Committee Secretary
Standing Committee on Industry, Innovation, Science and Resources
PO Box 6021
Parliament House
Canberra ACT 2600

3 February 2017

Dear Inquiry Secretary,

Please find enclosed our submission to the APH House of Representatives Inquiry into the social issues relating to land-based driverless vehicles in Australia.

We would be happy to supply additional material and make ourselves available to the committee in person.

Yours faithfully,

ARC Robotic Futures Research Team

Dr David Bissell, Australian National University
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Submission to House of Representatives Inquiry into the social issues relating to land-based driverless vehicles in Australia

1. Project Background

Our Robotic Futures research team is conducting a five-year project on 'Enhanced Humans, Robotics and the Future of Work' primarily funded by the Australian Research Council's *Discovery Projects* scheme. The key aim of the project is to assess the impacts that advances in robotic and artificial intelligence (AI) technologies are having on society. The project is doing this by exploring the sociological impacts of the current seismic shifts in automation, robotics and AI and how demand is created for digital skills around mobility and mobile technology. Some of the topics that we are focused on in this research include: what future workplaces will look like; how capital-intensive and labor-saving dimensions of robotics and AI transform work/life balance and underpin emergent mobile forms of employment; and how forms of physical mobility (such as travel and transport for employment) and digital mobility (such as e-work, e-commerce and e-services) are being developed within companies and organisations in response to the demands of technological change. `

Based on our expertise on this topic, we would like to address the following three terms of reference:

- General social acceptance levels
- Potential impacts on employment and different industry sectors
- access and equity issues

2. General social acceptance levels of driverless vehicles in Australia

In order to understand the extent to which the Australian public will be receptive to the use of land-based driverless vehicles, it is instructive to consider key insights produced in the field of science and technologies studies (STS). A key debate within this field revolves around the theory of technological determinism, which refers to the commonly held view that technology is an autonomous force in society, which inevitably leads to certain social outcomes. Many STS researchers have argued that technological determinism is a flawed theory principally because it has a tendency to downplay or over-simplify the role that society plays in shaping technological development (Mackenzie and Wajcman, 1999). Technological determinism tends to over-emphasize the economic or instrumental factors of why some technologies come to be adopted (Guy and Shove, 2000). STS research has shown through numerous case studies that technological acceptance is informed by a multitude of social factors, which are irreducible to economic and functional considerations alone. A technology may be accepted or rejected, for example, because it lacks a certain amount of governmental support. However, research also highlights that exaggerated ideas of the power of science and technology to transform society persist to the present day (Dronamraju, 1995). Most recently, social science underscores that uncertainty is always deeply interwoven into the adoption of new technologies in society (Nowotny, 2016). Significantly new technologies, such as electric vehicles, are permeated by human identities or world-views, which can influence the extent and pace at which technologies are taken up and adopted in people's lives (Heffner et al., 2007).

We find that these insights apply to our analysis of driverless vehicles in Australia. While driverless vehicles may be in some respects functionally or economically superior than existing forms of vehicular transport, there are still many obstacles which potentially stand in the way of their adoption by large segments of the Australian public. One of these challenges has to do with what the current system of private automobility affords. Recent qualitative sociological research (Kent, 2014, 2016) suggests that private car use is an entrenched practice in many parts of Australia not only because it is viewed as a time-saving device. Private car use is also attached to some people's cultural sense of self, in that it is viewed as an inalienable source of freedom and autonomy by some Australians.

This current cultural reality in Australia thus potentially presents a challenge to attempts to develop a public and highly regulated network of fully automated transport vehicles, as some commentators and industry futurists have envisioned (Silberg et al., 2012). However, this does not mean that other forms of driverless vehicles will necessarily find it as difficult to gain traction in the Australian context.

Recent research conducted in Australia and in other countries has highlighted how driverless vehicles exist along a spectrum in terms of how 'automated' and/or 'autonomous' they are (Gogarty and Robinson, 2011: 2-3). Some studies have found that there may currently be greater acceptance for driverless vehicle technologies that still require some substantial level of ongoing human input and direction (e.g., Schoettle and Sivak, 2014). However, it is important to note that attitudes towards driverless cars have been found to vary between different social groups, with some groups showing a greater preference for certain driverless car technologies over others.

Driverless cars promise to transform how drivers spend their time "on the road"; recent research highlights that drivers of semi-autonomous and autonomous vehicles undertake multiple forms of activity whilst "on the move" (Elliott and Urry 2010). Federal, state, city, and industry-based planning towards the acceptance of driverless cars will thus benefit from adopting a multifactorial and dynamic account of how much public support there is for driverless vehicles. We suggest that it is not enough to simply quantify public attitudes towards the use of driverless vehicles, as some studies have tended to focus on. Reasons for accepting or rejecting driverless technologies are likely to differ considerably—now and in the future. And so there is a need to capture and better understand what these culturally based reasons are. This knowledge—which remains nascent at the present moment—will help to identify which driverless vehicle technologies are the ones that stand to deliver the most social benefit and which technologies are most dangerous and require caution.

3. Potential impacts on employment and different industry sectors

Despite the uncertainties detailed above, automation and driverless technologies will likely have far reaching impacts on how goods are delivered and how people move about in Australia. Their potential impacts on employment will likely be significant and they will affect different industry sectors in different ways. Below are some of these potential transformations and the social impacts that are likely to take place:

3.1 Displacement and skill change

There is disagreement about whether automation will lead to large scale 'jobless' future through displacement (Ford, 2015), or whether such a jobless future will be averted by the creation of new jobs that do not currently exist (Mindell, 2015). However, despite this uncertainty, Brynjolfsson and McAfee (2016) advise that is likely is that the jobs created through automation will require different skills from those that are displaced. Furthermore, different employment sectors will experience different effects.

In the domain of land-based transportation, the advent of driverless vehicles is likely to change the labour skills required in the trucking sector. Rather than entirely unmanned vehicles, research on automation indicates that the role of the driver is likely to change from vehicle control, to monitoring (Lipson and Kurman, 2016). The precise combination of skills required will likely change at different stages of the journey. For instance, highway driving with minimal variations might involve a high degree of automation, whereas city driving would require more human control for making deliveries and pick-ups.

Nevertheless, many predict that the consequences for the current transportation labour force are likely to be negative, given that the economic rationale for driverless trucks to reduce labour costs and increase safety (e.g. Validakis, 2013). Predictions are for fewer workers with one operative potentially overseeing multiple vehicles.

Displacement as a result of driverless vehicles in the trucking industry introduces the wider question of automation and skill change. AI and changing technologies demand constant updating of digital skills (Brynjolfsson and McAfee, 2016). Thus, we need to examine variation in levels of engagement with and extension of digital skills, as well as the professional, personal and community factors which both support and limit the flourishing of such technical up-skilling. Digital literacy and the

advancement of what we call 'Digital Imaginaries' needs to be core subjects at all levels of school, vocational training and higher education.

3.2 New spatialities of labour

Many applications of driverless land-based vehicles are speculative or in testing stage. However, nascent applications provide evidence which can help to pinpoint some of the key social issues that may become prominent as more driverless applications develop. The resources sector in Australia has recently witnessed significant shifts to driverless transportation. Social science empirical research provides evidence to show how work has become reconfigured and relocated. For example, the automation of train driving in mines in the Pilbara has both restructured labour and displaced it (Ellem, 2016). Driverless trains have reduced the workforce required in the Pilbara and have created new jobs in control centres located in capital cities.

Geographical work on labour emphasises the significance of attending to the changing spatialities of the social impacts of driverless technologies. Crucially, whilst new jobs might be created by automation of a specific technology, these new jobs might be in a different location to where the technology is operating. The precise location of these new jobs can be influenced by a complex range of factors including the type of expertise required; the proximity to related service providers that are integral to operation; and economic efficiencies. Ellem's (2016) research indicates a tendency for control and supervisory jobs to move from rural and regional to metropolitan centres. Such a tendency potentially has implications for the future sustainability of rural and regional communities.

These social implications would potentially be exacerbated by fully automated driverless vehicles in the trucking industry. The services in many rural and regional communities in Australia rely on the trucking industry. These include service stations, highway cafes and restaurants, and motels. Fully automated trucks would potentially have negative effects on these businesses, as well as the support services that are involved in cleaning, supplying, maintenance and repair for these businesses. In many rural and regional communities, these spaces also perform an important social function (Prichard and McManus, 2000). It is therefore vital to account for the social, cultural and economic role of these supporting businesses especially for rural and regional Australia when evaluating the impacts on employment for driverless trucks.

Furthermore, the relocation of new 'supervisory' roles need not be bounded by the nation state. Offshoring of the control of driverless operations might be a cost effective for companies involved in implementing driverless technologies, but it introduces a host of other social problems, including regulatory challenges; lack of transparency of operation; in addition to the more explicit issue of domestic job loss (Urry, 2014).

3.3 Lowering labour standards

In current debates on the future of passenger transportation, there are uncertainties about whether taxis will be fully automated, or will involve a human operative. Whilst companies such as Uber have made clear their aspiration for fully driverless vehicles, experts indicate that this is unlikely in the short term. Therefore, in the meantime, the quality of labour standards for operatives of increasingly driverless technologies is an important issue. There is evidence that 'platform' companies such as Uber are undercutting traditional transportation providers by lowering their labour standards (Glöss et al., 2016). Designated as independent contractors, these workers have no rights to sick leave, annual leave, or maternity pay, and from a legal perspective have little protection from the organisations that they provide their labour for. It is vital therefore in the transition to driverless vehicles that the kinds of employment that are created are scrutinised for their labour standards.

4. Access and equity issues

Overall a seamless and integrated system of driverless vehicles with intelligent software and sensors is understood to be safer than one where human error is in a position to cause accidents and fatalities. However, there will likely be a period of transition where humans continue to control their vehicles

alongside driverless ones in the same fashion as current commercial airliner pilots working with fly-by-wire autopilots collaboratively. A situation where driverless vehicles are commercially available, but not yet ubiquitous, poses many unanticipated consequences that policymakers have yet to fathom. Projections suggest that a shift to driverless vehicles on land will not necessarily be a like-for-like substitution. Instead there is a high probability there will be a staggered, or stepwise, transition (Geels 2006). It is in the interim period between a fully driverless society and one where humans and smart vehicles co-mingle that will pose complexities for policymakers and transport planners with concerns for access and equity.

The overall safety and cohesion of vehicles will be determined by the ways human drivers respond to automated behaviours and the 'atmospheres' they produce on the road either subconsciously or overtly (Bissell 2010). A prevalent risk is that the many nuances and habits prevalent in motoring will be at odds with the clinical and inflexible driving practices of automated systems. Adequate safeguards will need to be in place to mitigate road equity for both classes of users and to promote tolerance (Waitt and Harada 2012). Instances of conflict or oversight will arise in a minority of cases, but these could be catastrophic. Robotics experts describe unusual situations that are difficult to anticipate but can have potentially profound consequences as 'corner cases' (Lipson and Kurman 2016 : 4). AI and robotics are at a distinct disadvantage in comparison to humans who are able to react spontaneously, intuitively and creatively to such events.

One area where driverless vehicles will invoke considerable issues around equity and access is for older adults unable to utilize private transportation. In Australia an unprecedented number of older drivers will be on the highways in the next few decades and these older drivers are not liable to forego automobile-dependence (Nakanishi and Black 2015). A chief risk here is the creation of a 'two-tier society'—that is, through class or age—between conventional road vehicles and those that are networking with the infrastructure, autonomous from human control and connected to each other (McCarthy 2016). Moreover, as driverless systems mature infrastructural investments will no doubt target affordances that are irrelevant or deleterious to solely human driven vehicles, such as vehicle-to-vehicle (e.g., platooning) or vehicle-to-infrastructure (e.g., wireless enabled traffic lights) communication systems (Lipson and Kurman 2016: 128). These will further alienate those unable or unwilling to utilize driverless systems.

One technique at hand to begin to unpick the access and equity issues is a socio-technical transitions approach utilizing different futures scenarios as outlined by Fraedrich et al. (2015):

Scenario 1
A first scenario is that of automobile 'evolution' wherein vehicles adopt driverless features as a part of perceived progress in ongoing safety, luxury and performance. Historically 'cruise control' is an example of a driverless technology already in place in the majority of automobiles adopted for safety benefits. Access to driverless vehicles in this scenario is gradual, predictable and in concert with both major incumbent manufacturers and policymakers in a grandly planned manner.

Scenario 2
A second scenario is a driverless 'revolution' where information and technology companies position existing human motoring social practices as obsolete in favour of knowledge work and entertainment; a notable present day forerunner of digital lifestyles while on the move is Google's Waymo. Here access and equity are far less predictable and liable to involve much software testing, updating, and troubleshooting by the citizenry at the expense of safety, predictability, access and control. Since incumbents will resist new entrants into the market from other sectors of the economy there is the risk of multiple systems and technologies conflicting or failing to cohere efficiently. The automobile will emerge as a part of a suite of personal technologies ranging from smart phones to social media services.

Scenario 3

A third scenario is 'transformation' where driverless vehicles deploy as hybrids of public and private transportation. In this future rolling stocks of vehicles are accessed as needed rather than owned as assets, often standing dormant while parked throughout the day. Here mobility patterns of users will change dramatically and in unforeseen ways and regulation and infrastructural standardization will be necessary for equity for all land vehicles to remain in place.

Regardless of which of these scenarios bears most similarity to reality in the future, access and equity will remain principle areas of action, as driverless vehicles impact upon 'spatial justice and the extension of basic human mobility rights and capabilities, including the potentials both to be mobile and to reside in a place' (Sheller 2014: 798). Notwithstanding widespread ubiquity of driverless vehicles, there will remain automobile enthusiasts and other niche-users who continue to demand access to traditional vehicles and access will need to remain open to them. As vehicles emerge as nodes of productivity or leisure and not simply transportation technologies there will be associated concerns about equity and access across the domains of social life.

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6. ARC Robotic Futures Project Team

Dr David Bissell is Senior Lecturer in the Research School of Social Sciences at the Australian National University. He combines qualitative research on embodied practices with social theory to explore the social, political and ethical consequences of mobile lives. His current research draws on social and cultural geography and mobilities research to investigate contemporary social problems involving mobility-labour relationships. Recent and forthcoming research projects are about the impact of commuting on cities; how mobile working practices are reshaping the home; and how new forms of workplace artificial intelligence are impacting on employment futures and family mobilities. He is co-editor of *Stillness in a Mobile World*, and the *Routledge Handbook of Mobilities*. He is on the editorial boards of *Mobilities* and *Social and Cultural Geography*.

Dr Thomas Birtchnell is a Senior Lecturer in the School of Geography and Sustainable Communities at the University of Wollongong. His latest book is *A New Industrial Future? 3D Printing and the Reconfiguring of Production, Distribution, and Consumption*. His research interests lie in the mobilities of people, knowledge and materials globally. He has recently published in the peer-review journals *Journal of Ethnic and Migration Studies, Transfers, Technological Forecasting and Social Change, Consumption, Markets & Culture, Journal of Geography in Higher Education, Area, Marketing Theory, Contemporary South Asia, Futures, Journal of Transport Geography, Mobilities and South Asia: Journal of South Asian Studies*. His books include *Indovation: Innovation and a Global Knowledge Economy in India* and *3D Printing for Development in the Global South: The 3D4D Challenge* co-authored with William Hoyle. His co-edited books include *Elite Mobilities* with Javier Caletrio and *Cargomobilities: Moving Materials in a Global Age* with Satya Savitzky and John Urry.

Prof Anthony Elliott is Dean of External Engagement at the University of South Australia, where he also holds the posts of Executive Director of the Hawke EU Centre for Mobilities Migrations and Cultural Transformations and Research Professor of Sociology. Professor Elliott is a prominent social theorist, sociologist and public intellectual. He is the author and editor of some 35 books, which have been translated or are forthcoming in a dozen languages. His books include *Social Theory and Psychoanalysis in Transition*, *Psychoanalytic Theory: An Introduction*, *Subject To Ourselves*, *The Mourning of John Lennon, Critical Visions, Social Theory Since Freud, The New Individualism* (with Charles Lemert), *Making The Cut: How Cosmetic Surgery is Transforming Our Lives, Mobile Lives* (with John Urry), *On Society* (with Bryan S. Turner), *Contemporary Social Theory: An Introduction, and Reinvention*. He is best known for *Concepts of the Self*, which has been in continuous print for over 20 years and across three editions.

Dr Eric L. Hsu is an Australian-based social scientist who specializes in the sociology of sleep, the sociology of time, and the social theory of disasters. His research has helped to advance the study of sleep from a sociological perspective. And his work has helped to investigate the phenomenon of social acceleration, the speeding up of social life. He is editor, most recently, of a 4-volume major works series on *Sleep: Critical Concepts in Sociology* and co-editor (with Anthony Elliott) of *The Consequences of Global Disasters*. Dr. Hsu is a Lecturer at the School of Communications, International Studies and Languages at the University of South Australia (UniSA). He is an Associate Member of UniSA's Centre for Sleep Research. At the Hawke EU Centre for Mobilities, Migrations and Cultural Transformations, he is leader of the 'Community Reactions to Disasters' (1.6) research node. He currently sits on the Editorial Board of *Palgrave Communications*.