Planning the Driverless Train Station

A political economy perspective on the governance of the autonomous vehicle transition

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Executive Summary

The disruption posed by autonomous vehicle (AV) technology has been the catalyst for marked uncertainty. It is therefore important for planners to be prepared to navigate this unfolding transition. This report has been prepared to assist Transport for Victoria to undertake planning for the smart mobility transition. Lending particular attention to the effects of AVs on train stations, this report provides a roadmap to steer towards a more certain future.

The report is presented in three sections. Part One explores the potentials and pitfalls of AV technology by unpacking the impacts around safety, congestion, land uses, accessibility, and environment. This event is the most significant disruption in the modern Victorian transport planning system, and a disruption of such magnitude carries with it significant uncertainty for planners working in the transport space. The report encourages Transport for Victoria to utilise the scenarios developed by Infrastructure Victoria (IV) (2018) to provide some scope for what the future might look like. It examines some evidence for the trajectory that Victoria is following, given the recent disruptive emergence of the ridesharing service Uber. The autonomous future we navigate towards is dependent on the vision of the developers of the technology, thus decision making power will be increasingly the role of public-private partnerships. The state government should prepare to engage with the private sector in order to set the policy context for the smart mobility transition.

Part Two highlights the Transport Integration Act (TIA) (2010), the legislative tool that provides the means by which transport institutions in Victoria are intended to coordinate their duties. Uncertainty will bring with it the need for planners to understand and guide the governance processes under which the deployment of AVs will occur. However, in practice these institutions are not operating as a coordinated front. It is critical that Transport for Victoria follow the clear policy objectives set out in the TIA, and train station design outcomes should be developed as part of a whole-of-government approach over the fragmented coordination in which it currently occurs. Recent transport megaprojects that have been delivered by the private sector in Victoria have faced public scrutiny as a result of poor engagement on behalf of social and environmental needs.

Having recognised the ineffectiveness of the TIA in guiding the AV transition, Part Three adopts the Transition Management framework as a tool to understand what actions could be taken by the State to realise an integrated and sustainable AV future. This lens unpacks the strategic, tactical, operational, and reflexive actions currently being taken by government, whilst offering guidance towards actions which could be taken.

Although this analysis considers the broader transport system within Victoria, particular attention is paid to the usefulness of this framework in understanding the impacts of AVs on train stations.

Transport for Victoria is in a position to guide policy making through the automobility transition in a way that offers a responsible and integrated approach. It should assume its role as the coordinating actor of the public transport sector and articulate a singular, clear vision for how to steer the deployment of autonomous vehicles. The following section unpacks the positive and negative impacts of AVs and adopts a political-economy framing through which the governance of the AV transition is analysed.

Part One: An Introduction to AVs

The Potentials and Pitfalls of AVs

The emergence of AVs is undoubtedly going to bring a suite of changes to urban mobility. Much of the rhetoric surrounding AVs suggests that these changes are likely to be positive. Yet, this discourse can at times appear forcefully optimistic, and it is important to explore the possible negative externalities which may arise from AVs (Hopkins & Schwanen 2018, 80). The following section will attempt to unpack the potential benefits and negatives of AV technology.

Safety

As autonomous vehicles reach Level 3 automation and above, it is likely that the number of traffic accidents and fatalities on roads will significantly decline (Fagnant & Kockelman 2015; McKinsey 2016). With human error contributing to more than 90 per cent of crashes, removing the human-factor from operating a vehicle means that AV technology has the potential to dramatically reduce the road toll and frequency of accidents (RACV 2018). The positive externalities of this is likely to extend beyond the user of the vehicle, and to also result in a marked reduction in accidents occurring between vehicles and other road users, such as cyclists and pedestrians (Anderson et al. 2016, 16). However, an "over-trusting" of technology may lead to increased risk taking behaviour amongst vehicle operators (for example drivers perceiving seatbelts as no longer necessary) and other road users (for example pedestrians becoming less cautious around vehicles) (Millard-Ball 2016).

Congestion

Reducing accidents is further likely to contribute towards easing traffic congestion. Whilst 50 per cent of all congestion can be attributed to recurrent delays – congestion that occurs at the same time in the same place on a regular basis (e.g. peak hour) - accidents account for 25 per cent of other delays on roads (Federal Highway Administration 2017).

By substantially cutting the frequency of accidents AVs could make a significant dent in easing traffic congestion (Anderson 2016, 23). Moreover, if the necessary technology and infrastructure is established to facilitate Level 4 and 5 automation, congestion could be further reduced. These reductions could be achieved through a more efficient use of the road network through such methods as platooning, reducing the distance between vehicles, reducing the frequency of braking and acceleration, and reducing intersection delay (Kamali et al. 2017). Furthermore, some anticipate that AVs will facilitate a shift away from private vehicle ownership towards models of ride-sharing (Firnkorn & Muller 2015). Ride-sharing, as part of a Mobiltiy-as-a-Service (MaaS) scheme, could dramatically reduce congestion on the roads as well as complement the existing public transport network through a first-and-last-mile program (Scheltes & Correria 2017).

Yet, while advances to technology may foster more efficient road usage, reductions to the marginal cost of operating a vehicle will likely increase the total number of kilometres travelled per vehicle (Smith 2013). Savings accrued through reduced fuel consumption, insurance premiums, maintenance costs, in addition to the gained productivity that the driver will experience during their commute, could entice more people onto the roads (Anderson 2016, 18). This could place further stress on existing infrastructure (Boesch et al. 2016), whilst also diverting investment away from existing public transport systems (Lam et al. 2016).

Land Uses

As the marginal cost of automobility is reduced, more people may opt to move to more remote locations. This could facilitate the further expansion of the city into the peri-urban and foster more dispersed land-use patterns (Thakur et al. 2016; Duraton 2016). At the same time, AVs could also lead to denser metropolitan cores. With AVs offering the potential to simply drop-off and pick-up users, the need for car parking within the city may dramatically diminish. Within most cities, car parking occupies approximately 30 per cent of a city's total surface area (Shoup 2005). This space once previously allotted for parking could one day be repurposed into public space or residential and commercial development, resulting in denser urban cores.

Accessibility

AVs may provide improved mobility to those who have previously been excluded from operating private vehicles, such as the elderly, disabled, or those too young to drive (Kockelman & Fagnant 2015, 170). For those who have previously not been able to operate a conventional motor vehicle, AVs may foster greater independence and access to essential services (Harper et al. 2016). This may both enhance access to public transport nodes whilst also increasing congestion on the road network.

It is important to recognise, however, that whilst AVs may engender more inclusive mobility for some, the technological barriers to uptake may serve to exclude others, such as the elderly or those without access to the internet (Kockelman & Fagnant 2015).

Environment

It can be further suggested that as well as improving social outcomes, there will likely also be positive environmental impacts. Predicted increases to the operational efficiency of both vehicles and the road network will likely improve fuel economy (Greenblatt & Shaheen 2015). As fuel consumption declines, so to do negative externalities such as greenhouse gas emissions and air pollution. Additionally, many anticipate that AV technology will be made available in tandem with alternative fuel sources such as electric or hydrogen vehicles (Seattle Department of Transportation 2018, 20). The transition away from petroleum based mobility could have profound positive impacts on the environment (Perujo et al. 2010). These potential improvements should however be considered against a likely increase to the total kilometres travelled per vehicle, and that without these alternative fuel sources becoming normative, negative externalities may in fact worsen.

It is clear that there are dramatic social, environmental, and economic benefits which may arise through the emergence of AVs.

Whilst it can at times be easy to get caught up in the hype of what AVs may offer, it is important that this optimism is balanced by a degree of caution to the several negative outcomes which may also occur. To what extent these positives and negatives play out is largely contingent on the sort of AV future that becomes reality. Yet, identifying which future may arise is the source of marked uncertainty within AV discourse. It is therefore important to understand what these futures may hold. The following section will first unpack this uncertainty, followed by an exploration of the potential AV futures which may occur.

Uncertainty and possible futures

AVs are likely to be the most significant disruption to urban mobility in the last 70 years (Legacy et al. 2018, 14). With planners and policy-makers confronted with a disruption of this magnitude, there is understandably a great deal of uncertainty as to i) what impacts this disruption may have, ii) what futures could potentially emerge, and iii) what actions (if any) should be taken to steer this transition. Planners will always be confronted with uncertainty (Albrechts 2004; Lau 2015). Uncertainty should not however be framed as something to be feared, but rather as an element of disruption to be understood and utilised to inform decision-making (Geels 2002).

As we approach an uncertain AV future, one way decision makers have attempted to grapple with this uncertainty is by envisioning a mixture of likely scenarios which might occur.

Much literature in recent years has sought to understand what these scenarios may be (see Litman 2017; Fagnant & Kockelman 2015; Anderson et al. 2014; Legacy et al. 2018). Although there are some differences to the possible scenarios imagined, it is possible to distill several common likely futures. In the absence of any exploration of possible futures established by Transport for Victoria, and rather than develop futures that have already been thoroughly discussed in existing literature, this report draws upon the recently proposed seven likely scenarios envisioned by Infrastructure Victoria (IV) (2018). Following the scenarios of IV is important because although they sit at arms-length as an independent body to the Victorian Government, at the state government level they offer the most comprehensive analysis of AVs to date.

It is important to recognise that these scenarios are unlikely to occur in isolation, and that the most likely future will probably be a combination of several of these futures. Nonetheless, it is helpful to consider the extremes of each of these possible scenarios.

Technological Transition (Scenarios 1-4)

1. Electric Avenue (2046): Petrol vehicles have been phased out and cars now operate on electricity. Automation, however, has not occurred, and cars are still operated by a human driver. Ride-sharing has also not taken root, and private-vehicle ownership is still normative.

2. Private Drive (2046): Vehicles are now both electric and fully automated. Resulting, the marginal cost associated with driving has dramatically declined, making driving more appealing than public transport. Because of this, public transport patronage is waning. Under this scenario, private-vehicle ownership is still normative.

3. Fleet Street (2046): Vehicles are now electric, fully automated, and available on-demand at the touch of a button. Private-vehicle ownership is now largely a thing of the past, and roaming fleets of AVs are available as part of a MaaS program. Ride-sharing is commonplace.

4. Hydrogen Highway (2046): Vehicles are now fully automated, but rather than operate using electricity, are fuelled by hydrogen. The availability of hydrogen as a fuel-source has had dramatic impacts on the freight industry. Private vehicle ownership is still normative.

Speed of Transition (Scenarios 5-7)

5. Slow Lane (2046): Both autonomous and manually-operated vehicles operate on the road network. Additionally, only some vehicles are electric whilst others still rely on petrol. With road space being shared, AVs are unable to operate at peak efficiency, and conflicts between old and new technologies is commonplace. Whilst there has been some success with MaaS, many people still own their own personal vehicle.

6. High Speed (2031): Breakthroughs in AV technology has meant that their roll-out in society has occurred far quicker than anticipated. Manually-operated and petrol-fuelled vehicles have largely been abandoned, and many people no longer own their own vehicle. Instead, mobility has shifted towards an integrated MaaS system, where fleets of roaming AVs are summoned on-demand and are complementary to the public transport system.

7. Dead End (2046): Both AV technology and the shift to alternative fuel sources has stalled. Subsequently, the current mobility paradigm continues. Cars are still manually-operated and fuelled by petrol. This is very much business-as-usual.

Clearly, some of these scenarios are more desirable than others. How then can planners attempt to understand what future we're headed towards? According to Jensen et al. (2017), it is possible to draw a priori conclusions about the direction of the future by conducting an epistemological experiment on what has already occurred. Simply put, by looking carefully at the past, it is possible to better understand the trajectory you're headed. In recent years, the phenomenon of ridesharing service Uber has changed the way citizens engage with mobility in Melbourne. Unpacking this case study offers an opportunity to explore the ways in which disruption has been governed, and to glean insight into what sort of AV future might manifest.

Uber at the airport

Currently, there are exclusive pickup ranks posted within the airport forecourt strictly for use by Uber drivers. According to the Uber website, you simply follow the signs for 'Uber' from any of the terminals and head to the Pick Up Zone in the airport forecourt. There are also special conditions for UberBLACK (a premium, higher cost service) to pick up from specific points within the short term carparks located adjacent to the forecourt and terminal 4. Locating the passenger is managed by special options in the app that ensure the passenger can identify their specific terminal to meet their driver.

But, until August 2017, this arrangement had been explicitly prohibited and the more popular UberX ride sharing service was not permitted to enter the airport.

In fact, it was once illegal for Uber to operate in Victoria at all. This was due to the Uber service classification as a ridesharing service, which was outside regulation under Victorian state legislation. Prior to legislative reform, Uber drivers could be fined for driving a hire car in the absence of a commercial license or registration and indeed, some drivers were fined (Choahan, 2016).. However, as the popularity of Uber grew it became no longer viable for penalties to be incurred. In August 2016, Victorian Premier Daniel Andrews announced that there will be legislation introduced that would seek to regulate Uber as a ride sharing service, and therefore open up the market for Uber to operate alongside existing taxi services (Willingham & Preiss 2016).

The Premier's announcement occurred after the introduction of a Ridesharing Bill in June 2016. This previous bill had sought to legalise services like Uber by excluding them from the definition of "commercial passenger vehicles" under the *Transport (Compliance and Miscellaneous) Act 1983 (Vic)* (Dosen & Rosolen, 2016). A deal was struck to table a framework for the legalisation of ridesharing services in the following months (Willingham & Preiss, 2016). Essentially, this meant that rideshare services were allowed in Victoria, but individual operators did not pay tax in the same way that operating taxi services did.

Uber pick-up zone at Tullamarine Airport. Source: Reuters 2017.

In August 2016, the Chief of Avalon Airport Justin Giddings announced the construction of a 5-space "designated Uber area" was to be placed in close proximity to entry into the airport, but insisted that it was not a rank, merely a pick-up area to ensure safety for passengers and provide structure for Uber on the airport grounds (Choahan, 2016). Even so, the Avalon Airport posted promotional material on Twitter for the construction of the designated area, offering reduced prices for its opening (Willingham & Preiss, 2016). Additionally, an Uber spokesman stated they had "worked closely with Avalon to ensure their technology makes the connection as seamless as possible" (Choahan, 2016). In response, the chief executive of the Victorian Taxi Association insisted that the structure Avalon Airport built was a rank, and that the taxi industry "was not scared of Uber, but wanted a level playing field" (Choahan, 2016).

This level playing field came under scrutiny once more at the passing of legislation that altered the registration system for commercial passenger vehicles in Victoria.

From the 16 August 2017, the new laws allowed Uber drivers to offer pick up services to Melbourne Airport, installing the required infrastructure, signage and promotional material the very day the legislation was passed (Cunningham, 2017). The Chief of Parking and Ground Access at Melbourne Airport stated that "[the airport] has worked closely with Uber to develop the right infrastructure in order to make the service work well for both drivers and travellers" (Cunningham, 2017). The Uber Victorian State Manager sought it as a "big win for consumer choice, tourism and the Victorian travelling public" (Cunningham, 2017). It is clear that Uber and the airport, along with the state government had been working in association in the lead up to this event. However, the evening before the new infrastructure was erected, a mass direct action blockade occurred, organised by taxi drivers in protest to the new laws. It involved up to 150 taxi drivers and caused up to 1200 passengers to have to find alternative means of transport (Bowden & Mannix, 2017).

This protest should be placed in the context of the smart mobility transition (Reardon & Marsden, 2018). What we've seen is evidence of the social ramification of disruption to the usual commercial passenger model in Victoria. Regulators placed in a 'wait-and-see' approach forced to catch up with shifting mobility. Ride sharing which had previously been an unregulated free-market system was placed under a classification the same as commercial passenger vehicles, like taxis. However, independent bodies, like the airports, maintained the right to prohibit ride sharing vehicles onto their premises regardless of the regulatory framework. As Uber patronage continued to grow, Avalon airport realised that they could no longer try to block access for safety reasons – thus, a "designated Uber area" was constructed, though not overtly in partnership with Uber, the fact that the parties had engaged together to deliver promotional material for its opening shows that there had been deliberation in the delivery of the infrastructure (Cunningham, 2017). Further evidence of this kind of engagement is present in the delivery of legislation that allowed commercial ride sharing vehicles to enter Melbourne Airport. Although, this time with the acknowledgement that the process had involved government, the airports and directly Uber themselves working in partnership. This partnership placed increasing pressure on the existing commercial passenger vehicle industry, and we witnessed its eventual fallout with a major backlash from taxi drivers.

This case study highlights how the smart mobility transition is already affecting the way people engage with mobility (Marsden & Reardon 2018). This transition has resulted in legislative changes, that have at once boosted the emerging technology, while externalising the negative impacts of the technology onto the existing industry . The governance approach to the emerging Uber market - that is in reaction to, and then in partnership with, the private sector – is a display of what has been referred to as *corporatized governance* (Legacy et al. 2018).

Corporatised governance

The emergence of Uber in recent years has tested the government's capacity to respond to disruption. As Uber's conflict-laden introduction to Melbourne's airports makes apparent, disruption is increasingly governed by a 'wait-and-see' approach that imposes few barriers to the free-market, followed by reactionary government regulation. This approach, according to Loorbach (2010), is fundamentally ineffective in producing equitable outcomes, and highlights the power in which the free-market has in governing disruption. More broadly, this state-of-affairs is representative of an increasingly steadfast paradigm of neoliberal mobility (Henderson 2013). Here, government assumes lesser responsibility and creates spaces for the market to fill in the way mobility discourse is framed and transport provided. This new paradigm is underpinned by the devolution of state responsibility, the primacy of economic rationality in decision making, and the market's capacity to take the place of government in service provisioning (O'Neill 2010). Growing depoliticisation has placed the private sector at the helm of steering how disruptions are managed, whilst concurrently limiting the state's capacity for influence (Legacy et al. 2018). The governance of mobility is being hollowed out, and this space is being filled by the market (Marsden & Reardon 2018, 163). What then are the consequences of such an approach, and what does this mean for the AV transition?

This setting of neoliberal mobility should cause concern for policy-makers, planners, and the public. If the market were to lead the smart mobility transition, the AV future in which we arrive at may not be conducive to the ideals of equity, inclusivity, and sustainability outlined in Melbourne's planning doctrines (Plan Melbourne 2050). Yet, there are many indications that the market is already leading this AV transition, and are already steering Melbourne towards a particular future. Discourses of economic significance and international competition have so far framed AVs, and the "race towards automation" has seen cities around the world hesitant to regulate (Hopkins & Schwanen 2018, 19). Private actors have sought and succeeded in securing a place on the local mobility market that increases their own returns (Docherty 2018).

Disturbingly, this neoliberal platform has fostered a dependence on private-sector interests, and cast aside space for critical intervention and public participation. There has emerged an apparent post-political consensus towards the indisputable need for the market to steer this transition (Mouffe 2005; Swyngedouw 2010). Yet, there are serious consequences to enabling this state-of-affairs. Unless government adopt a stronger position in steering the AV transition within this depoliticised environment, the private sector could shape cities without scrutiny (Keblowski & Bassens 2018). The primacy of economic rationality may come at the expense of public participation, radical dissent, and many of the principles which guide planning practice within Melbourne today (Legacy et al. 2018). Here rises a need for intervention because the vacuum left within this depoliticised environment is now filled by the market. This has left little capacity for the state to protect the public from the negative externalities of this transition and to steer towards a desirable future (Marsden & Reardon 2018).

Clearly then there is a need for overarching guidance to provide the state with a pathway to navigate this AV transition towards a more desirable future. As the central piece of legislation governing transportation within Victoria, the Transport Integration Act (2010) provides a vision for the integration of the Victorian transport network. However, unpacking this piece of legislation reveals that within a paradigm of neoliberal mobility, the influence of the free market in directing the AV transition has rendered the visions and objectives established within the TIA hamstrung and ineffective.

Part Two: Legislative Opportunities

Transport Integration Act

The Transport Integration Act (2010) is a piece of legislation that guides institutional change to unify all elements of the Victorian transport portfolio. It unpacks a set of principles that encourage triple bottom line thinking to articulate a future of an integrated transport system in Victoria. Its vision statement reads:

"The Parliament recognises the aspirations of Victorians for an integrated and sustainable transport system that contributes to an inclusive, prosperous and environmentally responsible State" (s6)

In the corporatized governance context, it is important to challenge the vision of the Act, because its core message is to serve the public good. In this first instance, the principles are problematised under Victorian car dependency (Dowling 2018).

The transport system is currently dominated by the car, thus transport operators have been seen to invest in infrastructure that privileges the car, in a process that induces demand from an already saturated mobility market (Woodcock et al. 2017). This hegemony serves to lock-in car dependency and thus, the AV future we see arise may be influenced by a deployment process that privileges economic rationality, at odds with the public good (Legacy et al. 2010). Evidence can be found in the Uber case where the private sector actor operating within an unregulated market gained control to steer policy in a direction that best suited its own economic interest. This economic rationality serves to undermine the democratic basis of the Act. The normative emphasis on market-led innovation maintains the ignorance of the public to the power held by the private sector within the corporatized governance structure (Flyvberg 1998). In effect this has cultivated a transport geography and discourse within Victoria centred on car dependency that undermines the vision of the Act.

Extending from its vision, the Act legislates the requirement for the state government to set out a Victorian Transport Plan, which must meet certain transport system objectives and decision making principles, outlined below.

Transport system objectives: Social and economic inclusion; Economic prosperity; Environmental sustainability; Integration of transport and land use; Efficiency, coordination and reliability; Safety and health and wellbeing (Division 2, Transport Integration Act 2010)

Decision making principles: Transport system objectives; Transport system objectives; Social and economic inclusion; Economic prosperity; Environmental sustainability; Integration of transport and land use; Efficiency, coordination and reliability; Safety and health and wellbeing. (Division 3, Transport Integration Act 2010)

These principles offer a wide scope in which to formulate a governance process that is conscious of the public good. However, integration within the Act is defined as an institutional goal, rather than a transport planning goal (p. 1). The principles are designed to create consistency between transport corporations and connect them under a shared vision and policy context. However, the Act is ineffectual when attempting to integrate transport planning because the decisions made by the various agencies are at their own discretion, according to the particular agency's somewhat narrowly-defined agenda (Whitten 2018). In effect, each agency operates as an independent corporation responsible for the day-to-day operations within their respective portfolio. This challenges successful planning in accordance with these principles as the various bodies responsible for administering transport planning act according to their own economic interests.

This is troubling under the neoliberal paradigm because by reducing its capacity to coordinate the steering of transport infrastructure planning, it has opened an attractive investment environment to draw in private sector participation (Legacy 2015). The private sector now fills the void in governance, and the transport agencies within the Act serve this economic interest.

Though, the principles of the Act are well placed to become fit as clear policy objectives for the mobility transition (Marsden & Reardon 2018). In advance of the AV disruption, a set of principles are required based on contested, local values which stand to highlight a return to a dialectical and participatory planning system (Mouffe 2000). This knowledge needs to be coupled with a further understanding of the drivers that motivate private sector behaviours (Guerra 2016). As we are at the coalface of smart transition planning in Australia, there is little local evidence base from which to navigate the impending disruption. At this critical juncture, the planning profession must identify best practice in the process of public policy making both domestically and abroad (Marsden & Reardon 2018).

It has been established that the overall legislative context has instruments available to planners to strategically manage the oncoming automobility disruption. Though, these instruments are obstructed from planning for the driverless train station given the car dependency of Victoria (Legacy et al. 2018; Dowling 2018).

Though, Dowling (2018) also comments that governance of transport is already adaptable and flexible, and this should rouse planners to reassess their difficulties with planning in uncertainty (Geels 2002). Given a reflexive governance framing driven by transition management, this can be achieved within the parameters of Melbourne's existing planning doctrines. The heuristic framework of Transition Management can assess the progress of a new technology whilst it's still niche and judge its viability according to the instruments available (Hopkins & Schwanen 2016; Geels 2002).

Part Three: A way forward

With the TIA lacking the teeth to steer the AV transition, it is critical to now ask what *is* being done and what *can* be done for government to secure a more influential role in guiding this transition. The Transition Management framework offers a lens for this to be accomplished. Given the TIA's explicit vision of an "integrated and sustainable transport system", it is helpful to narrow our scope to an element of Melbourne's transport system which anchors these principles - train stations.

The AV scenarios imagined by Infrastructure Victoria (2018) paint a deeply uncertain future for train stations. While some of these scenarios position AVs as complementary to the train network (scenarios 3 and 6), others pivot sharply and frame AVs as a profound threat to the future of train patronage (scenario 2, 5, and 7).

Transition Management offers a reflexive governance approach that seeks to embrace this complexity and potential for vastly differing possible futures (Hopkins & Schwanen 2016, 67). Whilst initially designed as a framework to understand sustainable development transitions (Loorbach 2010), this framework has been demonstrated as useful for analysing the governance of the smart mobility transition (Hopkins & Schwanen 2016).

This approach seeks to understand complex issues such as the AV transition and integrate the many perspectives, agendas, and beliefs of the varying actors (Vob & Bornemann 2011). Transition Management recognises that the governance of societal change is influenced by both the government and market (Meadowcroft 2005), and that a way to balance the state, private sector and society is needed (Loorbach 2010). Put simply, Transition Management offers a heuristic framework in which the governance processes surrounding the AV transition can be understood and evaluated (Hopkins & Schwanen 2016, 67).

The Transition Management framework comprises of four operational governance activities (Loorbach & Rotmans 2010).

Transition Management framework

1. Strategic: the processes of understanding opportunities and problems arising from the transition, and of exploring possible futures. In many ways, this is the process of government developing documents and plans to explore the challenges of an AV transition. This offers space for the discussion of potential regulation.

2. Tactical: the development of relationships, networks and coalitions between the various actors. Government recognise the various players seeking influence, and provide space for agonistic discourse towards the AV transition (Mouffe 2005).

3. Operational: this involves the actual field testing and experimentation of AV technology..

4. Reflexive: the opening up of discourse to debate and learn from the actions currently being taken. This is the process of assessing whether the transition objectives are being worked towards, and questioning what needs to be done to better manage this transition.

Looking towards a future which is underscored by a paradigm of neoliberal mobility (Henderson 2013) and automobile hegemony (Dowling 2018), whilst also remembering the anticipated decline in the marginal cost of operating an AV (Lam et al. 2016), the long-term vitality of the train station appears bleak. To avoid such a future, it is necessary to understand the strategic, tactical, operational and reflexive governance activities currently underpinning train stations and the broader transport system. By examining how these elements are being assessed today, whilst also understanding what actions can be further taken, the state may be able to reorient itself into a position to steer this AV transition.

Strategic

What is currently happening

The strategic level focuses on developing documents and plans to both navigate the problems catalysed by AVs, as well as build visions for the sort of AV future that is desired. To date, there is not a single document produced by, or in partnership with any of the transport corporation under the TIA which attempt to examine AVs and their impact on train stations. Whilst government have requested for Infrastructure Victoria to provide advice on the infrastructure requirements for AVs, it is not clear yet whether this will consider the requirements at train stations. Rather, strategic efforts have instead adopted a broader discourse towards AV technology.

Framing their discussion of AVs through a mostly technologically optimistic lens, 'Automated Vehicles' (Dosen et al., 2017) provides an overview of the benefits of AV technology, as well as consideration to the potential regulatory responses which may be required. Yet, scant attention is paid to how AVs may be sustainably integrated within the existing transportation network. Instead, its focus is on the economic implications of AV technology as "the driving force" for why the state should concern itself with AVs (2017, 7). From this, an economic rationalisation of the AV transition is already made clear, and the dimensions of the triple-bottom line purported by the TIA are shown to be weighted unevenly.

Whilst the state appears to be lagging behind in developing any meaningful AV strategic vision, there has been some movement at the local level. Looking at the potential impacts of AV technology on mobility and urban form, The City of Melbourne (2016) offers perhaps the most comprehensive analysis in the state. In their plan, consideration is given to the possibility of AVs servicing train stations through a ride-sharing scheme (2016, 36). Unlike the discussion presented by Dosen et al. (2017), this strategy grounds AVs as a critical element to a sustainable transport system, whilst further opening up discourse to the public for a conversation about the city's AV future.

Whilst several local councils have at least begun to consider the implications of AVs within their transport strategies, the overwhelming majority have not. Of the 79 Local Government Areas (LGAs) within Victoria, only 12 have recognised AVs within strategic documents. Further concerns are raised when considering that all of the LGAs which do make reference to AVs are situated within metropolitan Melbourne. This suggests that AV discourse has not provided for discussion towards the impacts of AVs in regional and rural Victoria.

What could be happening

To ensure that trains stations are ready to accommodate AVs, and for government to assume a more proactive role in guiding this transition, several strategic actions are available.

Strategy 1: In the absence of a Victorian integrated transport plan, develop a comprehensive AV plan to anchor decision making and policy development in the coming years. This plan should seek to draw upon the visions and goals for Melbourne's transport system as described in the TIA and *Plan Melbourne 2050*.

This plan should at least consider the following:

- Respond to the scenarios established by Infrastructure Victoria (2018) and articulate a desired AV future, in partnership with the AV technology developers.
- Assess the feasibility of developing a multimodal MaaS app. This assessment should consider the challenges and opportunities of such an app within Melbourne (for example, potential integration with the existing Myki system), whilst also turning to international examples for guidance (such as the state-led MaaS app currently operating within Munich). Additionally, this feasibility study should consider the potential integration of a first-and-last-mile feeder service to train stations.
- Acknowledgement of the impacts AV technology will have on suburban sprawl.
- Reassessment of the Victorian drivers licensing scheme to provide for AV systems as driving assistance requirements diminish as technology progresses.
- Understand the equity implications arising from AVs, including potential technological and social barriers.
- Increased accessibility strategy for non-drivers and under-serviced populations; unlicensed drivers, seniors, people living with a disability.

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- Set of design principles and guidelines for distribution to city precincts; e.g. sports venues, shopping precincts.
- Councils and state agencies should be prepared to review plans at a high frequency as the speed of technology continues to emerge at increasing rates.
- Alignment with broader emissions reductions target strategies in Victoria and Australia.

Responsible party: Transport for Victoria

Strategy 2: Develop a strategic document which explores the possible design actions required to facilitate AVs at train stations in the future. Design considerations should include:

- Accessibility to electric vehicle charging facilities.
- The expansion of pick-up and drop-off curbside space.
- The proximity of drop off location to entry/exit points.
- As demand for fixed car parking diminishes, planning for the gradual phasing out of existing car parking infrastructure, and consideration to repurposing this space for appropriate land uses. As an alternative to removing car parking facilities, consideration could also be given to the redesign of car parks to more efficiently fit AVs.

Rather than have empty AVs contributing to road congestion around stations (particularly during peak hours), existing parking facilities could be repurposed to enable more AVs to fit in less space (Nourinejad et al. 2017).

Responsible party: VicTrack

Strategy 3: Undertake an analysis of the possible impacts on road network capacity around train stations under each of IVs seven possible scenarios. From this, develop an arsenal of broad strategies that could respond to these scenarios. For example, one such strategy may be to examine the continued need for bidirectional lanes. During peak transit periods, traffic largely flows in one direction, whilst roads flowing the other way are mostly empty. Roads could potentially be repurposed to respond to demand. Further considerations include:

- Assess the impacts on existing road network users at varying stages of autonomy - vehicle miles travelled, shift away from tram/bus service.
- Zero-occupancy vehicle management strategy.
- Ongoing evaluation of how infrastructure changes impact multi-modal transport; bicycle, pedestrian.
- The initial reduction and subsequent removal of certain elements of transport infrastructure; e.g. traffic signals, speed cameras.

Responsible party: VicRoads

Strategy 4: It is critical that government has an understanding not only on what infrastructure is required to facilitate the AV transition, but who will be responsible for funding this infrastructure. Government should investigate the options available through private-public-partnership to better understand what infrastructure will need to be funded by the state, and what will be provided by the private sector. For example, it is likely that the transmission of data will be facilitated by the major telecommunication companies, but that physical infrastructure requirements such as adapted cycling infrastructure may be provided by the state.

Responsible party: Infrastructure Victoria

Strategy 5: Engage with local councils to ensure that they are better equipped to respond to the emerging challenges of AVs. This should extend beyond the metropolitan boundaries, and work should be done to attain a better understanding of the unique AV challenges and opportunities posed by AVs in regional and rural communities.

Responsible party; Transport for Victoria

Tactical

What is currently happening

The tactical level is concerned with developing networks and coalitions between stakeholders. For those operating within the public sector, the TIA already provides a framework to unify the various transport corporations under a common vision and goals. Yet, as has previously been discussed, the interplay between agencies can at times appear fragmented. There is so far no evidence to suggest that these agencies are partnering to better understand AVs at the city scale, let alone at train stations. Despite this apparent lack of cohesiveness within the public sector, there are some signs of the state engaging with the private sector to better understand the technological limitations of AVs on Victorian roads.

Trials of AVs on some road networks are currently underway, led by Transurban in partnership with VicRoads and RACV (2018). Through one framing, this reflects a healthy engagement between the public and private realms in working together to better understand the impacts of AVs within Victoria. Yet, from another perspective, the principle role in which Transurban has assumed within this study points towards a broader narrative of the hollowing out of state power and the steering role which the private sector is already taking.

Public-private-partnerships which are driven by the private sector can reinforce existing path dependencies (Dormois et al. 2005). Perhaps more worrying is an absence of engagement by the government with the public about AVs. This trend is in line with similar Transition Management studies abroad, where coalitions have mostly concerned themselves with engaging with expert dialogue, and the community have been positioned as passive participants (Hopkins & Schwanen 2018, 73).

What could be happening

Transition Management anchors the principles of inclusivity and openness as guiding principles for healthy partnerships and networks (Loorbach et al. 2015). There are several strategies available to the state to foster more robust relations between *all* stakeholders.

Strategy 1: Address issues of fragmentation between the transport agencies under the TIA. So far, the TIA has not been effective in steering the various agencies towards a common transport vision. Perhaps then more drastic measures are needed. This could be achieved through establishing a new transport body whose specific designation is to oversee the deployment of AVs. This agency should act as a conduit through which various transport agencies can connect to address the AV transition.

Strategy 2: Open up channels for community engagement and foster a broader discourse with the community. AVs are likely to have profound impacts on the lives of most Victorians. It is important that the public are not framed as passive participants in this transition, and that their perspectives are integrated into discussions and used to inform decision making.

Operational

What is currently happening

The operational level of activities is concerned with the experimentation and trialling of AVs. As AV technology has progressed in recent years, this aspect of the transition appears to have been a central focus of the government. The *Victorian Roads Safety Act (1986)* was last year amended to allow for permit application by individuals and organisations for the testing of AVs on Victorian roads. In conjunction with this amendment, $9 million dollars has been made available from the state's coffers to entice organisations to undertake such trialling. Government has largely framed the justification of these actions as a necessary step to ensuring safer roads. Accordingly, experimentation of AVs has adopted a similarly narrow scope. To date, trialling has only tested the capacity of existing infrastructure to accommodate AVs (Transurban 2018). This testing has focused on major roadways and atypical road spaces (such as university grounds), and the testing of AVs has not occurred around train stations. Further, trials seeking to understand the potential application of AVs within Melbourne's transport system have not been undertaken. Whilst testing the capacity of existing infrastructure to cope with AVs is critical, the limited scope that trials have so far adopted should be broadened.

What could be happening

Whilst working towards safer roads is understandably a critical component to the AV transition, more experimentation of AVs in different spatial contexts is needed. Additionally, trials of the potential models of application for AVs should also be undertaken.

Strategy 1: Conduct a trial of AVs within a regional and rural spatial context. Whilst this trial would serve to test the infrastructure requirements outside of a metropolitan setting, it could further bolster an understanding of the differing effects AVs may have on regional mobility. It is critical that the transition to AVs does not reinforce existing spatial inequalities, and so far trialling of AVs within Victoria has not considered these implications.

Strategy 2: Conduct a trial of AVs across a range of existing train station typologies. Whilst government may be hesitant to test AVs at actual train stations, it may be possible to simulate different typologies under closed-road experiments. Understanding how AVs currently behave within different station scenarios would likely prove useful in understanding how different station typologies could be redesigned to accommodate AVs. This trial should be carried out in partnership with VicTrack.

Strategy 3: Given the TIA's function to foster a sustainable and integrated transport system, it would be helpful to conduct a state-led trial of a MaaS scheme. Such trials are already being conducted in cities around the world. This trial would prove useful in understanding the technological requirements of a MaaS program, to assess public sentiment towards such an approach, and to feed back to decision makers what the ongoing requirements are. Whilst the technological limitations of AVs may not yet allow for the testing of such a feature, it may be useful in the future to further test the feasibility of a first-and-last-mile feeder service to existing public transport nodes.

Strategy 4: Empower the public beyond that of passive participants and involve the community in AV trials. This does not necessarily need to be a trial in and of itself, but rather a guiding principle to ensure that the community are actively involved in AV experimentation. Whilst this may simply involve inviting community members to participate in trials, some cities have already allowed AV manufacturers to operate on their roads and be accessed by the public (San Francisco Examiner 2018). Engaging with the community at these early stages could better inform the public about AV technology whilst also minimising resistance to AV adoption once the technology becomes more commerically viable (Hulse et al. 2018).

Reflexive

What is happening now

The reflexive stage is concerned with the learning processes guiding the transition. This consists of two key approaches. First, international responses to AVs should be understood by the government and used to inform decisions here. In the limited literature produced by the government thus far, it does appear that international experiences are being drawn upon (Dosen et al. 2017, 17). It has not been communicated what is being learnt from their international counterparts, but it is nonetheless clear that the government has a comprehensive understanding of the different regulatory responses that are occurring abroad. The second form of learning is through a self-reflexive process that prompts government to assess whether their transition objectives are being achieved. Publicly, it is unclear whether this evaluation is happening, and if so, what is being learnt.

What could be happening

Victoria is not alone in tackling the many challenges the transition to AVs pose. Cities around the world are grappling with these issues, and the discussions and responses generated internationally should be drawn upon as a valuable resource. Moreover, establishing a monitoring and evaluation process to the experimentation stage is a critical step in the Transition Management framework (Kemp & Loorbach 2003). There are several strategies available to government.

Strategy 1: Identify cities who are at the forefront of managing the AV transition, and reach out to establish mutual partnerships. Cities such as Stockholm, California, and Toronto have demonstrated in recent years a proactive approach to understanding and regulating AV technology. These responses haven't necessarily been uniform, and many cities have sought to tackle AVs with vastly different policy responses. It may prove useful to have an understanding of the different approaches available, and to learn from best-practice examples.

Strategy 2: As part of establishing a strategic framework to manage the AV transition, it is important that within these strategies a comprehensive monitoring and evaluation plan is put in place. By regularly assessing whether the goals underpinning the AV transition are being met, it enables government to gauge the success of their regulatory responses and to adjust their strategies accordingly.

Knowing what to do when faced with the unprecedented uncertainty arising from AVs is understandably daunting. Whilst the TIA should offer guidance on how to tackle the AV transition, it has thus far been ineffective.

Transition Management instead offers a pathway to better understand the potential actions needed to steer Victoria towards a desirable AV future. The actions proposed by this Transition Management framework should serve as the springboard needed to tackle the many challenges AVs pose not only to train stations, but to broader society.

Final thoughts

This report has looked at how Transport for Victoria should handle the incoming autonomous vehicle disruption. The report has unpacked the potentials and pitfalls of deploying the technology, and reinforces that uncertainty should not be feared within this space. The scenarios offered by Infrastructure Victoria provide some guidance as to what the future may look like, now there is an opportunity for the government to unpack those scenarios and base decisions from a more informed perspective. The discussion on corporatized governance highlighted that there is a need for intervention, because the state risks losing its capacity to inform decisions based on providing for the public good. If the automobility transition is steered by the private sector it may lead to negative externalities which may fall upon the state. Three overall recommendations have been made.

1. By enacting the Transport Integration Act (2010), a coordinated approach across the legislative transport agencies is possible, and therefore the government stands to carry more weight in the decision-making process.

2. Utilising a Transition Management approach offers a framework as to how to understand and evaluate the AV transition.

3. Articulated policy recommendations on how to direct autonomous vehicle traffic toward train stations, and therefore mitigate some of the negative externalities that may present.

Each corporation designated with the Act has some stake in providing for the adaptation of train stations in an autonomous future. For this to occur, Transport for Victoria must perform its statutory requirement to coordinate the Victorian transport agencies as a united front.

The scope for possible outcomes following the autonomous vehicle disruption is too broad for a comprehensive assessment here. Train stations vary in their design and location, therefore specific design plans have not been recommended.

Though, Transport for Victoria is encouraged to take note of the various scenarios proposed by the University of Melbourne Autonomous Vehicle Studio participants. Specific policies have not been recommended either as the technology is still too early in its development in Australia to provide locally informed advice. Rather, the government is advised that Transition Management will provide the feedback required to meet its triple bottom line commitments under the Act.

We are far from knowing what an autonomous future may provide, however a deeper understanding of the political economic dynamics surrounding its deployment can help government steer an integrated transport system.

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