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Contested transport futures: The case for 'Public' Transport in the age of automated mobility

Highlights

- Automation of mobility could both extend or diminish the range of opportunities and shared experiences open to particular groups of citizens

- We explore how the notion of 'publicness' can contribute to debates on any transition to automated mobility

- We conceptualize publicness in three levels of policy- and political debate: ownership and regulation, public value, and *civitas*

- Effective policy interventions will be required to achieve 'public' goals at each of these levels

- Applying the idea of 'publicness' could improve the governance of the transition to (more) automated mobility

Abstract

This paper highlights the extent to which a future mobility system dominated by Connected and Autonomous Vehicles (CAVs) poses profound challenges to the 'publicness' of the transport and mobility systems of many cities. This is evident at different policy levels: the regulatory posture of governments, changing notions of the contributions of mobility to wider 'public value', and the underpinning shared experiences of urban life and citizenship or *civitas*. There is relatively little discussion of how widespread automation might reduce the 'publicness' of transport systems in terms of the range of mobility opportunities they offer, how changing patterns of mobility across neighbourhoods and social groups will contribute to urban restructuring, and the implications of this for public value and the character or *civitas* of cities. In particular, we note how the huge expansion in mobility choices made possible by CAVs might lead to circumstances in which the outcome of individuals exercising that choice is to change the nature of urban mobility profoundly. We identify a number of key challenges that policy makers will need to address in managing the introduction of CAVs in their cities, and how using the lens of 'publicness' might help them do so.

Keywords

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Introduction

The aim of this paper is to raise the attention of those involved in the transport policy debate about the enduring wider societal value of 'public' transport, at a time when the policy landscape is increasingly dominated by the emergence of automated mobility, especially Connected and Autonomous Vehicles (CAVs) – more commonly termed 'driverless cars' – and attempts to plan for their integration into the wider mobility system (Smith et al, 2018a). Despite the undoubted scholarly energy being put into analysis of automation as a 'transport' phenomenon (see, for example, Litman, 2018), there is still surprisingly little debate about the wider implications of how CAVs (and their supporting technologies) will impact on the processes and experiences of the city as a socio-economic entity. We regard this as problematic, because it is increasingly clear that the widespread adoption of automation could produce "outcomes that run counter to goals of mobility, sustainability, accessibility and social equity" (Sadik-Khan & Solomonov, 2016: 285), substantially diminishing aspects of urban quality of life.

The potential for automated vehicles to disrupt the economy and society is probably greater than any other mobility innovation since the motor car itself. The narrative on CAVs, as articulated by producers and industry groups, is that such is their greater efficiency in terms of matching the supply of mobility to demand that they have "the potential to increase the modal share of all mobility services at the expense of single-car usage" (UITP, 2017; 2019; see also Fagnant & Kockelman, 2014; 2015; Herrmann et al., 2018)). However, more and more

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academic research is outlining that the postulated mobility 'utopia' of automation is no more likely to come about than a 'dystopia' (see Lyons, 2018; 2020). This is because of the evident potential for extreme 'Uberisation'[1] (Dudley et al, 2017) of individuals' mobility choices made possible by the ubiquitous, on-demand availability of autonomous vehicles offering genuinely 'door-to-door' journey options. In other words, mass deployment of CAVs brings the potential to substantially increase the share of private motorised travel in the overall mobility mix, and the absolute quantum of vehicle traffic overall, because they provide the convenience and flexibility of a car journey without the need to own, drive or park the vehicle.

Detailed analysis of the supporting technologies or 'platforms' such as 'Mobility as a Service' (MaaS) that will facilitate the widespread introduction of CAVs is beyond the scope of this paper (although see van Dijck et al (2018) for a broad review of the impacts of 'the platform society' on public values, including some aspects relating to transport and mobility). Nonetheless, the roots of our argument can be found in the conditions of what might be termed 'hyper-choice' that such platforms facilitate by releasing the disruptive potential of new hardware technology, in our case CAVs. Although the radical expansion of available choices can at first appear a sign that the existing market is innovating, it can also be a sign that the market itself is (rapidly) restructuring in one or more fundamental ways. Such is the power of the combination of automated hardware technologies and global software platforms that they can "reconfigure choice in ways that go beyond and fundamentally challenge existing understandings of what choice is, who and what is involved in producing knowledge about choice, and what it means to be a 'chooser'" (Graham, 2018:1).

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[1] We take 'Uberisation' to mean not only the disruptive type of innovation and challenge to regulatory structures explored by Dudley et al, but also the wider commercialisation and commodification of mobility.

Although the promise of CAVs is often described by their promoters in terms of their *complementarity* to mass transit systems by offering a so-called 'final mile' solution to improve accessibility to and from stations, the radical reconfiguration of mobility choices open to individuals that they present generates potential externalities at two scales that could significantly impact on the functioning of the city (see Ceccato and Diana, 2021; Silvestri et al, 2021). The first is their potential to *replace* short walking, cycling or public transport trips directly (see Rayle et al, 2015; Mulley and Kronsall, 2018; Graeler et al 2019), which would change how mobility is expressed at the level of the individual, and undermine longstanding efforts to make mobility in the city more sustainable, and to promote public health through more active travel. The second is that modelling work has shown how CAVs have the potential to generate much *greater* levels of traffic and congestion across the city overall. For example, *The Oslo Study* (Ruter, 2019: 9) identified a worst-case scenario of a doubling in overall traffic volumes, "resulting in a complete traffic breakdown" if CAVs were deemed "more attractive than (travellers') current mode of transport". This is because the rational economic incentive for providers in the potential 'trillion dollar industry' (McKinsey & Co, 2018) of automated mobility services is *not* to reduce the number of trips made on the network for sustainability reasons, but rather to "address significant unmet lifestyle needs across a range of traveller types" (Wocartz and Schartau, 2015: 1), or in other words *maximise* the number (and arguably the length) of trips so as to capture the greatest amount of travellers' time, attention and therefore money as possible (see Docherty et al, 2018; Marsden & Reardon, 2018). The impacts of such an increase of mobility at the collective level would be profound, and quite different to the often assumed and promoted role of CAVs and supporting technological platforms such as MaaS in "providing more sustainable urban transportation" (Li, 2019: 229).

In short, as Pangbourne et al (2020) point out, it is by no means inevitable that automated mobility will in fact deliver the wider public policy objectives of improved socio-economic and environmental outcomes that its proponents claim.

Furthermore, given that the policy environment that shapes the regulatory context and therefore the overall structure of transport provision (in the developed world at least), has been designed for largely incremental change (Marsden and Docherty, 2013), the potential for governments to be overwhelmed by the pace of change is readily apparent (see Guerra, 2016; Legacy et al, 2019). Indeed, such is the depth, scale and pervasiveness of the potential changes arising from the alignment of traditional car companies and technology giants forming new trans-national forces with immense technical and commercial power in pursuit of the widespread adoption of automated mobility, that there are few areas of urban economic, social and cultural life that would not be transformed. Failing to approach this transition critically presents regulatory frameworks for mobility with a new level of challenge in both scale and scope (Hensher et al, 2020), and might even risk the same kind of 'strategic misrepresentation' about the real scale of benefits, costs and risks of profound (systemic) changes that Flyvberg (2008) identified as evident in much strategic planning practice.

Our starting point for the paper is therefore that a future urban mobility system based around CAVs/driverless cars[2] – has the potential to become substantially less 'public' than the status quo in many respects because, to return to Graham's problematization above, it will fundamentally alter "what is involved in producing knowledge about choice" in how we travel

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[2] In referring to CAVs we define these as driverless cars with passenger capacities of around 8 or less since it is this kind of 'private' vehicle (as opposed to, say an automated bus) that is referred to in the modelling analyses and other studies we cite.

around in cities because the availability of instant, on demand mobility will increase dramatically. We seek to build upon the work of Paget-Seekins and Tironi (2016), who introduced the notion of different dimensions of 'publicness' in mobility beyond the direct provision of public transport services in the context of Latin America. We build on their conceptual framework, adapting it to illuminate the different levels at which innovations in the mobility system can change public life. By 'public' we refer to three levels of 'publicness' that transport as an urban socio-technical system exhibits: *public regulation and ownership* of assets and services; the *public value* created in the wider economy through mobility; and its contribution to *civitas*, that is the social cohesion and shared set of values derived from citizenship in the urban community (see Blanes et al, 2015).

Methodology

The analysis contained in this paper emerged from the coming together of the authors in the course of our recent research on various aspects of what is more widely termed as 'smart mobility'. Each of us was collaborating with one or more of the others on interlinked research projects dealing with transition pathways to a future mobility system, and the role of new technologies including automation in this. As we progressed through various stages of this work, it became apparent that we had assembled a small network of active researchers with shared interests in exploring the impacts of new technologies on mobility and the governance challenges of managing this transition. These interests ranged from the capacity of institutions to enact effective regulation, via the role of public sector organisations in innovation processes to the implications for local democracy and social justice of changing attitudes to the governance of mobility. The common thread linking all of these interests was the extent to

which the adoption of automation and supporting technologies would change the 'publicness' of the mobility system, and by extension, the city itself.

Our paper can therefore be regarded as 'emergent' from the rich discussions sparked by sharing the insights and analysis generated across the range of inter-related research we were undertaking in order to understand the implications of new mobility technologies. This paper does not engage in a traditional attempt at finding a gap in the existing literature, nor reports a specific empirical study designed to address such a gap. Rather, its purpose is to respond to Sandberg and Alvesson's (2011:23) call to present new problematizations in order to "move beyond gap-spotting" and "promote more interesting and significant theories". In our case, this is the importance of 'publicness' in managing the potential implications of automated mobility on the economic- and social-spatial structure of the city and the lives of its citizens. We judge this important given the scale of the producer interests in automated mobility outlined above, and the requirement for a critical appraisal of the impacts on urban life of such an assemblage of technological and financial power implies. There is increasingly work appearing in the published literature on how the notion of publicness might help us understand the impacts on wider community wellbeing from other platform-based socio-technological innovations, ranging from evolving social media (Wei and Liu, 2020) to blockchain (Brekke, 2020). Given the scale of the potential changes to how the city functions that are made possible by the automation of mobility, we aim to make a contribution to the mobility governance debate by applying the publicness lens to this domain of urban social life such that policy makers and public alike are better informed about the scale of potential change, and its implications.

The remainder of the paper proceeds as follows. First, we set out the key dimensions of 'publicness', expanding on our three-level model introduced above. Next, we review some key documents that set out how CAVs could be rolled out in cities, and the scale of the potential opportunities and threats to established systems and practices in different areas of urban life affected by them. From this analysis, we suggest that publicness could be characterised as an 'iceberg' given that only certain aspects of it are currently visible in the political and public debate. Many crucial issues remain below the policy- and political waterline, despite their central importance to determining the outcomes that such systems deliver. We conclude with a review of some critical challenges facing policy makers charged with managing the introduction of automated mobility, including some relevant insights that might be gained from the experience of the COVID19 pandemic.

Dimensions of 'publicness'

In identifying and defining our meaning of 'publicness', we take as our starting point a summary model of the policy cycle (see Jann and Wegrich, 2006) as it applies to mobility. The model describes the task of governance as a continual process of decision making that adjusts to a set of socio-economic and political inputs that change constantly in response to (technological) innovation (Figure 1). This conceptualisation is consistent with many longstanding approaches to articulating what 'publicness' and the 'public interest' might be, perhaps most notably John Dewey's enduring (1927) book *The Public and Its Problems*. As Dewey set out, it is not possible to reduce the notion of publicness to either a set of institutions (the state), nor a group of people (the demos). Rather, the 'public', and the democratic processes that ensure an appropriate degree of 'publicness' in decision making, are processes underpinned by many interlocking issues that are of common concern.

Externalities (such as the pollution and congestion arising from traffic) and the creation of public goods (such as the accessibility afforded by the mobility system) are two examples of concepts that emerge as of societal importance using a 'publicness' lens. Publicness is therefore as much enacted in networks of social relationships across the population at large as it is from a set of formal and official institutions such as regulations.

<<Figure 1 here>>

We therefore define 'publicness' as the different manifestations of the public interest that governments and society at large deploy to manage these consequences and externalities at multiple scales. Some of these are highly visible in the day-to-day political debate on resource allocation; others are more hidden, and shape deeper socio-economic processes that work over the longer term, and are often one step removed from mainstream political debate on transport and mobility (see Vigar, 2002).

Publicness and the transport and mobility debate

In their work introducing the idea of different dimensions of 'publicness' to the transport debate, Paget-Seekins and Tironi (2016: 176) highlight that the term 'public' when used with respect to transport has multiple meanings. They identify "four publicness types – public space, public goods, public ownership, and public concern", which are designed to illuminate the many different dimensions of public interest in the provision of transport beyond collective modes such as buses and trains that are traditionally defined as 'public'. Their framework connotes the ideas of 'new economic democracy' underpinning the justification for direct government ownership and operation of public services (see Cumbers, 2020), the

sharing of a collective experience (you take public transport with other people), and an equalities dimension given that public transport is a space that "has the ability to strengthen (or weaken) social bonds" (page 177). Public concern can be described as the extent to which the public transport network makes it possible for citizens to share a collective and equal experience through accessibility to employment, services and social ties, mediated by the routes and corridors these systems use. The differential accessibility offered across the geography of the city and between social groups, particularly for those without access to a car, has long been a key concern of policy makers (see, for example, Stanley and Lucas, 2008; Mackett and Thoreau, 2015).

The rubric of Paget-Seekins and Tironi – which focuses on public ownership and control of assets, the shared or 'public' experience of the act of travelling, and the impact our mobility choices have on the nature and quality of public spaces and the nature of the city – also reflects the general evolution of the literature about 'public' transport over the last three or four decades, which has graduated from a first phase about the impacts of privatization and deregulation of services in the 1970s and 80s (Kay and Thompson, 1986), via concerns about the erosion of public spaces and the urban realm implied by private ownership and control (Punter, 1990), to more recent explorations about the lived experience of 'shared' assets such as ride hailing vehicles (Morency, 2007) that despite providing notionally 'public' services are in fact beyond public regulatory control, and the new biases in service provision that might occur as a result (Middleton and Zhao, 2019; Tjaden et al, 2018).

Given our research interests lie in the debate about the most appropriate political- and societal responses to the introduction and potential transition to a system (increasingly)

dominated by CAVs, the framework we adopt is different to that of Paget-Seekins and Tironi. Since our core concern focuses on how hyper-choice facilitated by automation might change the *outputs* of the mobility system such as accessibility, pollution and socio-economic structuring set out in Figure 1, our 'publicness' framework is constructed around the "key question" for public policy posed by Moulton (2009: 889), namely "to what extent can understanding dimensional publicness lend insight to understanding and managing for public outcomes?". In the next section therefore, we consider some short case studies of how the likely consequences of the transition to automated mobility will affect the 'publicness' of mobility, and what the policy responses to these changes might be.

The publicness 'iceberg'

Our model (Figure 2) defines three dimensions of publicness that can be ordered by the extent to which they are 'visible' in 'politics as usual' (see Wodak, 2009), but also by the scale of their implications for socio-economic practices over the long term. We conceptualize this model as an iceberg because it has long been understood that those charged with governing mobility generally only 'see' those 'above the waterline' issues that affect actual users' – and hence voters' – everyday lives, such as the cost and reliability of travelling, (see Wodak, op cit; Hanf and Sharpf, 1978, McConnell and t'Hart, 2019). More profound issues of how our mobility policy choices capture or constrain wider public value and, especially, how they restructure the nature of the experience of citizenship in the city, remain mostly hidden from view beneath the surface, yet they are vital to understanding the impacts of different potential strategies for the rollout of CAVs (see Moscholidou and Pangbourne, 2020). In this section, we review some of the key potential impacts of automated mobility at each of the three levels, focusing most on the fundamental yet hidden notions of *civitas* since, since this is the aspect

of publicness that has had least attention in the literature to date, and appears to us to be least visible in the wider discourse on mobility.

<<Figure 2 here>>

Ownership and regulation

The first of our dimensions of publicness – public ownership and regulation – is the everyday concern of transport agencies and governments around the world as they attempt to meet stated socio-economic and environmental goals for mobility and minimize its negative externalities. There is a vast literature about why governments might seek to intervene in the mobility market through regulation and direct ownership of transport assets (see, for example, Birch and Siemiatycki, 2016, Mees 2009), and it is not the purpose of this paper to review this. To summarize the salience of this issue for our argument however, we look to Lyons' (2018: 7) observation that much of the wider policy landscape for mobility is framed by "the *relative* strength of influence from public sector urban governance and political leadership". Thus the posture of the state on issues of ownership and regulation, or in essence the extent to which it is able and willing to intervene in the mobility market – is a crucial determining factor about how mobility choices and externalities are distributed. Whereas the state had been in retreat from such intervention in many places for decades, the unprecedented billions of dollars of state aid that have flowed to transport operators to keep services running during the COVID19 pandemic has opened up a space for renewed discussions about the optimal public/private ownership and regulatory models for transport (as for other aspects of the economy) in future (McCann and Vorley, 2021).

Even before the scale of the bailouts required to cope with the pandemic became apparent, regulatory concerns were prime amongst those new 'above the waterline' issues that policy makers have identified first, largely because the need to change legal frameworks to permit even the pilot introduction of CAVs is the most visible impediment to their arrival in most jurisdictions. The vast majority of the debate about the likely impacts of CAVs so far – that is to say the most visible part of the 'iceberg' apparent to policy makers – therefore concerns issues such as the law on road safety and crash liability to the framework for the taxation, licensing and allocation of road and curb space to automated vehicles (see Sørensen and Paulsson, 2020; Marsden et al, 2020). But for our problematization, the key regulatory concern is not about the conditions under which they will be licensed to operated, but rather about how growing automation and the eventual possible dominance of road-based CAVs could present a reconstituted phase of automobility (Dowling and Simpson, 2013), and an even greater competitive threat to established public transport networks such that their role, purpose and perhaps even viability is called into question (see Hensher, 2017; Stone et al, 2018). This challenge is especially acute in cities that are either smaller, have less well-developed public transport networks and/or less regulatory control over their networks (see Clewlow and Mistra, 2017; Young and Farber, 2019) where the potential for direct substitution of public transport by CAVs is most apparent.[3]

Even in larger cities with more comprehensive and established transit provision, the transition to a mobility system dominated by CAVs poses significant regulatory challenges. This is because most urban public transport systems depend on public revenue, and so even modest

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[3] Some American cities with minimal transit provision have already experimented with subcontracting 'public' transport to firms such as Uber on an experimental basis. See, for example, https://www.uber.com/cities/innisfil/partnership/

declines in ridership can make their continued support economically and/or politically challenging (see White, 2016). This is not only due to direct abstraction of passengers and their fare, but also because the extent to which politicians are prepared to continue with public transport support can reduce if it becomes seen as 'less important' in terms of its contribution to the overall mobility mix, especially in contexts such as many North American cities where transit's modal share is already low. In addition to these revenue finance considerations, the scale of capital investment required to construct the most 'successful' public transport modes (particularly urban light rail and metro) suggests that reduced future patronage, or even greater uncertainty in future demand models resulting from the potential for substitution by ride sharing, renders them difficult to justify under the appraisal frameworks commonly adopted (see Hickman and Dean, 2018).

Public Value

Our second domain of 'publicness' is that of *Public Value*. Here we adopt the definition of public value put forward by Bozeman (2007:17):

> "(1) the rights, benefits, and prerogatives to which citizens should (and should not) be entitled;
>
> (2) the obligations of citizens to society, the state, and one another;
>
> (3) the principles on which governments and policies should be based."

Whereas the ownership and regulation debate focuses mainly on issues of control and the allocation of resources (and surpluses) *within* the transport sector (particularly the extent to which the provision of services is regulated by public bodies and/or undertaken directly by

them (Bryson et al, 2014)), the public value domain is characterized by attempts to construct more holistic analyses of how governmental intervention reflects deeper socio-economic "beliefs, practices, traditions and dilemmas" (Boyte, 2012) that are negotiated democratically. The public value focus is therefore explicitly concerned with the broader strategic *outcomes* of government action – as we identify in our model of the policy cycle (see Figure 1) – especially the fair and equitable distribution of opportunities and the management and mitigation of negative externalities across society, rather than the raw political framing of whether the inputs and throughputs of the mobility system are controlled or delivered by public entities *per se*.

Crucial to conceptualising public value in the mobility system is the extent to which this system is either planned by the state on the basis of shared obligations and principles or organised according to the neo-liberal notion of 'choice', with individuals being incentivised to use the transport mode deemed most appropriate to the value of their journey within the wider market economy (see Gössling and Cohen, 2014). As we note in the introduction, perhaps the most potentially disruptive aspect of CAVs is the way in which the real-time matching of mobility supply to demand (Wong et al, 2018) represents a radical extension of the 'choice' approach to urban mobility that has come to dominate in the neo-liberal paradigm. Exercises such as *The Oslo Study* and the International Transport Forum's work on Lisbon that it draws upon (see ITF-CPB, 2017) show that, under the conditions of 'hyper-choice' implied by ubiquitous availability of CAVs, although individuals might enjoy almost unlimited on-demand travel choices, public value will be significantly eroded because the outcomes of the mobility system as a whole risks having many greater negative externalities, such as extreme

congestion and/or much higher carbon emissions (see Wadud et al, 2016; Anair et al, 2020; Brown, 2020).

Given the apparent attractiveness of CAVs as a futuristic, rhetorically 'green' extension of individual choice, it is perhaps not surprising that governments risk finding themselves being "forced into" (Legacy et al., 2018: 84) accommodating their introduction, or at the very least do so for the "fear of missing out" of the postulated benefits of new technology (Lajas and Macário, 2020). Renewed focus on public value faced with the challenges of 'hyper-choice' in mobility provision suggests that authorities should adopt a 'purposive' governance stance (see Smith et al, 2005; Dale et al, 2013) in order to first understand, then articulate to the electorate, and finally act upon the challenges automation presents for public value *proactively*, rather than solely reacting to political critique when things go wrong.

Such proactive approaches to dealing with policy challenges are far from easy; in the transport domain, public authorities have struggled to adopt them for decades in areas such as congestion relief, local air quality enhancement, spatial accessibility, and more recently, carbon emissions. But as Rauschmayer et al (2015) suggest, failing to define adequately what the terrain of collective public value might be in complex policy areas such as transport, where there are multiple actors and tradeoffs, risks focus on minutiae at the expense of taking those critical decisions that shape long term path dependencies and avoid market failures. One of the most remarkable aspects of the COVID19 pandemic for mobility so far is how it has brought the tensions between commercial interests and wider, more diffuse 'public' interests of what the transport system is 'for', and the kinds of public value it can create, into sharp focus. The need to reorientate the public transport network towards servicing the needs of

'key workers' and almost overnight relocating urban space from cars to pedestrians and cyclists in order to cope with the socio-economic dislocation of lockdown demonstrates how quickly our understanding of where public value lies can change.

What might a 'civic' shared and autonomous mobility future look like?

The notion that the transport system is fundamental to the nature, form and social experience of the city has been explored across many domains of the wider literature for decades, perhaps most famously in Jane Jacobs' enduring classic *The Death and Life of Great American Cities* (1961). She highlighted the impact of the transport choices made by governments not just on the physical form of cities, but also on the conditions for genuine social cohesion and the wider set of values derived from citizenship in the urban community and its neighbourhoods as the key locations where shared experiences take place. This shared experience of urban life, which we have termed *civitas* in our iceberg model of publicness, is about much more than the technical aspects of public regulation and ownership of assets and services or indeed broader public value concerns about generating economic surplus for redistribution and correcting market failures in mobility provision. Instead, it is about how the lived experience of the city mediated by the available mobility opportunities contributes to feelings of citizenship and the potential for social cohesion and solidarity across diverse and vulnerable populations (Sheller, 2018).

Such debates are seemingly far removed from the everyday transport politics of ticket prices and parking restrictions, but they are crucial to how individual travel choices and experiences (if, when and for whom there is a choice available) shape the collective experience of urban life, and thus how the city understands and reproduces itself. The limited debate thus far

about the implications of automated mobility for *civitas* is largely derived from that about the quality of urban places themselves (see Ewing and Cervero, 2019; McLeod and Curtis, 2019). City planners have increasingly embraced ideas of *placemaking* as central to the promotion of sustainable transport policies – especially increased rates of walking and cycling – as part of wider strategies to ensure urban redevelopment contributes to wellbeing derived from a distinctive 'sense of place' (Chan et al, 2021). Whilst the concept of 'transit oriented development' is not new, the idea that sensitive design of neighbourhoods around the transport infrastructure nodes that serve them, and hence the wider mobility choices it provides, has become increasingly important as planners have better understood the role of social interaction in wellbeing and the economic resilience of local communities over time (see Bonner, 2002; Heller and Adams, 2009). Indeed such concerns have been highlighted in work on the importance of high quality local places to support social interaction and wellbeing during the COVID19 pandemic (Ramkissoon, 2020).

The encouragement of the active modes as the preferred access mode for neighbourhood facilities such as local retailing and public transport hubs has become a mainstay of effective planning for a diverse range of placemaking objectives from minimizing the impacts of cars and traffic on the streetscape, to retaining discretionary spending in areas with high concentrations of locally owned businesses (see Pucher and Buehler, 2010). Yet if the responsiveness and availability of CAVs reaches the levels envisaged by their promoters, then many more people will be able to bypass these local places altogether in the course of satisfying their daily needs. The discretionary purchase at the local corner shop facilitated by the modal interchange between walking and the bus or tram will be replaced by one at a city centre or out-of-town store, or by home delivery. Urban sprawl is likely to increase (González-

González, et al, 2018), and the social cohesion and interaction sustained by planned and chance encounters between individuals at the station café or on the street will be diminished as a greater proportion of trips are made from home to final destination without any intermediate 'chaining' element where the moment of interchange provides opportunities to interact socially and economically beyond narrowly defined existing social networks.

The level of policy effort in recent years that has gone into improving the design of the public realm to support a pleasant walking and interchange experience reflects our increasing understanding about the benefits to general wellbeing that the *civitas* of shared enjoyment of authentic places built at the human scale as places of meeting and social exchange brings to individuals. This is because both time spent in quality public spaces and the use of the active modes are closely associated with improved physical and mental health. te Brommelstroet et al (2017) capture a large body of literature focused on the extent to which different transport modes are able to enhance wellbeing and socialisation using the concept of connectedness. They argue that travelling on public transport, compared to the private car, provides the opportunity to interact with people beyond the traveller's usual group thus offering the potential for positive interaction and reflection. They cite Epley and Schroeder's (2014) experiment to explain how passengers who engaged in conversations with others during their journey reported a higher sense of wellbeing, and, as for those that undertook the act of walking in the urban environment, the brief conversations experienced facilitated enhanced feelings of connection and trust with others. Given what we already know about the abstraction of short public transport, walking and cycling trips by existing ride sharing services (Circella et al., 2019), the potential for ubiquitous automated mobility to reduce the number of urban encounters between individuals such that the level of exchange in materials and

experiences that determine the richness of urban life is materially diminished (Liggett, 2003) is readily apparent. Thus, to return to Graham's commentary on new technological platforms from the introduction, ubiquitous, on demand automated vehicles will not only radically alter the mobility choices available to people in the city, but in so doing will also 'change the choosers'. How mobility structures daily life will alter fundamentally with automation, and by diverting the time, attention and spending of people away from the shared public places in which the origin and destination points of their trips are located, to the private, in-vehicle distractions of the door-to-door CAV experience, the choosers will change the form of the city fundamentally.

Conclusions

Our aim in this paper is to raise the attention of those involved in the transport policy debate about the enduring wider societal value of 'public' transport in the city, at a time when the policy landscape is increasingly dominated by the potential of automated mobility, especially the mass adoption of Connected and Autonomous Vehicles i.e. driverless cars. Our key contention is that there is no guarantee CAVs and their supporting technologies will make cities better; indeed they might become materially poorer places in which to live, with an eroded public realm and undermined notions of *civitas*. We constructed our 'publicness' framework around the "key question" for public policy posed by Moulton (2009: 889), namely "to what extent can understanding dimensional publicness lend insight to understanding and managing for public outcomes?", focusing on different levels of publicness which vary in their visibility in the day-to-day political debate (Wokan, 2009). We highlight the 'hyper-choice' of mobility options made possible by CAVs as the key innovation with the potential to disrupt the mobility system at multiple levels.

In presenting our analysis on how automated transport technologies might change cities, we do not seek to argue that the mobility status quo, nor all the aspects of publicness it represents, is somehow ideal. The very rapid reappraisal of the most appropriate priorities for, and patterns of provision of, transport during the pandemic has brought into sharp relief the contested nature of what exactly is 'publicness' in terms of *how,* to *what extent*, and *for whom* public value is delivered through the mobility system. Equally, not all domains of public value are equally threatened by the emergence and embedding of these technologies. The transition to a future mobility system in which CAVs play a central role will occur at different paces in different cities and regions, and their actual impacts on policy outcomes will depend on the extent to which local governing regimes are able to exert significant strategic capacity to be able to pull appropriate policy levers to act quickly enough to meet new imperatives as they emerge and evolve (see Konvitz, 2016).

Our central point in conceptualizing our problem statement via the iceberg model is therefore to encourage decision makers to take full account of the 'below the water line' implications of the choices they will make about how to incorporate CAVs in the urban mobility systems for which they are responsible. Such is the intensity of the general policy- and political debate on recurring everyday issues such as subsidy profiles, user charges and congestion that other longer-term considerations can become lost. Prime amongst these is how the implications of cumulative, discrete transport planning choices alters the collective experiences that underpin the life of the city – *civitas* – and therefore the extent to which citizens share a collective experience of the city thanks to the mobility opportunities open to them.

To date, citizens, *civitas* and the changing bargain between the state and the public has not been sufficiently visible in the debate over how automation will radically change urban mobility systems. This is because the debate has been one almost exclusively between government and producers of new mobility technologies and platforms, and in which the population is regarded as a pool of customers and users in a market rather than as citizens, with all the wider (collective) interests that the latter definition suggests (see Sørensen & Paulsson, 2020). Holding up the lens of 'publicness' to the current debate not only shows where it is falling short, but also shows how we are at present in a limited 'window of opportunity' (Reardon and Marsden, 2018) to shape and direct how the transition to smart mobility might be managed to deliver wider economic, environmental and societal goals. Experiences during the COVID19 pandemic have highlighted to some extent how notions of social cohesion and solidarity can become an important part of debate about how to (re)build socio-economic prosperity. But the flipside of this are the interests seeking to shape the debate around individualised mobility as a 'resilient response' to the pandemic which, if such an approach does become embedded, would point towards the more damaging outcomes towards the 'dystopian' end of the CAVs scenario spectrum. It therefore seems essential to plan both proactively for models of development which develop civitas, but also to plan to block those which threaten it.

We argue, therefore, that one clear lesson to be learned from our conceptualization is that failing to robustly interrogate the voice, influence and power of those commercial interests that stand to win big from a widespread transition to CAVs has potentially significant implications for public value, and places even greater obstacles in the path of efforts to shape urban transport systems to meet environmental and social equity objectives. If the pathway

to the automation of mobility is that commercial interests take an even greater stake in transport system design and operation, then it will not be possible to future proof the relationship between governments and citizens so that regulatory frameworks can adapt to protect us properly against future risks. Once again, the pandemic offers some early warning signs that this possibility is very real, given the swift exercise of power by many interest groups such as car manufacturers, motoring lobbies and the construction industry arguing that they are 'priority' sectors for rebuilding (Reardon et al, 2021). Given these same interests are at the heart of the automated mobility complex, we might expect these arguments to evolve and become more powerful still.

Thus, despite the rhetoric of those with most to gain from the widespread adoption of automated mobility, there is no guarantee that positive outcomes will be achieved for public value or for the solidarity of the city under conditions of hyper-choice and monetisation of time spent inside CAVs. Indeed, the benevolent operator/shareholder narrative being promulgated by the technology's promoters should sound an alarm given the potential 'trillion dollar industry' scale of automated mobility. As for any transition of this magnitude, good governance and appropriate, targeted policy interventions designed to actively align public and private interests will be required to capture the potential benefits and minimise the costs (Sørensen, and Paulsson, 2020). Not only are automated mobility technologies highly disruptive, but the scale and scope of their potential restructuring of the myriad urban processes that shape the city that depend on the mobility system is perhaps unprecedented in the modern era. The 'rules of the game' for how key social processes such as the labour market and the housing market work in practice, as well as the level of disparity in accessibility of employment and other social opportunities will be subject to radical change as automation

progresses. As for the transformation of the automobile itself, such profound restructuring of the physical and socio-economic fabric of the city requires active and transparent renegotiation across society if it is to be managed well. In reframing the public 'bargain' about how mobility is organized and distributed in our cities, policy makers should consider how the lens of 'publicness' can help clarify how shared and automated mobility can extend rather than diminish the range of opportunities and shared experiences that their citizens can benefit from.

Using the lens of 'publicness' opens new conceptual and empirical spaces to think about the future of transport and mobility, in particular for its governance. Keblowski and Bassens (2018) and Marsden and Reardon (2018) argued for a more critical approach to research into mobility governance, and bringing 'publicness' into clear view opens up a number of important questions for future research. These range from issues about the role of 'place' in shaping mobility futures given the global reach and scale of the companies driving technological innovation to how we facilitate public participation and explorations of the notion of mobility solidarity in a landscape shaped by rhetoric and 'promises' about what these technologies might deliver for our cities. We would argue that the lens of 'publicness' is an important – even essential – one to use in order to properly understand the cumulative impact of successive discrete policy decisions. How much influence over the *civitas* of lived experiences will governments have once automated services serve most people and the basis of their providers' share price and market power is dependent on actual ridership and revenue? Such questions really challenge the boundaries of the current urban mobility 'settlement' between public, providers and governments, and expose the extent to which the definition and utility of a 'public' transport system for cities of the future is uncertain.

How then to progress? One approach might be to try to surface more of the iceberg during the early learning phases of the adoption of automated mobility. In particular, we reiterate the call for greater consideration of governance arrangements in the research and demonstration programmes of early CAV demonstration projects that are funded and/or facilitated by government. It should be part of the bargain between citizen, state and mobility provider that increased value from changing patterns of mobility and our use of the public realm is matched by a requirement for greater collaborative planning throughout, and particular consideration of how agreed outcomes reflecting public value and civitas should be embedded in decision-making. The choices we make today about how we open up to these innovations in our cities will define policy paths for future generations, and ensuring we build in the importance of 'publicness' from the very start is essential.

Figures

Figure 1: a conceptual model of 'publicness' in mobility policy development
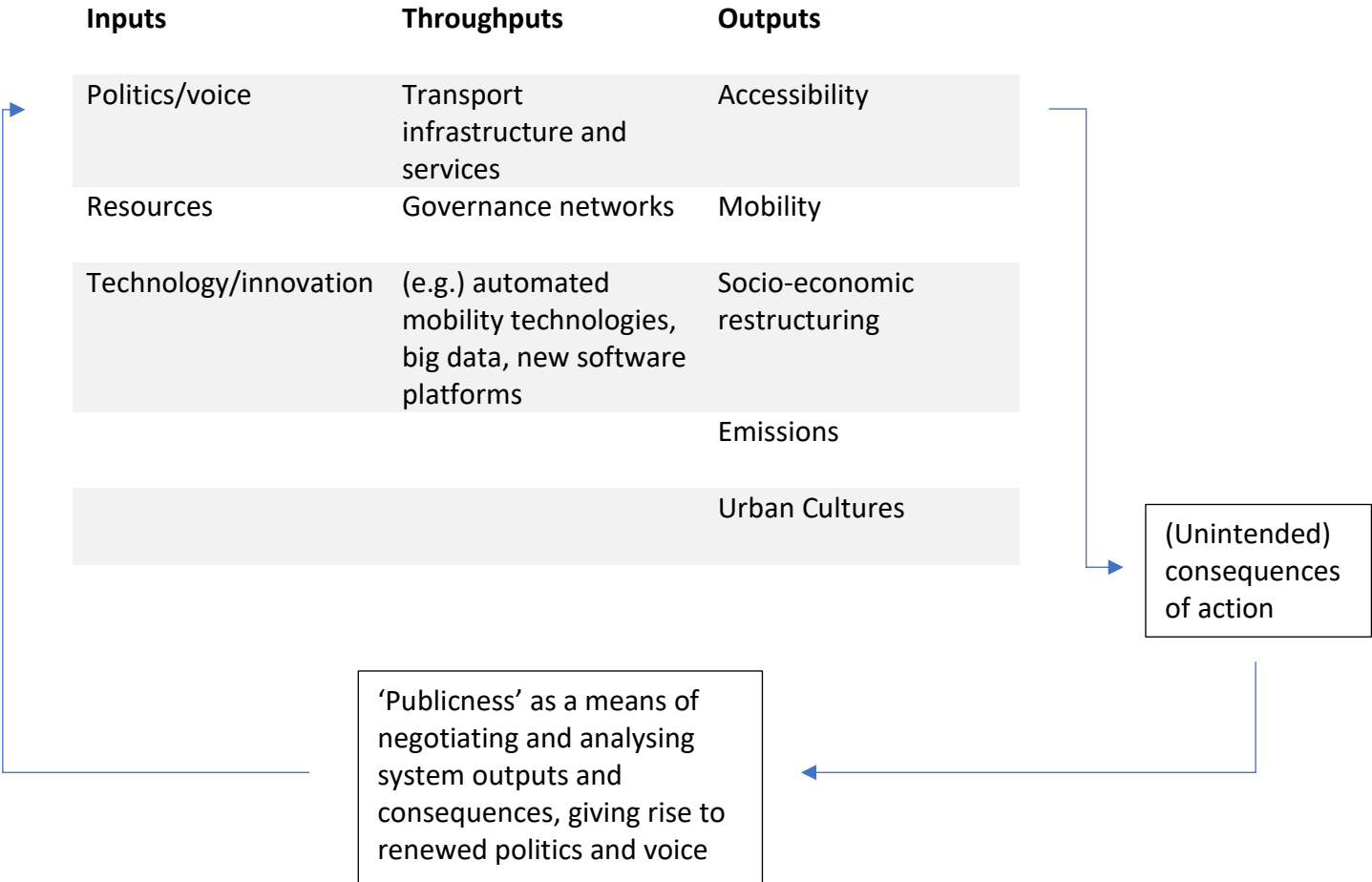
Inputs	Throughputs	Outputs
Politics/voice	Transport infrastructure and services	Accessibility
Resources	Governance networks	Mobility
Technology/innovation	(e.g.) automated mobility technologies, big data, new software platforms	Socio-economic restructuring
		Emissions
		Urban Cultures

(Unintended) consequences of action

'Publicness' as a means of negotiating and analysing system outputs and consequences, giving rise to renewed politics and voice
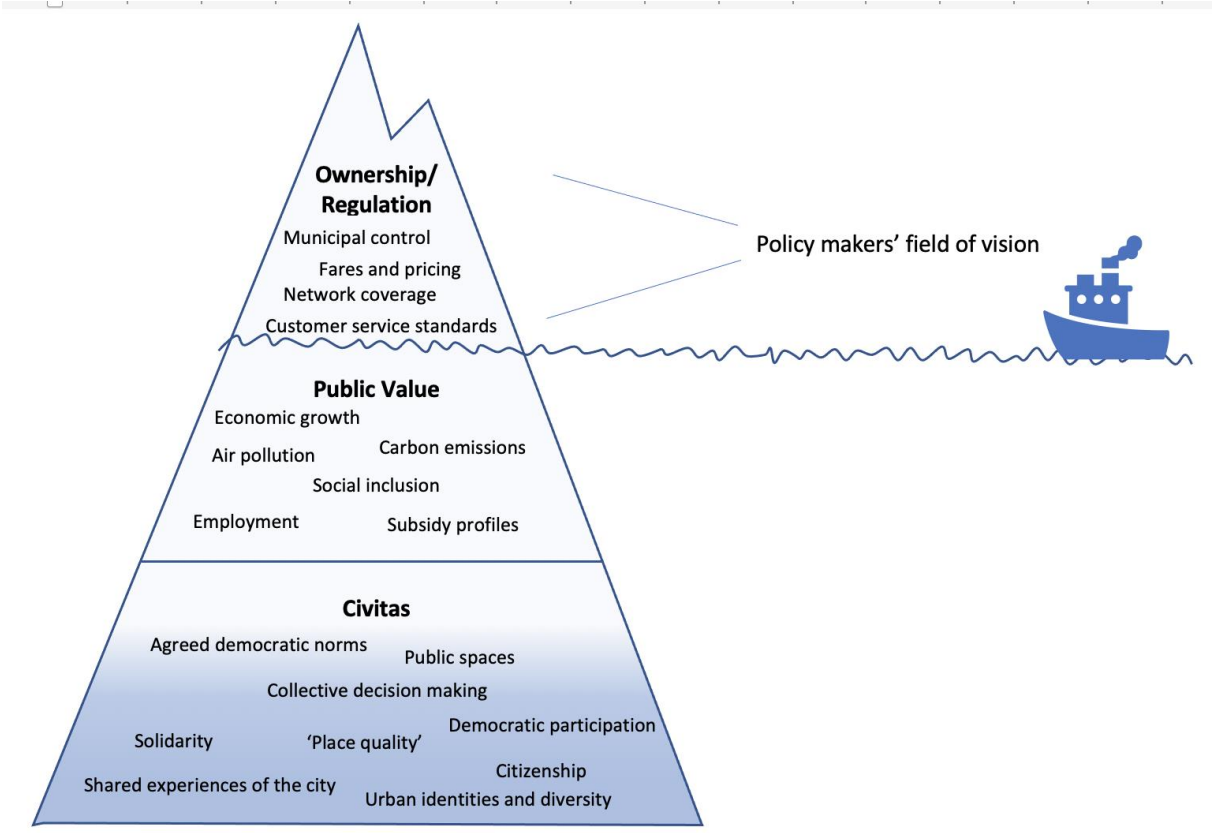
Figure 2: the publicness 'iceberg'

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