

Dant, T. (2004) The Driver-car, *Theory, Culture and Society*, 21:61-79.

DEMAND (2015) Research Insight 3: Carrying Capacity: The Cargo Function of the Car. Accessed 29/08/2018. Available at: www.demand.ac.uk

Department for Transport (2018) Future of Mobility: Call for evidence. Accessed 29/08/2018. Available at: https://www.gov.uk/government/consultations/future-of-mobility-call-for-evidence

Devaneyan, S. (2016) Solar-Powered Retrofit Electric Three-Wheeler for Multipurpose goods carrier with manual pedaling, *International Journal of Science, Engineering and Technology Research (IJSETR),* v.5(6), pp.2000-2004.

Engel-Yan, J., Hollingworth, B., & Anderson, S. (2007). Will reducing parking standards lead to reductions in parking supply?: results of extensive commercial parking survey in Toronto, Canada. *Transportation Research Record: Journal of the Transportation Research Board*.

Fuller, G., Waitt, G., Buchanen, I. and Ozolins, N. (2018) The problem isn't dockless share bikes. It's the lack of bike parking, *The Conversation*. Accessed 08/02/2019. Available at: https://theconversation.com/the-problem-isnt-dockless-share-bikes-its-the-lack-of-bike-parking-102985

Guo, Z. (2013). Does residential parking supply affect household car ownership? The case of New York City. *Journal of Transport Geography*, 26, 18-28.

Haas, B. (2017) Chinese bikeshare graveyard a monument to industry's 'arrogance', *The Guardian*, 25th November 2017. Accessed 29/08/2018. Available at: https://www.theguardian.com/uk-news/2017/nov/25/chinas-bike-share-graveyard-a-monument-to-industrys-arrogance

Hansen, W. G. (1959) How accessibility shapes land use. *Journal of the American Institute of Planners*, 25(2): 73–76.

HMGO (2015) The Building Regulations 2010 Access to and Use of Buildings, Approved Document M, Volume 1: Dwellings. Available at: www.gov.uk/government/publications/access-to-and-use-of-buildings-approved-document-m

Hodson, M. & Marvin, S. (2014) *After Sustainable Cities?,* London & NY: Routledge.

Hui, A., Day, R. and Walker, G. (2018) Demanding Energy: Space, Time and Change, Palgrave MacMillan.

IBI (2018) *Smart Cities Strategy.* Accessed 20/06/2018. Available at: https://www.ibigroup.com/

Jalas M and Rinkenen J (2016) Stacking wood and staying warm: Time, temporality and housework around domestic heating systems. *Journal of Consumer Culture* 16(1): 43–60.

Kasera, J., O'Neill, J. & Bidwell, N. (2016) Sociality, Tempo and Flow: Learning from Namibian Ride-sharing, ACM, 1st African Conference on Human Computing Machinery.

Kent, J. L., & Dowling, R. (2013). Puncturing automobility? Carsharing practices. Journal of Transport Geography, 32, 86-92.

KPMG (2017) *Reimagine Places: Mobility as a Service*. Available at: http://bit.ly/2iAk9iy.

Larsen, J. (2015) Bicycle Parking and Locking: Ethnography of Designs and Practices, *Mobilities*, v.12, n.1, pp.53-75.

Maller C, Nicholls L and Strengers Y (2016) Understanding the materiality of neighbourhoods in 'healthy practices': Outdoor exercise practices in a new master-planned estate. *Urban Policy and Research, v.*34, n.1, pp.55–72.

Marsden G (2006) The evidence base for parking policies - a review, *Transport Policy*, v. 13, pp. 447-457.

Marsden, G, Dales, J., Jones, P., Seagriff, E. and Spurling, N (2018) All Change? The future of travel demand. *First Report of the Commission on Travel Demand*. ISBN 978-1-899650-83-5.

Marvin, S., Luque-Ayala, A., McFarlane, C. (2015) *Smart Urbanism*, London: Routledge.

McCahill, C., & Garrick, N. (2010). Influence of parking policy on built environment and travel behavior in two New England cities, 1960 to 2007. *Transportation Research Record: Journal of the Transportation Research Board*, (2187), 123-130.

Merriman, P. (2007) *Driving Spaces: A Cultural-historical Geography of England*, Blackwell Publishing:Oxford.

Mylan J and Southerton D (2017) The social ordering of an everyday practice: The case of laundry. *Sociology*. Epub ahead of print. DOI: 10.1177/0038038517722932.

Pitas, C. (2018) Uber to introduce mandatory rest breaks for UK drivers, *Technology News*, 16 January 2018, accessed 08/02/2019, https://www.reuters.com/article/us-uber-britain/uber-to-introduce-mandatory-rest-breaks-for-uk-drivers-idUSKBN1F1J6.

Schatzki, T. R. (1996) *Social practices: a Wittgensteinian approach to human activity and the social*, Cambridge University Press: New York.

Schatzki, T. R. (2010) Materiality and Social Life, *Nature and Culture*, 5(2):123-149.

SFCTA (San Francisco County Transportation Authority) (2017) *TNCs Today: A Profile of San Francisco Transportation Network Company Activity*, Final Report, June 2017. Available at: https://www.sfcta.org/sites/default/files/content/Planning/TNCs/TNCs_Today_112917.pdf

Shoup, D. C. (2005) *The high cost of free parking*. Chicago: Planners Press.

Shove, E., Pantzar, M. & Watson, M (2012) *The Dynamics of Social Practice*, Sage: London.

Shove, E., Watson, M. & Spurling, N. (2015) Conceptualising Connections: Energy demand, infrastructures and social practices, *European Journal of Social Theory*, v.18, pp.274-287.

Shove, E. (2017) Matters of Practice, in Hui, A., Schatzki, T. and Shove, E. (Eds) *The Nexus of Practices: Connections, constellations, practitioners*, Routledge:London.

Simpson, J. (2015) Parking fines four times more likely for delivery drivers in London, 27 July 2015. Accessed 08/02/2019. Available at: https://leasing.com/car-leasing-news/parking-fines-four-times-more-likely-for-delivery-drivers-in-london/

Spurling, N. and McMeekin, A. (2015) Interventions in Practices: Sustainable mobility policies in England, in Strengers, Y. and Maller, C. (eds) *Social Practices, Interventions and Sustainability: Beyond Behaviour Change*, Routledge: London.

Spurling, N. (2018a) Making Space for the Car at Home: Planning, Priorities & Practices, in Shove, E. and Trentmann, F. (Eds) *Infrastructure in Practices*, Routledge: London.

Spurling, N. (2018b) Matters of Time: Materiality and the changing temporal organisation of everyday energy consumption, *Journal of Consumer Culture*, v. 16, n.1, pp.43-60.

Taylor, E. and Van Bemmel-Misrachi, R. (2017). The elephant in the scheme: Planning for and around car parking in Melbourne, 1929-2016, *Land Use Policy*, v.60, pp.287-297.

The Hindu (2017) E-rickshaws in Bengaluru, accessed 08/02/2019, available at https://www.thehindu.com/news/cities/bangalore/e-rickshaws-in-bengaluru-to-ply-or-not-to-ply/article21828083

Transport for Greater Manchester (2017) *TfGM Strategy 2040.* Accessed 20/06/2018. Available at: https://www.tfgm.com/2040

Uber (2019) A Guide to Stopping on the Road: Driving in London. Accessed 08/02/2019. Available at https://www.uber.com/en-GB/drive/london/resources/stopping-guide/.

UITP (2016) World's First Example of Mobility as a Service now Live in Hannover. Accessed 11/02/2019. Available at https://www.uitp.org/news/maas-hannover

UKCES (2014) The Future of Work: Jobs and Skills in 2030, Evidence Report 84, February 2014. Accessed 11/02/2019. Available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/303334/er84-the-future-of-work-evidence-report.pdf

UN (2018) *World Urbanization Prospects*, Dept of Economic & Social Affairs, New York: UN.

Urry, J. (2004) The 'System' of Automobility, *Theory, Culture and Society*, v.21, n.4/5, pp.25-39.

Urry, J. (2016) What is the Future?, Polity Press: Cambridge.

Warde, A. (2005) Consumption and theories of practice, *Journal of Consumer Culture*, v.5, n.2, pp.131-153.

Watson, M. (2012) How can theories of practice inform transition to a decarbonized transport system, *Journal of Transport Geography*, v.24, pp.488-496.

Wegener, M. (2004) Overview of land use transport models. In David A. Hensher and Kenneth Button (Eds.) *Transport Geography and Spatial Systems,* Handbook 5 of the Handbook in Transport. UK: Pergamon and Elsevier Science, pp. 127-146.

Wegener, M. and Fuerst, F. (2004) *Land-Use Transport Interaction: State of the Art*. SSRN.

While, A. (2014) Carbon regulation and low-carbon urban restructuring, in M. Hodson and S. Marvin (Eds) *After Sustainable Cities?*, London & New York: Routledge, pp. 41-58.

Zerubavel E (1985) *Hidden Rhythms: Schedules and Calendars in Social Life,* London: University of California Press.