PRIVACY, DEMOCRACY AND SOCIAL FAIRNESS

Technologies, including self-driving ones, are not autonomous – they (are made to) shape the worlds they are embedded in. CAVs are permeated with visions of the world in which they are deployed. As previous research has shown (Urry, 2004), automobility is a self-organising, non-linear 'technosocial system' that spreads the world over and includes cars, drivers, non-drivers, roads and roadside infrastructure, petroleum and electric supplies, multifold artefacts, technologies, signs as well as regulatory apparatus. It also has profound impacts on the social aspects of work, entertainment and family. Suburbanisation, for instance, has been one impact of the car culture: the automobility culture has had wider social effects beyond providing seamless and effective mobility. It has created the automobile city, transforming the time-space 'scapes' of the modern urban/suburban dweller (Sheller and Urry, 2000) as well as the automobile 'subject', together with his desires and performance of status, man/womanhood and power (Böhm et al., 2006).

Therefore, transition to CAVs, as well as any transformation in the transport sector, should take into consideration social science findings about the challenges and impacts of an automobility-dominated urban environment. CAVs may make demands on building new infrastructures, improvements and redesign of roads, regulation and human behaviour. They will also demand new skills and responsibilities from both users and non-users. Responsible innovation and good governance of

> Responsible innovation and good governance of the future road transport system must address the multiple complex societal issues at stake.

CAVs must address these challenges while trying to **create versatile mobility ecosystems that disrupt the monoculture of automobility and address the potential benefits of other forms of sustainable and quality-of-life-focused mechanised and non-mechanised personal mobility**. Beyond the arguable benefits that CAVs will bring, reflecting on the transition must address questions about how CAVs will be embedded in society, as well as anticipating the social impacts beyond transport issues. Innovation and policy dealing with future transport challenges should create a responsive ecosystem involving and engaging different stakeholders who will be impacted by unforeseen changes in the social constellations created by new transport arrangements.

This chapter considers the possible implications of future mobility solutions on privacy, democracy and equity. As will be discussed, when considering the potential issues at stake, the creation of regulatory sandboxes and living labs is advised where new technologies and mobility solutions can be tested with the engagement of citizens and other stakeholders, allowing them to observe and influence any possible implications.

13.1 Privacy

CAVs and other connected mobility options collect, store and use data in multiple ways. **The principles of 'privacy-by-design'[80], and 'privacy-by-default'[81] should apply without any manual input from the end-user**. The application of such principles must be reassessed time and again to fit both the societal expectations of privacy and developments in data applications in technology. Privacy-by-design should apply to broad sets of data, including personal identification, location-based service (LBS) data (location and time, destinations, travel time, etc.), LBS derivatives (habits or characteristics based on LBS data), video and audio surveillance and derivatives, pass-through (e.g. emails, photos, passwords, websites, music, videos, etc.), to name but a few. The principles of privacy must apply to a broad number of stakeholders who provide, use and store such data, including users, manufacturers, operating systems/control and application systems developers, mobility-as-a-service providers, maintenance and repair companies, insurance companies, enforcement agencies and regulatory bodies, once again to name but a few.

"Any entity processing personal data on behalf of data controllers *will also have direct obligations to safeguard privacy and data use.*"

To keep up with innovation in CAVs, traditional automotive manufacturers are transforming their business models. Besides hardware, they are also producing innovative software that leverages the immense amount of data CAVs will generate to continuously improve CAV services for users. Under the EU's General Data Protection Regulation (GDPR), any entity processing personal data on behalf of data controllers will also have direct obligations to safeguard privacy and data use. Stakeholders across the CAV value chain will need to enter into carefully structured agreements which identify each party's obligations regarding the use and protection of personal data and the apportionment of risk where data breach may occur. This is particularly important as authorities can impose fines of up to 4% of annual global turnover for breaches of principles governing data processing and data subjects' rights under the GDPR.

Gaining the trust of stakeholders is key to the successful transition to CAVs. If users do not trust the fact that their personal data is protected and adequate safeguards have been put in place to ensure security and privacy, they will opt out of data use and sharing. This would significantly restrict the improvement of CAVs and the usability of their services. Stakeholders will conduct comprehensive data-protection impact assessments, analyse any potential exposure under the applicable data-protection legislation and implement appropriate measures to ensure ongoing compliance. Such measures are to be applied as early as possible in the development of new CAV technologies, as privacy-by-design is an essential part of the GDPR.

As CAVs are fully connected to the world around them, the risk of hacking and security breaches is growing. This is important as it is not only personal data that may be compromised but lives may also be put at risk. During the process of CAV transition, manufacturers and other players across the CAV value chain must work closely together with regulators, certification entities, other key stakeholders and user organisations to establish a clear set of guidelines over the short to medium term and a formal set of regulations over the long term. Regulatory sandboxes may be applied to experiment with more flexible regulatory arrangements.

13.2 Democracy

Democracy is usually defined as a political system that provides the opportunity to choose and replace a government through free and fair elections; the active participation of the people, as citizens in political and civil life; protection of the human rights of all citizens; and a rule of law in which the law and procedures apply equally to all citizens (Diamond, 1999; Diamond, 2004). This may be translated into technology and mobility transitions as special attention to political and social fairness, social inclusion, privacy and human rights, as well as the transparency and accountability of all processes related to innovation and mobility.

Automobility has been dominated by economic visions of competitiveness and efficiency as well as social imaginaries of status, independence and comfort. It has arguably added social benefits while, at the same time, creating serious inequalities, social uncertainties and negative environmental impacts. (Re)creating a connected, automated and omnipresent car-dominated mobility ecosystem may impact citizens in multiple ways. Point-to-point CAM will limit situations of social inclusion by using ever-more public space for mobility infrastructure. Efficient and seamless transport systems may limit participation in the political process by hindering the access of specific cultural or social groups (either by pricing them out of using such systems or because they lack the skills to use them), **as well as severely restricting the availability and use of public spaces for social and political interaction**.

> “Efficient and seamless transport systems may limit participation in the political process *by hindering the access of specific cultural or social groups.*”

As vehicles will be fully connected and users will not be driving, CAVs may also increase access to politically and socially relevant information through social media and other social platforms increasing the challenges posed by ‘filter bubbles’ (the intellectual isolation that can occur when platforms use algorithms to select information it is assumed a user wants to see), further assisting the spread of a post-truth and post-trust political culture (Bozdag and van den Hoven, 2015). Therefore, **innovation, development and the deployment of CAVs must anticipate and respond to potential social impacts on democratic principles such as accountability, transparency, trust and social inclusion**.

At the opposite end of the spectrum, the benefits of future mobility, enhanced access, the declining social exclusion of vulnerable groups, connectedness, and sharing, may enhance political participation, engagement, and political inclusion, thereby widening the democratic process (Vecchio, 2017).

To avoid the traps of policy push and regulatory blockage, regulatory sandboxes and living labs should be created in which innovators, citizens and other stakeholders may experiment together with new technologies. Involving and engaging knowledge of diverse stakeholders will ensure that innovation in CAVs includes complex social impacts and uncertainties. Regulators will learn and adjust regulatory regimes since CAV deployment requires constant regulatory adaptation.

> "Involving and engaging knowledge of diverse stakeholders will ensure that innovation in connected and automated vehicles *includes complex social impacts and uncertainties.*"

Beyond ethical considerations, societies have not yet found ways to meet societal concerns and expectations when developing new technologies that include machine learning, AI and multidimensional connectivity. For example, CAVs use machine learning to address the complexities of driving in different environments, terrains and social settings. In this sense, CAVs are not finalised products or fully formed technologies, nor will they ever be. The algorithms that drive CAVs are continuously updated with new data to handle any eventuality that may arise on the move. Machine learning in specific CAVs may be a fleet learning – any information that helps the system to better understand eventualities will be shared with all other CAVs within a specific, privately owned fleet rather than across the entire mobility system. One of the challenges to the democratic process lies in this 'privatisation of learning', which jeopardises both public trust and the potential long-term benefits of CAVs discussed in previous chapters.

The politics of algorithms, also in transport technologies, is key for the future of democracy. In many ways, algorithms tend to be 'black boxes': devices which can be viewed in terms of inputs and outputs but without any knowledge of their internal workings. In addition, as algorithms that enable CAVs to navigate the complexities of their environments become more specialised and complex, even their creators may no longer be able to understand them. Algorithmic accountability in terms of the legibility of algorithms is a major challenge. **Algorithms in CAVs are tasked with engaging with uncertain and complicated**

environments, the complexities of which cannot be captured by a set of simple and formal rules. Therefore, a 'right to explanation' (Goodman and Flaxman, 2016) is required as algorithmic decisions may have a profound impact on people's lives.

In addition, incorporating social and ethical values, as well as other societal concerns must be reflected in the design of CAVs as AI systems. For CAVs to be safe, trusted and accepted, **AI should be designed to take up ethical considerations and moral consequences in an accountable, responsible and transparent way**[82]. This may include ethical considerations beyond privacy and data security, including ethical dilemmas in different road-use situations impacting different stakeholders. Similar to privacy-by-design, 'values-in-design' (Friedman et al., 2006 in Zhang and Galletta, 2006) methodologies are to be applied that have human values as their main focus. This process is a theoretically grounded approach to technology design that accounts for human values in a principled, systematic and comprehensive manner.

Following the principles of accountability, responsibility and transparency (ART) in algorithmic decision-making that enable CAVs to operate, special attention must be paid to democratising the process of (social) learning. Advances in machine learning should be made public and shared across the whole system and must not remain proprietary to just one company or technology provider. Frameworks and processes of responsible research and innovation (RRI) (Von Schomberg, 2013 in Owen et al., 2013) should be applied, paying attention not only to the risks and challenges of new technologies but also to public concern as to how and why specific innovations happen in autonomous mobility systems.

It is also interesting to note that disruptive technologies, CAVs included, claim to offer solutions to past social pathologies of technological development, such as inequality, social exclusion or ethical dilemmas. Innovation in CAVs suggests a special form of 'solutionism' that frames the present as deficient as regards a specific mobility technology fix that will provide an appropriate, technologically and socially beneficial solution – a situation referred to as 'technopoly' by Postman (Postman, 1992). This is exemplified by claims that CAVs can provide a solution to human driving mistakes. While the number and gravity of accidents will probably be reduced, other problems, ethical challenges and social contingencies will emerge. Institutions and individuals need to build and develop an appropriate reflexive capacity to diverge from a technology-fix approach and focus on social learning, complex assessments of impacts and responsiveness to challenges thereof, both in the sense that people learn and assess impacts socially and that societies learn, reflect and respond constantly.

13.3 Social fairness

CAVs are also discussed as vehicles for social improvement (Bilger, 2013). They are promoted as offering social benefits beyond efficiency, sustainability and connectivity. It is suggested that automation technologies practically remove the barriers to driving. They may enhance the potential mobility of those who are prevented from driving, such as the elderly or underaged population, people with medical conditions or those without a driving licence. Existing in-vehicle autonomous technologies, such as collision warning, lane-departure warning, parking assist, navigation assist, etc., are beneficial to older and less-experienced drivers, helping them to avoid accidents and improving their comfort. Such technologies can enable the elderly to use cars safely by compensating for the decline or loss of functional abilities (Eby et al., 2016). However, these user groups also have special needs when it comes to interacting with new technologies and tend to avoid or even reject them due to a lack of skills, ability or desire (digital divide) (Simões and Pereira, 2009). In addition, new pricing models which attempt to address greater demand (both in terms of general road use and peak-hour use) may also adversely impact poorer user groups who may be priced out of accessing these new modes of mobility.

A transport system is fair if, and only if, it provides a sufficient level of accessibility to all under most circumstances (Martens, 2017). In this respect, during the transition to CAVs, special care and attention should be given to vulnerable groups in accordance to the principles of justice which argue that social and economic inequalities must be arranged to the greatest benefit of the least advantaged. Insufficient or a lack of transport, as well as the lack of skills to use versatile and affordable means of transport, are the primary cause of people's inability to escape poverty, find jobs, meet daily subsistence needs, including the social needs of spending time with family and friends. This is especially relevant in gendered contexts causing specific harm to women in need.

> "Future transport will see the emergence of new mobility opportunities *increasing the access of specific social groups to efficient and affordable public transport options.*"

In addition to CAVs, future transport will see the emergence of new mobility opportunities increasing the access of specific social groups to efficient and affordable public transport options. The wide availability of last-mile options, however, may hinder the choice of more active transport modes, such as walking or cycling, with negative impacts on public health. In addition, if new transport opportunities enter into competition with public transport and eventually contribute to reducing its efficiency, they can further limit accessibility for poorer social groups and thereby reduce transport equity. Interventions in the transport system are only socially legitimate as long as they have no detrimental impact on the accessibility levels experienced by those who already experience poor accessibility levels. One problem is that transition to CAVs requires major investments in roadside and other transport infrastructure. The high costs of new infrastructure may adversely impact vulnerable groups. Limited resources will cause the diversion of funds from enhancing traditional, public modes of transport, will reduce investment in new forms of public transport and infrastructure for traditional modes of transport, like cycling, and will obstruct the creation of urban environments that help reduce mechanised mobility and invest in non-mechanised mobility, such as improving the pedestrian infrastructure.

An additional risk in terms of equity lies in the optimisation of the system. Research results suggest that the traffic management systems that utilise data from CAVs can maximise the capacity of the transport system through dynamic congestion pricing, capping the number of vehicles using the system at any given moment, or even limiting vehicle ownership (Belov, 2017). This may also adversely impact poorer user groups who may be priced out of high-demand travel time slots. The traffic management system would be able to know the identity, position and transport activity of every vehicle user, at any given moment, including their history and their expected future behaviour. While technical solutions based on

CAVs may maximise the total benefit for society, the risk is that the cost of accessing the system would be regressive, becoming proportionally too high for the lower-income population and thus actually hurting vulnerable social groups. The combination of equity and privacy issues with the potentially higher degrees of automation in traffic management raises the question of democracy in transport activity. While the current conventional transport system allows for anonymous access to all, **new solutions based on CAVs will highlight the trade-offs between individual freedom and system efficiency**.

As for privacy and democracy, and for equity and fairness, too, the complexity of the issues at stake makes it very difficult to anticipate all the possible implications of new mobility options. Setting up a network of European living labs where new mobility solutions can be tested with the direct engagement of citizens can help both public and private entities to ensure that the new options will be financially sustainable while simultaneously contributing to improving the transport system.

Some ethical considerations are discussed in Box 12.

BOX 12. New ethical issues in transport

A recent article published in *Nature* (Awad et al., 2018) explored moral decision-making as regards AVs. The investigation presented volunteers worldwide with scenarios involving AVs and unavoidable accidents with pedestrians and passengers. Participants had to decide which lives the vehicle would either spare or take based on factors such as gender, age, fitness and even species of the potential victims. The results suggest that while there are some universal moral preferences across the globe (saving the largest number of lives, prioritising the young, and valuing humans over animals), **ethics varied significantly between different cultures, sometimes leading to controversial moral preferences** (e.g. discriminating against overweight or homeless people). The answer to the question whether the behaviour of AVs conflicts with the moral values of society can be a decisive factor for user acceptance.

In Germany, an Ethics Commission on CAVs was established in September 2016, with experts from academia, society, the automotive industry and the digital technology sector. In June 2017, they delivered a report with 20 ethical rules as initial guidelines for policymakers and lawmakers, setting out special requirements in terms of safety, human dignity, personal freedom of choice and data autonomy (German Federal Ministry of Transport and Digital Infrastructure, 2017).

In the US, Google's algorithms misidentified images of people with dogs and black people as gorillas. As AI expert Vivienne Ming explained, machine-learning systems often reflect biases in the real world. Some systems struggle to recognise non-white people because they were trained on internet images which are overwhelmingly white (Barr, 2015).

CAVs are made possible by major advances in AI and machine learning. However, in CAV advancement, the so-called Moravec's paradox (named after Hans Moravec, an early robotics expert), seems particularly important. According to him "[T]he hard problems are easy and the easy problems are hard" (Pinker, 1995). The challenge that is particularly hard is that while driving is a relatively simple task, it is easy to create a set of rules that see driving as an engineering task so CAVs are then optimised to solve these tasks. However, the world of mechanised mobility is also a social world with many social and behavioural uncertainties.

SUMMARY

Transport and land use have a strong historical relationship. A disruption in the transport sector will have strong impacts on urban and land-use development. Without an active policy by local authorities, the reduced costs of travelling enabled by the new trends and technology options may put the vehicle back at the centre of urban mobility and intensify the problems that have affected urban living over the last century. At the same time, new technologies provide the tools to achieve a new comprehensive governance of the mobility options available in the city. Shared and individual transport, public transport and soft transport options should all help to satisfy peoples' mobility needs in a sustainable and equitable way. City administrations must ensure that instead of competing for profit, all actors in the mobility landscape will cooperate in achieving this overarching goal. In addition to transport governance, cities have the option to rethink the urban fabric in order to reduce the need for mobility. In Europe, there are important initiatives and platforms to support the work of urban planners and promote the exchange of information and best practices. This chapter addresses ways in which cities can support the transition towards sustainable urban mobility.