Autonomous vehicles and the future of urban tourism

Article *in* Annals of Tourism Research · January 2019

DOI: 10.1016/j.annals.2018.10.009

CITATIONS
0

READS
106

2 authors:

Scott Cohen
University of Surrey
66 PUBLICATIONS **1,596** CITATIONS
SEE PROFILE

Debbie Hopkins
University of Oxford
45 PUBLICATIONS **329** CITATIONS
SEE PROFILE

Please refer to the definitive version of this article when citing:

Cohen, S.A. & Hopkins, D. (2019). Autonomous vehicles and the future of urban tourism. *Annals of Tourism Research*, 74, 33-42.

Highlights:

- Connected and Autonomous Vehicles may have large impacts on the tourism sector.
- CAVs could reconfigure urban tourism including when, where and how tourists move.
- Imagining futures provides analyses of how CAVs may emerge in cities.
- Contextually sensitive urban analyses of CAV impacts and implications are required.

Autonomous vehicles and the future of urban tourism

ABSTRACT

Connected and autonomous vehicles (CAVs) have the potential to disrupt all industries tied to transport, including tourism. This conceptual paper breaks new ground by providing an in-depth imaginings approach to the potential future far-reaching implications of CAVs for urban tourism. Set against key debates in urban studies and urban tourism, we discuss the enchantments and apprehensions surrounding CAVs and how they may impact cities in terms of tourism transport mode use, spatial changes, tourism employment and the night-time visitor economy, leading to new socio-economic opportunities and a range of threats and inequities. We provide a concluding agenda that sets the foundation for a new research sub-field on CAVs and tourism, of relevance to urban planners, policymakers and the tourism industry.

Keywords: connected and autonomous vehicles, imaginings, urban tourism, shared mobility, autonomous taxis, urban night

INTRODUCTION

Connected and autonomous vehicles (CAVs) have the potential to dramatically change the way people live, work and travel in cities (Lu et al., 2017). Navigation of CAVs will be fully automated in their most advanced stage, making driver engagement with driving tasks obsolete, or illegal (Krueger et al., 2016). Nissan, Volvo and other incumbent vehicle manufacturers hope to have commercially-viable automated-driving capabilities in multiple car models by 2020 (Fagnant & Kockelman, 2015). New entrants to the motor industry – Google, Apple and Uber – also aim to develop a fully automated vehicle along a similar timeline (Hopkins & Schwanen, 2018a). Such timelines have contributed to a race to vehicle automation led by national governments as well as incumbents and new entrants (Hopkins & Schwanen, 2018b), and consequently, automation has come to dominate visions of future mobility. Allowing time for CAVs to become cost comparable to non-CAVs[1], regulation to catch up with technological capabilities, some degree of mass market penetration and growth

[1] Either for individual consumers in a private ownership model, or businesses, organisations and cooperatives in a shared ownership model.

in public acceptance, CAVs may be on the mass market as soon as 2025, first in parts of Asia, Europe and the US, and are somewhat optimistically forecasted by some to be the primary means of car transport globally by the 2040s (Fagnant & Kockelman, 2015; Kellerman, 2018). Under these assumptions – which are not guaranteed – all industries closely tied to transport will be gradually disrupted, and the tourism sector is no exception.

Given the potentially short timeline until CAVs enter the mass market, it is surprising that no research to date has considered in depth the potential future widespread implications of CAVs for the tourism industry. To the best of our knowledge, the only existing study of CAVs in tourism is Tussyadiah et al.'s (2017) examination of public attitudes towards the concept of 'self-driving taxis'. However, CAVs represent far more than 'self-driving taxis' and 'public perceptions'; they raise questions of, for instance, changes to urban form, and tourist experiences. More widely, as CAVs are still in the conceptual development phase, the majority of research on them is on technical and technological aspects, to the extent that social science literature constitutes just six percent of the total scientific literature on CAVs (Cavoli et al., 2017). This comparative lack of social science perspectives, alongside the rapid pace of CAV technological development, led Cavoli et al. (2017) to urgently call for more studies on their socio-behavioural implications, and to observe that few authors have examined CAVs in the context of urban planning.

Against this background, this conceptual paper seeks to break new ground in the social scientific study of tourism, by being the first to consider some of the potential far-reaching implications of CAVs for the tourism industry. Our focus is on urban mobility, primarily in the global north, in that we aim through conceptual discussion to bring out what we consider to be some of the most significant social and behavioural impacts that CAVs will have on urban tourism in developed nations. Urban environments are at the forefront of CAV innovation (e.g. Hopkins & Schwanen, 2019), and there is potential for the urban context to be gradually transformed because of CAVs (Lu et al., 2017), along with urban tourism. Set against key debates in urban studies and urban tourism, we imagine how CAVs may impact cities in terms of tourism transport mode use, spatial changes, tourism employment and the night-time visitor economy. The 'imaginings' approach, as the method for this paper, emerged from innovation and Science Technology and Society (STS) studies, and has been used widely for research on innovations that are not yet part of public cognition (Corn, 1986; Jasanoff & Kim, 2009).

Our discussion will not only be of interest to the academy, as its original ideas and concluding research agenda are likely to spark a new sub-field of empirical interest in tourism research, but the transformational potential of CAVs for urban tourism also means that planners, policy makers and the tourism industry will find this paper of immediate and ongoing relevance. As the following sections reveal, CAVs will lead to new socio-economic opportunities for urban tourism spaces, but will also present a range of threats and inequities that will demand the attention of industry and policy stakeholders.

AUTONOMOUS VEHICLES AND URBAN TOURISM

CAVs – also known as 'driverless', 'self-driving' or 'automated' vehicles - are often represented in industry, media and public discourse as inevitable, revolutionary, and broadly incontestable. Such technological determinist accounts are widely critiqued (e.g. Bissell, 2018), pointing to how such framings overstate efficiencies and often make claim to largely unsupported and wide-ranging benefits. CAVs do, however, present the potential to disrupt current practices of mobility, including "the spatial morphology of cities; the discipline and

control of vehicle occupants; the generation of public revenues through vehicle taxation; the livelihoods of currently employed drivers; the power geometries of access; and the viability of other modes of transport" (Bissell, 2018: p.57), with important implications for urban tourism.

Contemporary CAV innovation is the culmination of more than 80 years of automation processes in vehicles, beginning with automatic transmission systems, and recently continuing through the automation of navigation, lane keeping and parking (Kellerman, 2018). The process of automation is ongoing, with development aimed at moving, seemingly as quickly as possible, through the International Society of Automotive Engineers' (SAE) automation taxonomy for CAVs, which spans from no automation (SAE Level 0) through driver assistance, partial, conditional, high, and ultimately, full automation (SAE Level 5) (Heinrichs & Cyganski, 2015). This paper's discussion is largely contingent on reaching widespread deployment of SAE Level 5, fully automated vehicles. It is within, and perhaps *only if* this most advanced stage of automation is achieved, that the primary societal appeal and impacts of CAVs lay.

Yet CAVs are already emerging, by way of public trials, initially on clearly defined 'off-road', and increasingly 'on-road' routes – and tourists are likely to be some of the first to experience this innovation. Heathrow Airport, for example, has been a key partner in many CAV experiments in the UK, trialling 'pods on demand' at Terminal 5, which they claim reduce travel time from 27 to 4 minutes, and save on average 50,000 tons of carbon (WestfieldAVs, 2018, https://westfieldavs.com/): time and carbon savings are two primary justifications for CAV development and implementation more broadly, as discussed below. CAVs are now being proposed as autonomous shuttles for travellers to aircrafts at Gatwick Airport. There are further plans to expand the application of CAV pods in tourist settings, with propositions to implement a trial in England's Lake District national park framed as a 'sustainable transport solution' to help overcome congestion and pollution (Mogg, 2018). Thus, tourists appear to be a key demographic exposed to CAV innovation in the short-term, aimed to overcome unsustainable practices, and to make use of controlled airport environments, with relatively consistent routes, rhythms and flows of people.

The enchantment of CAVs

A number of enchantments underpin the often-utopic visions of automated urban futures. These enchantments include technological solutionism to urban crises (e.g. air pollution, congestion), economic development and creating innovative storylines of urban governance (e.g. Hopkins & Schwanen, 2019). The proposed benefits of CAVs, elaborated below, help to justify and legitimate public funding of research and demonstration, with these benefits contingent not only on the degree of automation (e.g. SAE Level 1-5), but also on behavioural and governance questions that include: ownership models (e.g. shared versus private), the share of CAVs versus non-CAVs on the road, power train technologies, and the regulations, policies, technologies and algorithms governing and guiding CAV use. Despite uncertainty in how the future will unfold in terms of the timing and nature of development, adoption and governance, the appeal of widespread deployment of fully automated vehicles is based on a number of key proposed benefits.

First, discourses of safety are central to the promotion of an automated mobility future. CAVs are argued to potentially eliminate up to 90 percent of traffic accidents, by reducing driver error (Bonnefon et al., 2016). This is significant in tourism contexts, particularly where new driving rules, driving direction (e.g. left/right), unfamiliar environments and tiredness from travel can all contribute to collisions involving tourists. Second, it has been suggested that

congestion may be reduced, due to fewer accidents, but also because fewer CAVs would be required to meet mobility demands as compared to human-driven cars (Kellerman, 2018). This claim is strongly dependent on dominant ownership models, and would require a far greater proportion of shared versus privately owned CAVs to be achieved, which we discuss further below. Traffic flows may be optimised due to automated vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communication, albeit Fagnant and Kockelman (2015) suggest congestion benefits will be less in cities as the complexities of city-driving are harder to address than those of motorways and other high-speed roads.

Third, CAVs hold the promise of improving accessibility for non-drivers, who may for instance be elderly, disabled or children (Cavoli et al., 2017), and thus it has been argued that CAV innovation offers social justice benefits to urban mobility. While CAV emergence is likely to be in cities of the global north initially, it is worth noting that, like drone technologies, CAVs could be viewed as a leapfrogging technology for cities of the global south, especially where there are lower rates of driver licencing (Kellerman, 2018). Yet, this increased social access to automobility may compromise some congestion savings. Fourth, CAVs may allow for environmental benefits, particularly in terms of saving fuel and lowering emissions, through improved driver behaviour – eliminating practices such as harsh breaking in favour of so-called 'eco-driving', as discussed further in the next section. Finally, it has been proposed that travel time would become more 'useful', as passenger compartments will be transformed to allow former-drivers to, for example, safely eat, read and watch movies (Fagnant & Kockelman, 2015), or perhaps to safely sightsee unencumbered by the task of driving. Nevertheless, despite these *enchantments*, CAVs are also critiqued in a number of ways, which are important to discuss before turning our focus towards the implications of CAVs for urban tourism.

Apprehensions surrounding CAVs

Despite substantial enthusiasm by governments and industry sectors, most of whom have a substantial stake in CAV development, CAVs are also the subject of many concerns. First, by making travel time 'more useful', CAVs hold the potential to create induced demand, increasing the amount of time people spend travelling by car. With time in cars taking on higher utility value, individuals may be willing to travel farther distances, for commuting, other daily trips, business and/or leisure travel, which could, for instance, "encourage individuals to shift their home locations to more remote locations, to enjoy lower land prices (and thereby bigger homes)" (Bansal et al., 2016, p. 2). This could result in greater urban sprawl and further increase car dependency (Cavoli et al., 2017; Legacy et al., 2018) – perhaps resulting in tourists favouring private vehicles over coach tours, decreasing demand for public transport modes, and shifting preference for hotel locations – or even changing tourists' relationships with *static* hotels.

Second, as part of the wider "upcoming trend of robots and information technologies replacing human workers" (Kellerman, 2018, p. 134), CAVs also threaten significant future job losses for professional drivers. Taxi, bus and coach drivers, and any travel company that relies on human drivers, stand to be affected, though the transition away from professional human drivers is likely to be gradual and in stages. This is already reflected by Uber's piloting of CAVs in Pittsburgh since 2016, wherein customers may be randomly paired with a CAV with an employee in the driving seat who supervises, with the aim of being fully autonomous by 2021 (Tussyadiah et al., 2017). Such claims, however, vastly understate the driver's role – the tasks, and identities that are assumed in the role. For instance, London taxi

drivers offer distinct and unique local knowledge that tourists may struggle to gain from other sources.

Third, considerable doubt remains as to the CAV business models that will be advanced by industry, preferred by publics and encouraged by governments. Many proposed benefits of CAVs – lowering traffic congestion, energy use and emissions, and increasing access – depends on a dominant business model in which CAVs are primarily shared, rather than privately owned. Fagnant and Kockelman (2015, p. 167) point to "[c]omplementary trends in shared rides and vehicles [that] may lead us from vehicles as an owned product to an on-demand service", and suggest one shared CAV could replace around ten privately owned vehicles, longer trips excluded. Shared CAVs (SCAVs) would make CAV travel affordable and provide wider socio-economic access (Cavoli et al., 2017), and may be most appealing for tourists – particularly in terms of destination mobilities. Ride sharing could be incentivised by cheaper fares, as is presently so with uberPOOL in some American cities, and will especially appeal to budget-conscious travellers, whether that be city residents or segments of the urban visitor economy. However, users of SCAVs may be forced to spend time with strangers in a confined space (Krueger et al., 2016), a situation characterised by both variance in cultural willingness to do so, and in differing social expectations depending on the number of strangers present: Kauppila (2017) for instance suggests that sitting with one stranger in a SCAV may be viewed as unacceptable due to an expectation to talk, whereas with two or more strangers this expectation is reduced. But such interactions with 'locals' may be appealing to some tourists.

Fourth, claims of environmental benefits from CAV innovation are contingent on shared ownership models and electric propulsion, however, some electric vehicles have higher cradle-to-grave emissions than internal combustion engine vehicles, with the emission reduction potential of electric vehicles dependent on production processes and fuels for electrification (European Climate Foundation, 2017). There is a greater likelihood of electric *urban* mobility, while for long-distance trips, petrol and diesel fuels may prevail (Cavoli et al., 2017). There is furthermore a risk that CAVs could erode train use for intercity travel, thereby reducing their environmental benefits. Governments must play a role in encouraging SCAVs, though this will largely be against the interests of car manufacturers, and thus strong opposition by automotive lobby groups could be expected (Gössling et al., 2016).

Fifth, concerns surrounding ethical, security and privacy issues in CAV development and use have been identified and are gaining increasing attention (e.g. Taeihagh & Min Lim, 2018). The most notable ethical conundrum in CAV development is whether they should be programmed to protect their passengers above all, or sacrifice passengers for a greater good (c.f. Bonnefon et al., 2016): potential CAV consumers have been shown to approve of CAVs for others that are set as utilitarian, or the greater good, but prefer to ride in ones themselves that prioritise passenger safety above all. CAVs may also threaten the security of those outside them. While the recent death of a pedestrian in the US, who was struck by an experimental Uber CAV, gained widespread media attention (T.S., 2018), there is also the potential for terrorism facilitated by CAVs, which will likely be able to travel unoccupied into crowded urban attraction areas.

Finally, data privacy while travelling in CAVs is an emerging issue, especially for business travellers who may access sensitive information on devices connected to its Wi-Fi. Vehicle travel data may also be used to inform targeted advertising, which may prove disconcerting to consumers (Fagnant & Kockelman, 2015). Indeed, the commercial applications of CAV travel data extend to tourism, where not just marketing, but even the commercialisation of CAV routes in the urban environment may be affected, as discussed further below.

Method and approach

This paper's research approach is centred on '*imagining'* urban tourism futures as they intersect with socio-technical innovations. As a concept and method, imaginings have been used in a variety of contexts to "articulate feasible futures*"* (Jasanoff & Kim, 2009, p. 123). To date, however, there has been only limited application of imaginings in tourism studies, and even less so intersecting critical analyses of tourism with socio-technical futures. The focus of tourism studies has been on where imaginaries originate, how they circulate, and the impacts. For instance, Salazar (2012, p. 863) shows how a critical analysis of imaginaries can help to uncover the existence and power of "ideological, political, and sociocultural stereotypes and clichés" in international tourism studies.

Yet imaginings can offer ways of thinking about both enchantments and apprehensions of socio-technical innovations, such as CAVs. Jasanoff and Kim (2009, p. 123) articulate how:

> …imaginaries are instrumental and futuristic: they project visions of what is good, desirable and worth attaining… imaginaries also warn against risks or hazards that might accompany innovation if it is pushed too hard or too fast. In activating collective consciousness, imaginaries help create the political will or public resolve to attain them.

This underscores the power and performativities of imaginaries: who constructs them, how they diffuse (or not) and their spatial and temporal dimensions are all of critical importance.

In this paper, we provide imaginings of urban tourism futures, which tie specifically to the emergence of CAV innovations. We do so by drawing from the established urbanism and innovation scholarship in which imaginings are seen as a tool for exposing heterogeneous, often-unintended and multi-directional urban futures (Bina et al., 2017). Imagining has two key values for our purpose; first, it foregrounds how urban space(s) are socially and discursively constructed, as well as the material-built environment, which allows us to press further into urban futures, to uncover heterogeneous meanings and experiences. Second, it opens space for speculations, and critical engagement with the unknown.

While some imagining literature draws from science fiction or discourse analyses to expose avenues for investigation (e.g. Collie, 2011), such an approach is problematic, if not impractical, for CAVs and urban tourism due to the early stage of development of technologies, but more importantly, the early stage of thinking about the implications of CAVs for urban tourism. We focus on key debates in urbanism and urban tourism, to uncover how CAV innovation may contribute to stasis and change across interconnected parts of the urban tourism system. In doing so, this paper develops analysis of the interconnections between people, places, infrastructures and policies that make, and are made by, the urban. To create the imaginings, we bring into conversation the various assumptions and visions of CAV innovations, with literatures on critical urban tourism and contemporary debates in urban studies. From these three bodies of work together, dominant themes arose that provide imaginings of CAVs and urban tourism, and around which the paper is structured.

An obvious limitation to this approach is its reliance on two authors and their collective knowledge and interpretations, however as this paper is designed to provide a launchpad to more detailed, place-specific and context-sensitive analyses, which may include future-forecasting/ backcasting approaches, it offers sufficient depth of detail and intersections across the various literatures to serve its purpose. Moreover, given the inherent limitations to

future-focused research (e.g. ability to imagine the future), it offers an approach that may be developed in further tourism research debates.

Urban studies and urban tourism

Our thinking in this paper does not relate to a specific city or country. And while we do acknowledge the limitations of such an approach, our aim is to be provocative; to stimulate greater engagement with the topic of CAVs – and other socio-technical innovations and (urban) tourism. With this goal in mind, we reflect on the urban as a site of/for analysis, but urge future work to provide context-specific analyses that may help uncover new and alternative ways of thinking about CAVs for urban tourism, with localised socio-cultural and built environmental specificities.

There are different ways that key issues in urban studies (and their implications for urban tourism) can be ascertained. Authors can start from either tourism studies, or urban studies. For the former, this might involve examining tourism literatures for reviews of urban tourism and agenda setting papers (e.g. Ashworth & Page, 2011; Edwards et al., 2008). While for the latter it could involve analyses of current issues in urban studies, and critical reflection on these topics for urban tourism and CAVs. The latter approach has been adopted in this paper. This is because this offers the most up-to-date thinking, space for considering wide-ranging implications, and acknowledges the subjectivity of claims of 'key concerns' as constructed by the authors.

We identify five key concerns in urban scholarship, particularly relating to transport, mobilities and tourism, as including: 1) regimes that enable and constrain everyday urban mobility practices (Pierce & Lowhon, 2018); 2) transformations of urban space including processes of gentrification (Grube-Cavers & Patterson, 2015); 3) sustainability agendas and urban sustainable development (Dempsey et al., 2011); 4) city-regions and conceptualisations of (degrees of) urban-*ness*; and 5) urban innovation and experimentation (Karvonen & van Heur, 2014). Clearly this list is not comprehensive, but depicts the variety of topics with which urban scholars are grappling. While social science research on urban environments often focuses on the everyday, there are important and lasting intersections with tourism and tourists. For instance, gentrification, urban regeneration and tourism often go hand-in-hand. Gotham (2005, p. 1099) speaks of processes of 'tourism gentrification', where middle-class neighbourhoods are transformed into "relatively affluent and exclusive enclave(s) marked by a proliferation of corporate entertainment and tourism flows". Within such enclaves – and beyond – tourists often 'play the role of the local' (Fuller & Michel, 2014), performing practices include taking the Underground in London, or walking across the famous zebra crossing outside Shinjuku station in Tokyo: doing what (urban, affluent) 'locals' do.

Yet the wants, needs, patterns, flows and practices of residents and visitors are not always alike – they can be jarringly divergent – or result in competition for the same resources (e.g. property) leading to discontent and hostilities (Pinkster & Boterman, 2017). Airbnb exemplifies this, where offering tourists the opportunity to 'live as locals do' has contributed to heated property markets becoming inaccessible for locals. The infrastructures, policies, planning and regulation of urban governance may not always suit both groups, and more tangibly can lead to tensions, negative stereotyping and resistance to tourism development (e.g. Colomb & Novy, 2016). Such dualisms (resident versus visitor) may not be useful, as it is likely that many people will take on both roles often simultaneously, however for the purpose of thinking through the novelty of CAVs and their implications for urban tourism, the

relationalities between heterogeneous groups of tourists and residents may be a productive pathway forward.

Transport infrastructures are often designed with (particular groups of) locals' needs in mind. Tourists consequently often co-opt existing infrastructures for their own needs. When (semi)publicly funded infrastructures are designed for tourists, this can sit uneasily, particularly, for instance, after almost a decade of post-global financial crisis austerity politics dominating public sector decision making, with important impacts at the local scale. Yet transport – and its various modalities including trains, buses, taxis, hire-cars, cycling, walking – also offers opportunities for different types of encounters (Boterman & Musterd, 2016). For instance, travelling by train on Amtrak in the US might afford different encounters than air or car travel. Each offers distinct opportunities to meet 'locals'. Yet not all modalities are equally available to all groups. Notions of perceived safety, security, risk and freedom are likely to underpin the types of travel decision-making for tourists. In some cities, for instance, public transport may be perceived 'unsafe', resulting in private vehicle use.

Shaw's (2014) work on the urban night offers another important intersection with urban tourism and the potentialities of CAV innovations. He shines light on the heterogeneity of the night-time economy, beyond the traditional focus on bars, pubs and clubs – topics which have been a significant focus of tourism studies of the night (e.g. Jayne et al., 2012). With a focus on night-time taxi drivers and street cleaners, Shaw (2014) shows how taxis are a central component of urban mobilities (e.g. Cooper et al., 2010), assembling "the bodies required to generate atmosphere" (Shaw, 2014: 91; Anderson, 2009). The intersections of thinking on the night-time economy, tourism and mobilities may offer alternative conceptualisations of how CAVs may be implemented – as they are often visualised in a daytime context – and which may present new affordances in the urban night.

This sketch of urban-scale issues helps to contextualise our thinking on how, where, when and why CAV innovations may intersect with urban tourism. We now use this as a conceptual base on which to develop four overarching but intersecting imaginings. The first is situated broadly around themes of CAVs in urban tourism; second, transformations of urban space; third, autonomous taxis, sightseeing and tourism employment; and fourth, hospitality and the urban night.

CAVS in urban tourism

Most of the existing literature on potential CAV use in cities is concerned with commuting and other daily – and day-time – urban mobilities (Kellerman, 2018). Yet all types of vehicle transport involved in urban tourism will be affected by the potential transition to automation. This ranges from airport shuttles and transfers, through city taxis, car hire and vehicle-based guided urban sightseeing. CAVs are anticipated to provide 'last-mile solutions' that may facilitate multi-modality (Krueger et al., 2016), and thus may play an important role in moving urban tourists between, for instance, a train station and their accommodation. By (partially) eliminating the driver, the cost of such transport could be significantly lower, however initially it is likely that the novelty, and potential other benefits of CAVs could place a price-premium on CAV mobilities. The present trialling of CAVs in airport settings offers free transport to tourists, whilst testing the technology in a relatively constrained and controlled environment, and exposing (wealthy, travelling) publics to the innovation. Nevertheless, CAVs may help overcome international tourists' perceived barriers to hiring a car in a foreign environment. The risk of jet lag, fatigue, misunderstanding new driving rules, and cultures of mobility could be minimised. This would be significant in countries such as

New Zealand, where fatalities involving foreign tourists as drivers have recently received significant press attention, with fatigue from long-haul air travel and differing road-rules used to explain the collisions (Macdonald, 2017). Moreover, if, as Anderson et al. (2014) propose, CAV manufacturers take responsibility for insurance and liability of CAVs, this offers further benefits for overseas tourists.

These changes may, however, have undesirable and unintended effects on urban tourism destinations. Examples could be the reconfiguration of airport transfers with automated driving systems for taxis and vehicle-based guided sightseeing, which we expand on further below. These are opportunities where encounters between tourists and 'local' drivers could have occurred, and those encounters may instead be replaced with advertising. It is not immediately clear how losing such encounters might affect the quality of tourist experiences, but this does warrant further consideration. It is likely however, at least early on in the societal CAV adoption process, that experiencing a CAV through urban tourism will be an attraction in its own right (Kellerman, 2018), especially among younger generations eager to try out new things (Tussyadiah et al. 2017). This could result in fleets of urban CAVs designed specifically for tourists' needs – which are likely to differ from the needs of local communities – and which could exacerbate urban transport inequalities, particularly if investments in tourism-related CAVs are at the expense of services for local residents.

Higher levels of CAV hire by urban tourists may also negatively impact city planner efforts to encourage visitor public transport use, resulting in 'overtourism' taking the form of hordes of small CAVs congesting urban tourism spaces – as seen today with taxis, mini-buses and coaches. CAV developers and entrepreneurs are now exploring low-occupancy CAV concepts, considered 'rightsizing', as average vehicle occupancy in the US, and cities across the global north, is less than two persons (Greenblatt & Saxena, 2015). Yet in a scenario with private CAVs, average vehicle occupancy could be reduced to less than one person, with so-called 'zombie cars' travelling autonomously – and empty - around urban roads as they return to 'depot' or perform other tasks. Moreover, with little suggesting vehicle preferences will change substantially with the introduction of CAVs, urban residents and tourists are likely to continue to prefer larger vehicles due to perceptions of safety, prestige and increased comfort, especially in intercity travel. Should CAVs replace traditional coach-tours, major urban attractions can anticipate congestion as ten or more CAVs may equal the capacity of one conventional tour bus. CAV use in urban tourism may, therefore, prove an exception to expectations that CAVs will lead to reduced congestion and better traffic flows (Kellerman, 2018). This must be an important consideration of regulating and planning for urban CAV futures.

Transforming urban space

The desired aesthetics of urban spaces for tourists vary substantially (Gispodini, 2001), however it is broadly accepted that the concrete jungles of roading infrastructure and car parks are unappealing for residents and visitors alike (ibid). Yet, remarkably, parking occupies one third of the central city real estate in some large cities (Henderson & Spencer, 2016). Urban public sector actors – particularly civil servants and elected officials – are increasingly confronted with the juxtaposition of public funds from parking, and the desire for liveable urban centres with more green spaces and less vehicles. Parking-related policy has been used in some contexts to both restrict and encourage the adoption of car-sharing schemes (Kent & Dowling, 2016). CAVs may reconfigure urban space, and the design of urban space, by forcing a rethink on the provision of urban-centre parking facilities. CAV innovation could

bring this about by reducing: a) the number of parked vehicles (and hence the spaces required) and b) the space needed for parking them, as those parking will do so closely together in a depot, which some have suggested will require just one quarter of the space in a conventional parking lot (Alessandrini et al., 2015). Similarly, connectivity may offer real-time information on parking, to reduce time spent looking for parking – a function that would also benefit traditional vehicles.

Under a high SCAV-use scenario, an impressive reduction in urban land used for parking could be assumed, with the potential to increase the liveability of cities – assuming the space is used for civic rather than economic purposes (Cavoli et al., 2017). And while the assumptions of shared mobilities present a range of formidable challenges – to overcome entrenched cultures of private ownership – such thinking offers opportunities to imagine what optimal urban environments might look like, who might benefit, and how it could be achieved. What if parking lots and roadside parking could be transformed into city parks, event spaces and bike lanes? The socio-cultural benefits of such a transformation in urban form, coupled with supportive political, social and cultural contexts could be limitless. Likewise, envisioning urban environments without the need for extensive vehicle parking might include opportunities for hotels to add rooms or develop spaces in other ways, such as for events (Henderson & Spencer, 2016), and reconfiguring urban tourism attractions with CAVs drop-off and pick-up spaces rather than car-parks.

In contrast, a future in which CAVs are predominately privately owned suggests personal CAVs would, if not parking in depots, be running home empty after dropping off passengers, before picking them up later, and hence perpetuating congestion and increasing emissions. Moreover, the network of shared mobility requires further attention, with implications for urban form, as SCAVs will still need to be serviced, charged, cleaned and stood waiting at quiet times. Where this will happen and who will live next to these spaces are important yet still unanswered questions in urban planning. The likelihood of replicating existing patterns of inequality is high – if strong governance of the introduction of any shared mobility system is not provided by public sector actors in coalition with local community organisations. Urban design and planning processes need to think deeply about the question of urban space in a CAV future, with an eye on who may benefit from such transformation, and who will not.

Personalised CAV urban sightseeing may also exacerbate existing and create new economic inequities, as based on how they are bundled as ‘products’ and routed within cities. CAV sightseeing bundles may be themed in ways not previously possible before due to distances between attractions. This will induce changes in the spatiotemporal flows of urban tourists, and their trip configuration, and eventually transform urban spaces so as to extend city tourism beyond the urban core. The itineraries are likely to be affected by algorithms that give preferential treatment to sites that pay for service – which could benefit large multi-nationals, and neglect local businesses in the short term – and may result in backlash as some tourists seek ‘authentic’ local experiences. The spatial routing of tours may therefore be commercialised to the extent that CAVs will hide certain aspects of the urban environment from tourists, blacking their view. As an example, souvenir shops paying for inclusion within the algorithms may enjoy streams of visitors. Although there are similarities to the long-standing practice of tour guides gaining commissions from bringing in tourists to particular shops, what differs is that competitive advantage will instead be gained through algorithmic favouritism. This phenomenon may not only be limited to shopping, but also affect the constitution of urban attractions themselves, wherein those attractions favoured through the algorithms affecting CAV city tours may gradually become authenticated as ‘must see attractions’ (Cohen & Cohen, 2012; Lugosi, 2016).

The impact of CAVs on urban tourism extends beyond intra-urban travel, as city-to-city travel will also be significantly affected, mainly in terms of transport mode, destination choice, distances covered, travel frequency and preferred accommodation. This could transform urban space by reimagining routes, entry-points and exits, by rethinking what constitutes accommodation, and how destinations are understood. For instance, a shift in transport mode away from both intercity trains and short-haul aviation is likely, as CAVs reduce the burden of train stations and airports. The current trend towards low-cost airlines entering long-haul routes is therefore likely to continue, as low-cost airlines will eventually face increasing competition in short-haul routes from CAV travel. City-to-city coach travel is also likely to be out-competed by SCAVs running at least in part on traditional fuels. SCAVs will furthermore signal a forthcoming end to the private hire of human-driven coaches, including coach travel between cities for events, whether that be student fieldtrips, concerts or sporting events. Traditional itinerary-based multi-city coach tours will likewise have to compete with CAVs, whether individualised or shared, though the latter may still have a human guide. Individualised CAVs for city-to city tourism travel may not be always be small, as already evidenced by Volkswagen's plans to build autonomous campervans (Smith, 2017).

New urban tourism destinations may emerge as CAVs rise in popularity, whether this be specific attractions that were previously hard to access within existing city destinations, or new secondary cities emerging as stronger competitors for visitors due to newfound transport connectivity. These mobilities may generate new conceptualisations of what constitutes the 'central business district', or indeed 'central' and 'peripheral'. By making car travel less strenuous, CAVs will affect the distance, frequency, flows, and experiences of intercity travel: longer distances may be covered by car and shorter intercity trips, especially during weekends, may become more frequent (Kellerman, 2018). City-to-city travel times can also be expected to become more reliable by car, as CAVs can reduce vehicle spacing by 'platooning' (vehicles following closely to each other in the slipstream), and couple this with near-constant velocities (Fagnant & Kockelman, 2015). Whereas for some this will increase the attractiveness of longer-distance CAV travel, it may enforce a speed and route incongruous with tourism desires, and thereby be rejected by others who opt for the scenic route. There may therefore be a concurrent rise of intercity tourist travel wherein more emphasis is given to scenic aspects of the connecting journey, rather than just the cities themselves, with consequent pressures for instance on scenic highways.

Autonomous taxis, sightseeing and tourism employment

The introduction of driverless taxis has received perhaps some of the most attention across all applications of this innovation. This may be because it is anticipated that SCAVs in the form of autonomous taxis are likely to gain rapid early market share (Greenblatt & Saxena, 2015). Cities are expected to have 24/7 transport options, and taxis are an important part of this system – particularly for tourists for whom the environment is unfamiliar. Globally, cities have grown in relatively consistent ways, so much so that taxis are a relatively simple transport mode to use even with language and cultural barriers. In an automated mobility future, cities can be expected to have 24/7 on-demand CAVs, shared or private, which are effectively real-time car rentals on a per-minute or per-mile basis, ordered using mobile devices (Fagnant & Kockelman, 2015). Autonomous taxi fares are likely to be lower in part by not needing to pay drivers, which account for more than half the fare. These savings could replace conventional taxis at current CAV technology costs, and even lower fares. Once CAV costs fall, conventional taxis may be unable to compete (Greenblatt & Saxena, 2015), unless they are able to make a clear case for the additional services provided beyond transport (e.g.

tour guiding). Already companies such as Uber and Lyft are putting pressure on traditional taxi operators both in terms of platforms and costs, and the emergence of CAVs could further stress an already fragile sector.

Yet autonomous taxis will not be problem-free, as already demonstrated by Ge, Knittel, MacKenzie and Zoepf (2016) who used data on 1,500 rides with Uber and Lyft in Seattle and Boston in the US, finding female passengers were taken on longer, more expensive rides than males, and that African American passengers waited longer and were twice as likely to have their trip cancelled. Social, ethnic and gender biases evidenced within ride-hailing technologies are thus in danger of being reproduced in the context of shared autonomous taxis. Nonetheless, Tussyadiah et al.'s (2017) study of autonomous taxis found a higher level of public intention to use 'self-driving taxis' as tourists than as residents; they conclude this indicates that autonomous taxis will have a major impact on tourism – however the direction and shape of these impacts are not yet clear.

Vehicle-based guided urban sightseeing will be affected in a number of ways through automation. City bus tours, including the hop-on hop-off variety, will at a minimum replace drivers with stewards or guides. This will especially be the case in the medium-term as human driver re-engagement remains important while CAV technology becomes more reliable (Cavoli et al., 2017). It is possible, however, that intra-city bus tours will in due course become obsolete and replaced by individual CAVs. Vehicular city sightseeing may thus become personalised and on-demand. This would have benefits such as increasing accessibility for disabled travellers, and CAVs may therefore play an important future role in accessible tourism, which is not only important to mobility rights and sustainability within cities, but is also a significant economic market (Darcy et al., 2010). Destination management organisations may consequently also look to support a transition to CAV city tours.

City walking tours may join bus tours in the switch to small CAVs. However, as CAVs are likely to make both urban walking and walking tours safer by reducing pedestrian car accidents, these modes may eventually gain more participants. CAV use in crowded tourist areas, where there may already be high volumes of distracted pedestrians, could generate further tensions with local residents and amplify perceptions of overtourism. Thus, while it is difficult to predict whether CAV city tours will erode walking tours, and potentially cause further knock-on effects in tour guide employment or residents' perceptions of tourism, what is foreseeable is that proximity, the main factor in the design of city walking tours, will become less important, as the sequence of sites visited will matter less when covered by CAV.

Hospitality and the hedonic urban night

It has been claimed that urban studies, and academic research more broadly, suffers from *nyctalopia* – in that it "tends to overlook what happens when night falls" (van Liempt et al., 2015, p.407) – and the same is true of conceptualisations of futures of automated mobilities, including tourism mobilities. The focus of attention to date has been on the day-time/day-light use of CAVs – whether private or shared. In the urban night, van Liempt et al. (2015, p.408) suggest that "a variety of practices and emotions gain traction within a particular space–time which generate a special atmosphere associated with particular activities, experiences and possibilities". Shaw (2014) reminds us that the night-time economy is more than the "criminal acts, a rendezvous for lovers, nonconventional behaviours, or organizing rebellion", as noted by Williams (2008, p.518) – and that it is much more than an economy, with unique and distinct atmospheres, sensations and feelings. Yet a focus on the urban night offers the

opportunity to examine the intersection of CAV innovation and wide ranging, night-time tourist experiences.

The deployment of CAVs in cities will affect hotels, events, restaurants and bars in ways not yet meaningfully considered by the tourism, hospitality and events industries, or the academy. Tourism in the urban night is intricately connected to the hospitality industry. At the same time, violent crime and antisocial behaviour often take place in areas of busy nightlife (e.g. Bromley and Nelson, 2002), thus the intersection of automated mobility and the urban night demands systematic and place-specific analyses. This might include questions of how prostitution, and sex more generally, in moving CAVs, becomes a growing phenomenon. For instance, 'hotels-by-the-hour' are likely to be replaced by CAVs, and this will have implications for urban tourism, as sex plays a central role in many tourism experiences (e.g. Carr, 2016). While SCAVs will likely be monitored to deter passengers having sex or using drugs in them, and to prevent violence, such surveillance may be rapidly overcome, disabled or removed. Moreover, personal CAVs will likely be immune from such surveillance. Such private CAVs may also be put to commercial use, as it is just a small leap to imagine Amsterdam's Red Light District 'on the move'.

Cities may also encounter increases in attendance at events, as attendees may travel by CAV without the need to access traditional public transport, or park – with far reaching positive and negative implications. Restaurants may find themselves in competition with CAVs that become moving restaurants, or combine urban sightseeing with dining – as exist today with dinner cruises. Evening CAV city tours may in this sense become more popular, and be combined with increases in alcohol consumption, as drunk-driving will no longer be an issue when riding in a CAV. City visitors might also therefore drink more at bars and restaurants, but additionally may spread drinking out more geographically. Stag and hen dos may become spread out, as opposed to concentrated in particular bar districts, and reliant on CAVs to move drunken revellers across greater distances between drinks in the urban night, perhaps even crossing multiple cities.

Claims have been made that hotel location will become less significant in guest selection criteria (Bainbridge, 2018) as it will no longer be as important that hotels are located by public transport, other hotels, or other types of facilities such as bars or restaurants, which will in many cases be easily reached through CAV travel. Such claims appear to overlook the heterogeneous urban mobilities and tourist experiences that make up urban tourism. Urban visitor accommodation will be affected however by CAVs in other ways. Many hotels, as in the US for example, are adjacent to motorways that link cities. Widespread use of CAVs may affect travel patterns so that passengers decide to sleep in their car, while it takes them onwards to their final destination, rather than overnight in these hotels (Henderson & Spencer, 2016). CAVs as 'moving motels' would affect both business and leisure travellers in this respect and would not just be limited to autonomous campervans. Thus the present day night-time motorways, highways and autobahns, occupied predominantly by heavy-goods-vehicles moving goods across the country, may become filled by slow-moving CAVs with sleeping occupants.

CONCLUSION

There are many uncertainties about the emergence and diffusion of CAVs across the world. If, how, where, when and at what pace CAVs emerge, and their potential implications for far-reaching industries, sectors, practices and infrastructures, are contingent on a range of assumptions. In this paper, we have imagined what a limited set of futures of urban tourism

might look, sound and feel like with different configurations of CAV innovations (e.g. private versus shared). Our discussion was framed by key areas of research in urban studies relating to mobility rights regimes, gentrification, sustainability, (re)conceptualisations of 'cores' and 'peripheries', and urban innovation and experimentation, and centred primarily on how CAVs can be expected to impact cities in relation to tourism transport mode use, spatial changes, tourism employment and the night-time (visitor) economy. Each of these areas rendered a number of key social and behavioural issues that not only form areas of inquiry for further research, but should also demand the immediate and ongoing attention of urban planners, policy makers and the tourism industry.

The paper therefore contributes a foundation and starting point for a new empirical sub-field in tourism research, centred on CAV innovations and the tourism system, which will help structure the formation of knowledge in this area through empirical studies in the years that follow. This sub-field may build upon, and relate to, growing bodies of work focusing on urban automation and robotics more broadly, to consider the wide-ranging ways that robotics and automation may intersect with tourism studies (e.g. robotic servers, hosts, entertainers). To facilitate this further, we now provide a concluding research agenda that hopefully will inspire scholars to take the study of CAVs and tourism forward empirically in a range of directions. This paper's imaginings has revealed a number of domains likely to be most affected by the introduction of CAVs, which may help to structure future more fine-grained analyses, namely around the changing nature of taxis, car hire, bus and coach sightseeing, the routing of city tours, parking and mobile hotels and restaurants.

Our analysis has thrown light on questions relating to how tourism studies conceptualises mobility and immobility – for instance by way of tourism infrastructure(s) including accommodation. The dominant static notion of accommodation as a mooring – a point of stability – will be reconfigured by CAV innovations, which may enable a proliferation of 'moving hotels'. Such night-time movements are not overly radical; night trains and buses have been a popular, and often low-cost mode of travel/accommodation, mostly for budget travellers. However, CAVs could offer *personalised, private* travel, or high-end luxury mobile accommodation. This could change the dynamics of night-time roading, a time often used for repairs and by long-haul trucking companies, as roads becomes inundated with sleeping pods. For tourists short-on-time, this could maximise opportunities to see multiple sites, and travel overnight – much akin to cruise tours – and potentially with many of the same issues emerging. Such innovation pushes tourism scholars to rethink traditional framings of mobilities and moorings, of flows and rhythms, for which mobilities scholarship may be particularly helpful.

Reconceptualising the night-time also intersects with considerations of mobilities in the urban night, and the ways through which CAVs might afford new types of activities, practices, interactions and socialities, whilst preventing others. Future research might seek to better understand informal interactions between tourists and 'locals', and use innovative approaches to consider how these might be extended or reduced, or reconfigured in new directions in a CAV future. SCAVs may develop so as to cater only to locals, only to tourists or possibly to both, thereby creating opportunities for interaction. This intersects with considerations of tourism work and workers – and how social interactions may change as a result not only of CAV innovation but wider propositions of robotic work including in care and hospitalities.

This paper only discussed intercity travel briefly, yet it is in this context, and in rural travel more generally, where affective attachment to driving itself, as an embodied and integral part of travel experiences, may present a barrier to CAV adoption. Among some drivers there are strong attachments to driving, due to affective, sensory and symbolic dimensions (Sheller,

2004), and links to personal identities, which will be difficult for CAV technologies to unseat. Further research will be needed on how non-rational attachments to driving for leisure and tourism purposes may stand in the way of CAV use in tourism.

A range of issues relating to governing CAVs in relation to tourism also require further exploration. To date, such thinking has been limited to everyday – and day-time – mobilities. Tourism and leisure users have, however, been some of the first to experience automated vehicle technologies. Future thinking needs to diversify into the broader suite of (potential) users, and temporalities. Moreover, urban planners will need an understanding of who may benefit from the transformation of urban space resulting from high CAV adoption, and who is likely to suffer mobility injustices as a result – CAVs undoubtedly have the potential to replicate, perpetuate and potentially extend current inequalities. They will also need research that informs policies on how to safeguard urban attractions from the use of CAVs for terror attacks. Governance will likely be required to protect CAV users' travel data from misuse for commercial purposes, and to regulate the algorithms that will underlie personalised CAV urban sightseeing, so the routes do not fall prey too heavily towards commercial interests, and create stark economic inequities between attractions and businesses that can and cannot afford to pay to be part of the routes.

We also call for future work that provides context-specific analyses that may reveal alternative ways of thinking about CAVs for urban tourism. As Kellerman (2018, p. 116) observes, '[t]he pace of AV adoption may not only differ individually among people, but it may further differ among countries', and we would take this further to suggest there will also be highly differentiated paces of adoption within and across cities. CAVs will emerge in and impact certain cities earlier than others, and while the effects will initially be centred largely within the global north, there will be differential impacts across space and time in cities globally. Moreover, critical social science analysis is required to unpack the potential for CAV innovation and its dominant technological solutionist, neoliberal discourse to distract from other, arguably more pressing concerns, such as decarbonising mobilities (including but not exclusively tourism-related), urban inequalities and social justice. Whether or not CAVs become dominant in urban spaces is, as yet, unclear. And if they do, the configurations of CAVs and non-CAVs, of ownership styles and of fuels are also uncertain. However these very uncertainties offer timely, interesting and important opportunities for scholars to reconceptualise the urban in tourism studies, and to delve into the inner workings of urban life and urban tourism to contribute to discourses of urban futures.

REFERENCES

Alessandrini, A., Campagna, A., Site, P.D., Filippi, F., Persia, L. (2015). Automated vehicles and the rethinking of mobility and cities. Transportation Research Procedia, 5, 145-160.

Anderson, B. (2009). Affective atmospheres. Emotion, Space and Society, 2(2), 77–81.

Anderson, J.M., Kalra, N., Stanley, K.D., Sorenson, P., Samaras, C., Oluwatola, O.A. (2014). Autonomous vehicle technology: A guide for policymakers. RAND Corporation. https://www.rand.org/content/dam/rand/pubs/research_reports/RR400/RR443-2/RAND_RR443-2.pdf, Accessed 19/6/2018.

Ashworth, G., Page, S.J. (2011). Urban tourism research: Recent progress and current paradoxes, Tourism Management, 32(1), 1-15.

Bainbridge, A. (2018). Autonomous vehicles & auto-tours. The Spontaneous Travel Company. http://www.destinationcto.com/docs/AutoTour.pdf, Accessed 30/72018.

Bansal, P., Kockelman, K.M., Singh, A. (2016). Assessing public opinions of and interest in new vehicle technologies: An Austin perspective. Transportation Research Part C, 67, 1-14.

Bina, O., Mateus, S., Pereira, L., Caffa, A. (2017). The future imagined: Exploring fiction as a means of reflecting on today's Grand Societal Challenges and tomorrow's options. Futures 86, 166-184.

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

Bonnefon, J.F., Shariff, A., Rahwan, I. (2016). The social dilemma of autonomous vehicles. Science, 352(6293), 1573-1576.

Boterman, W.R., Musterd, S. (2016). Cocooning urban life: Exposure to diversity in neighbourhoods, workplaces and transport. Cities, 59, 139-147.

Bromley, R.D., Nelson, A.L. (2002). Alcohol-related crime and disorder across urban space and time: Evidence from a British city. Geoforum, 33(2), 239–254.

Carr, N. (2016). Sex in tourism: Reflections and potential research directions. Tourism Recreation Research, 41(2), 188-198.

Cavoli, C., Phillips, B., Cohen, T., Jones, P. (2017). Social and behavioural questions associated with automated vehicles: A literature review. UCL Transport Institute. https://www.ucl.ac.uk/transport-institute/pdfs/social-and-behavioural-literature-review.pdf, Accessed 11/6/2018.

Cohen, E., Cohen, S.A. (2012). Authentication: Hot and cool. Annals of Tourism Research, 39(3), 1295-1314.

Collie, N. (2011). Cities of the imagination: Science fiction, urban space and community engagement in urban planning Futures, 43(4), 424-431.

Colomb, C., Novy, J. (2016). Protest and Resistance in the Tourist City. London: Routledge.

Cooper, J., Murray, R., Nelson, J. (2010). Taxi! Urban Economies and the Social and Transport Impacts of the Taxicab. Farnham: Ashgate.

Corn, J. J. (1986). Imagining Tomorrow: History, Technology and the American Future. Cambridge, MA: MIT Press.

Darcy, S., Cameron, B., Pegg, S. (2010). Accessible tourism and sustainability: A discussion and case study. Journal of Sustainable Tourism, 18(4), 515-537.

Dempsey, N., Bramley, G., Power, S., Brown, C. (2011). The social dimension of sustainable development: Defining urban social sustainability. Sustainable Development, 19(5), 289-300.

Edwards, D., Griffin, T., Hayllar, B. (2008). Urban tourism research: Developing an agenda. Annals of Tourism Research, 35(4), 1032-1052.

European Climate Foundation (2017). From cradle to grave: emobility and the French mobility transition. https://europeanclimate.org/wp-content/uploads/2018/01/Electric_vehicles_ENG_AW_WEB.pdf, Accessed 26/7/2018.

Fagnant, D.J., Kockelman, K. (2015). Preparing a nation for autonomous vehicles: opportunities, barriers and policy recommendations. Transportation Research Part A, 77, 167-181.

Fuller, H., Michel, B. (2014). Stop being a tourist! New dynamics of urban tourism in Berlin-Kreuzberg, International Journal of Urban and Regional Research, 38(4), 1304-1318.

Ge, Y., Knittel, C.R., MacKenzie, D., Zoepf, S. (2016). Racial and gender discrimination in transportation network companies. Nber Working Paper Series. National Bureau of Economic Research, Cambridge MA. Available: http://www.nber.org/papers/w22776.pdf

Gospodini, A. (2001). Urban design, urban space morphology, urban tourism: An emerging new paradigm concerning their relationship. European Planning Studies, 9(7), 925-943.

Gössling, S., Cohen, S.A. & Hares, A. (2016). Inside the black box: EU policy officers' perspectives on transport and climate change mitigation. Journal of Transport Geography, 57, 83-93.

Gotham, K.F. (2005). Tourism gentrification: The case of New Orleans' Vieux Carre (French Quarter). Urban Studies, 42(7), 1099-1121.

Greenblatt, J.B., Saxena, S. (2015). Autonomous taxis could greatly reduce greenhouse-gas emissions of US light-duty vehicles. Nature Climate Change, 5, 860-863.

Grube-Cavers, A., Patterson, Z. (2014). Urban rapid rail transit and gentrification in Canadian urban centres: A survival analysis approach. Urban Studies, 52(1), 178-194.

Hayward, M. (2018). Air taxi trials possible in six years as tech company trials flying vehicle in Canterbury. stuff. http://www.stuff.co.nz/technology/102203642/Air-taxi-trials-possible-in-six-years-as-tech-company-trials-flying-vehicle-in-Canterbury, Accessed 21/6/2018.

Heinrichs, D., Cyganski, R. (2015). Automated driving: How it could enter our cities and how this might affect our mobility decisions. disP - The Planning Review, 51(2), 4-79.

Henderson, J., Spencer, J. (2016). Autonomous vehicles and commercial real estate. Cornell Real Estate Review, 14(1), 44-55.

Hopkins, D., Schwanen, T. (2018a). Automated mobility transitions: governing processes in the UK. Sustainability, 10, 956.

Hopkins, D., Schwanen, T. (2018b). Governing the race to automation. In Marsden & Reardon [Eds]. Governance of Smart Mobility, Bingley: Emerald.

Hopkins, D., Schwanen, T. (2019). Experimentation with vehicle automation. In Jenkins & Hopkins [Eds.] Transitions in energy efficiency and demand: The emergence, diffusion and impact of low-carbon innovation. Abingdon: Routledge.

Jasanoff, S., Kim, S-H. (2009). Containing the atom: Sociotechnical imaginaries and nuclear power in the United States and South Korea, Minerva, 47(2), 119-146.

Jayne, M., Gibson, C., Waitt, G., Valentine, G. (2012). Drunken mobilities: backpackers, alcohol, 'doing place'. Tourist Studies, 12(3), 211–231.

Karvonen, A., van Heur, B. (2014). Urban laboratories: Experiments in reworking cities. International Journal of Urban and Regional Research, 38(2), 379-392.

Kauppila, J. (2017). Is shared mobility the answer to congestion, emission and access issues? Transport Knowledge Conference, New Zealand Ministry of Transport, 27 November.

Kellerman, A. (2018). Automated and autonomous spatial mobilities. Cheltenham: Edward Elgar.

Kent, J.L., Dowling, R. (2016). "Over 1000 Cars and No Garage": How Urban Planning Supports Car(Park) Sharing. Urban Policy and Research, 34(3), 256-268.

Krueger, R., Rashidi, T.H., Rose, J.M. (2016). Preferences for shared autonomous vehicles. Transportation Research Part C, 69, 343-355.

Legacy, C., Ashmore, D., Scheurer, J., Stone, J., Curtis, C. (2018). Planning the driverless city. Transport Reviews, DOI: 10.1080/01441647.2018.1466835

Lu, Z., Du, R., Dunham-Jones, E., Park, H., Crittenden, J. (2017). Data-enabled public preferences inform integration of autonomous vehicles with transit-oriented development in Atlanta. Cities, 63, 118-127.

Lugosi, P. (2016). Socio-technical authentication. Annals of Tourism Research, 58, 100-113.

Macdonald, B. (2017). The truth about tourist drivers. The Spin-off, 28 December 2017. https://thespinoff.co.nz/society/28-12-2017/the-truth-about-tourist-drivers/, Accessed 10/8/2018.

Maitland, R. (2008). Conviviality and everyday life: The appeal of new areas of London for visitors, International Journal of Tourism Research, 10(1), 15–25.

Mogg, T. (2018). Driverless pods could be used to ferry tourists around a U.K. national park. Digital Trends: Energing Technologies. https://www.digitaltrends.com/cool-tech/driverless-pods-lake-district/, Accessed 26/7/2018.

Pierce, J., Lawhon, M. (2018). The right to move: Informal use rights in urban practices of mobility. Urban Geography, 39(5), 667-686.

Pinkster, F.M., Boterman, W.R. (2017). When the spell is broken: Gentrification, urban tourism and privileged discontent in the Amsterdam canal district. Cultural Geographies, 24(3), 457-472.

Salazar, N.B. (2012). Tourism imaginaries: A conceptual approach. Annals of Tourism Research, 39(2), 863-882.

Shaw, R. (2014). Beyond night-time economy: Affective atmospheres of the urban night. Geoforum, 51, 87-95.

Sheller, M. (2004). Automotive emotions: Feeling the car. Theory, Culture & Society, 21(4-5), 221-245.

Smith, L.J. (2017). Volkswagen transform classic camper van into awesome driverless vehicle that SMILES at you. https://www.express.co.uk/life-style/cars/752059/Volkswagen-ID-Buzz-concept-camper-van-autonomous-electric, Accessed 26/6/2018.

Taeihagh, A., Min Lim, H.S. (2018). Governing autonomous vehicles: emerging responses for safety, liability, privacy, cybersecurity and industry risks, Transport Reviews. DOI: 10.1080/01441647.2018.1494640

T.S. (2018). Why Uber's self-driving car killed a pedestrian. The Economist. https://www.economist.com/the-economist-explains/2018/05/29/why-ubers-self-driving-car-killed-a-pedestrian, Accessed 18/6/2018.

Tussyadiah, I., Zach, F.J., Wang, J. (2017). Attitudes towards autonomous on demand mobility system: the case of self-driving taxi. In Schegg, R. & Stangl, B. (Eds.), Information & Communication Technologies in Tourism. Springer.

van Liempt, I., van Aslst, I., Schwanen, T. (2015). Introduction: Geographies of the urban night. Urban Studies, 52(3), 407-421.

Williams, R.W. (2008). Night spaces: Darkness, deterritorialization, and social control. Space and Culture, 11(4), 514–532.