LAW AND TECHNOLOGY IN THE DIMENSION OF TIME

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Forthcoming in Sofia Ranchordas and Yaniv Roznai (eds) *Time, Law and Change: An Interdisciplinary Study* (Hart Publishing, 2020)
[2019] *UNSWLRS* 75

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Lyria Bennett Moses and Monika Zalnieriute 'Law and Technology in the Dimension of Time' *forthcoming* in Sofia Ranchordas and Yaniv Roznai (eds.) *Time, Law and Change: An Interdisciplinary Study*, Hart Publishing, 2020.

Chapter 14

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Lyria Bennett Moses and Monika Zalnieriute

I. Introduction

The relationship between law and technology in the dimension of time is a popular theme in legal and policy circles, usually recurring as a critique of outdated laws.[1] In these debates, law is most often portrayed as falling behind technology as both travel together along the dimension of time. While such images simplify the relationship between law and technological change, they reflect some insight into the challenge faced in ensuring law remains relevant, appropriate, comprehensive, well-adapted and clear in the face of an ever-evolving socio-legal-technical landscape.[2] Law's struggle in the face of socio-technical change has been referred to as the pacing problem[3] or the challenge of regulatory connection.[4]

A phenomenon that receives much less attention in these popular debates is the temporal impact of attempts to embed the law and social values into technological design. There are a variety of terms that capture ideas around design-based regulation, each with different foci and associated literature.[5] For example, 'value sensitive design' focuses on the design process, while 'compliance by design' focuses on extracting, modelling and implementing legal requirements but both are about using architecture and processes to achieve a particular effect (respecting values or ensuring compliance with law). The idea of embedding law, values or preferences into technical design choices and business processes is rarely subjected to similar time-inspired critiques despite the fact that technology and procedures can be designed around outdated understandings of legal requirements and policy goals. Whether technology design decisions are based on technical,

1 This generally takes the form of mocking outdated or short-sighted legal requirements such as the Locomotive Act 1865 (UK) which required that self-propelled vehicles be accompanied by a man with a red flag walking ahead of it.

2 L Bennett Moses, 'Recurring Dilemmas: The Law's Race to Keep Up with Technological Change' (2007) *University of Illinois Journal of Law, Technology and Policy* 239.

3 GE Marchant, BR Allenby and JR Herkert (eds), *The Growing Gap Between Emerging Technologies and Legal-Ethical Oversight: The Pacing Problem*, The International Library of Ethics, Law and Technology 7 (Springer, 2011).

4 R Brownsword and M Goodwin, *Law and the Technologies of the Twenty-First Century: Text and Materials* (Cambridge University Press, 2012) Pt V.

5 See section III.B of this chapter and the literature cited therein.

commercial, legal or regulatory objectives and requirements (or combinations thereof), they may come to be seen as obsolete as those objectives and requirements evolve. Therefore, the challenge of staying up-to-date or continuing to fit in an evolving world is not only a *legal* challenge.[6] Technology can also fail to meet evolving legal requirements or fail to adapt seamlessly to other technical elements within systems as the broader socio-legal environment evolves. In particular, law can impose particular demands on technology, so that it is called on to catch up.

There is, however, no perfect symmetry here. Both law and technology are human processes; while technological change is sometimes framed as inevitable or exogenous, it is driven by humans (most obviously in laboratories and corporations, but also acting as consumers and regulators).[7] This means that lawmaking and technology design are constrained by human knowledge, inevitably based on data from the past and present. The pace of legal change makes it more predictable so that, while it is rare that lawmakers will foresee not-yet-existing technologies,[8] technological design may pro-actively pre-empt legal change long before its implementation (which may be years after it is first proposed). Because humans can only consciously influence the future, based on knowledge and action in the present,[9] technology can more easily be designed so as to pre-empt law than the converse. This explains why law lagging technology is a more common complaint than the converse.

Just as the past and the present can influence today's technical and legal agendas, so do our beliefs about the socio-techno-legal landscape of the future. For example, ideas about tomorrow's technologies will affect how laws are drafted today. What we can do, what we ought to do and what we in fact do is influenced by the socio-techno-legal landscape of the present. But we also design that landscape with an eye to the future, concerned about, for example, the future-proofing of law through the attractive, if unachievable, goal of technological neutrality.[10] Here, a sense of the eternal failure of law to keep up with technology encourages the design of flexible laws. But what we need are adaptable and flexible socio-techno-legal *systems* that recognise all the ways in which its elements can fall out of sync with the broader landscape.

This chapter seeks to explore how an enhanced understanding of the evolution of socio-techno-legal landscapes over time can help to improve decision-making in the present. Section II summarises how legal scholars imagine technology and the future and how they characterise law's failures to adapt to socio-technical change over time. Section III discusses the various approaches

6 Generally on the pacing problem, see GE Marchant, 'The Growing Gap between Emerging Technologies and the Law'. *The Growing Gap between Emerging Technologies and Legal-Ethical Oversight* (Springer, 2011) 19–33; L Bennett Moses, Lyria Bennett. 'How to Think about Law, Regulation and Technology: Problems with "Technology" as a Regulatory Target' (2013) *Law, Innovation and Technology* 5.1, 1–20.

7 On the importance of lawyers taking account of both instrumentalist and substantivist understandings of technology, see generally A Cockfield and J Pridmore, 'A Synthetic Theory of Law and Technology' (2007) 8(2) *Minnesota Journal of Law, Science and Technology* 475; MAC Dizon, 'From Regulating Technologies to Governing Society: Towards a Plural, Social and Interactive Conception of Law' in H Morgan and R Morris (eds), *Moving Forward: Tradition and Transformation* (Cambridge Scholars Publishing, 2012) 115.

8 An exemption is the case of feared technologies on the near-horizon, as in the case of human reproductive cloning which was banned before it was ever done.

9 D Kutach, 'The Asymmetry of Influence' in C Callender (ed), *The Oxford Handbook of Philosophy of Time* (Oxford University Press, 2011).

10 Bennett Moses (n 2); A Chander, 'Future-Proofing Law' (2017) 51(1) *UC Davis Law Review* 1 (summarising mostly US scholarship in a special issue).

that describe the use of technology as the primary regulator (so that design choices replace or supplement law's regulatory effect) and considers how such design-based regulation fares along the dimension of time. Section IV supplements these theoretical musings with concrete examples drawn from the context of automated driving systems and data privacy laws in Australia and Europe. Section V concludes.

II. Socio-Technical and Legal Change and the Dimension of Time

The idea of time plays an important role in policy and scholarship on the theme of law and technology. This importance manifests via the perceived chronologies of technology (fast) and law (slow), as well as considerations of the timing of legal interventions designed to regulate technology. The relationship between law and technology over time is often conceptualised as a race in which law is the perpetual loser, although the reality is far more complex than this metaphor would suggest. For instance, the fast pace of technology is often associated with the oversimplification of the innovation process and the idea that innovation is mostly disruptive, which is not always true. Actual chronologies of technology and law will vary. In times of perceived crisis or where it is politically opportune, legal change can be surprisingly quick. Conversely, the innovation process can be frustrating and experience extended periods of slowness in particular fields. As this section will demonstrate, law and technology do not take isolated journeys over the course of time and history, and developments in one area will often affect the other. On the one hand, law may prohibit certain paths of technological development, such as human reproductive cloning.[11] On the other hand, technology may change or render obsolete the social impact of law, as was the case, for instance, when barbed wire fences effectively overturned the law of the open range in the American West.[12] This section briefly sketches the role that time plays in understanding the relationship between legal and socio-technical change.

Both the content of law and features of socio-technical systems can be understood and mapped along the dimension of time. Legislation is passed, perhaps amended and possibly repealed, all by reference to explicit commencement dates and, more rarely, sunset clauses. While the law of the present comprises the cumulative effect of this alongside case law, one can also search legislation as at particular points in time.[13] Moreover, judges look to the past to construct the future, interpreting pre-existing statutes and case law to articulate the principles on which cases in the present will be decided. There is a sense of legal progress along the dimensions of time, as concepts are explained and refined, bad ideas are discarded, and statutes are adapted to new possibilities. Similarly, technological artefacts and possibilities generally expand over time due to the engines of invention and innovation. For example, computers began with ideas and designs in the nineteenth century, with the first physical electronic digital computer, the Atanasoff-Berry Computer, built between 1937 and 1942.[14] Before this, writing computer software was not an

11 Prohibition of Human Cloning for Reproduction Act 2002 (Cth).
12 G Calabresi, *A Common Law for the Age of Statutes* (Harvard University Press, 1982) 244.
13 For example, the Australian Legal Information Institute, Austlii, allows for point-in-time searches of New South Wales legislation: http://portsea.austlii.edu.au/pit/xml/nsw/act/ (last accessed 24 September 2019).
14 AR Burks and AW Burks, *The First Electronic Computer: The Atanasoff Story* (Ann Arbor, University of Michigan Press, 1988).

observable activity, whereas today, mobile phones have become more powerful computers than machines that once filled rooms.

With regards to technology, there is also a general sense that it is not only moving forwards over time but that the rate of change is increasing.[15] In articulating the challenge of this pace for law, references to Moore's law (that the performance of integrated circuits doubles over 18–24 months) are common, as are references to the rate at which new products and processes are introduced and the rapid growth of technologically driven enterprises.[16] In the world of technology, there is a sense of exponential acceleration; a sense that time is not only moving quickly but that the pace is simultaneously exhilarating and exhausting. Law, on the other hand, is rarely described in such fast-paced terms. The point here is not that there is such a thing as 'speed of change' that can be measured and compared across disciplines in a meaningful way, only that the literature suggests a perceived difference in relative velocity.

It is therefore unsurprising that the dominant discourse about law and technology envisages a perpetual 'catching up'. For example, 'Law, marching with medicine but in the rear and limping a little'[17] and 'The hare of science and technology lurches ahead. The tortoise of law ambles slowly behind'.[18] These metaphors place law clearly behind technology in their chronological orientations – law commands in the present but is directed to the socio-technical landscape of the past. Judges are often conservative, declining to develop or interpret law to extend its protective reach when older formulations fail to deal adequately with new situations.[19] Thus formulations and categories designed around an historic socio-technical landscape continue to operate into the present, to the detriment of those who may be harmed or have their values impinged on by newer technologies. It is not just formal law, but also policy and ethics that are said to struggle on a rapidly moving and risky technological frontier.[20] There are thus calls for disruptive and innovative thinking in government, legal and policy circles that mirror the mantras of technological innovation.[21]

The reification of law and technology as differently paced travellers moving along the dimension of time is often unhelpful. Aside from an arbitrary metric of 'progress', against which it would be difficult to compare such different entities as legal rules and technical systems, engineers and lawyers work on very different kinds of problems. Engineers' ability to create the future by sheer will is unmatched in the legal profession, outside of roles such as legislators and, some might argue, judges. Most of the time, lawyers are called on to predict the present based on texts written in the past. It is also not clear whether we want legal rules that are projected too far into the future – road rules that prescribe how to overtake vertically would be useless and unhelpful. The inability

15 RW Rycroft, 'Time and Technological Innovation: Implications for Public Policy' (2006) 28 *Technology in Society* 281.
16 R Brownsword, E Scotford and K Yeung, 'Law, Regulation and Technology: The Field, Frame and Focal Questions' in R Brownsword, E Scotford and K Yeung (eds), *The Oxford Handbook of Law, Regulation and Technology* (Oxford University Press, 2017) 3, 3–4.
17 *Mount Isa Mines v Pusey* (1970) 125 CLR 383, 395.
18 M Kirby, 'Medical Technology and New Frontiers of Family Law' (1987) 1 *Australian Journal of Family Law* 196, 212.
19 See distinction in AJ Cockfield, 'Towards a Law and Technology Theory' (2004) 30 *Manitoba Law Journal* 383.
20 Rycroft (n 15) 297; D Rejeski, 'Public Policy on the Technological Frontier' in Marchant, Allenby and Herkert (eds) (n 3); MH Shapiro, 'Is Bioethics "Broke"? On the Idea of Ethics and Law "Catching Up" with Technology' (1999) 33 *Indiana Law Review* 17.
21 Rejeski, *ibid*..

to predict the directions of technological change or the nature of its legal and social implications makes the creation of law directed at the future an extremely challenging task.[22]

Despite the prevalence of hare and tortoise metaphors in comparing technology and law,[23] it is not true that lawyers focus on the old and ignore the new. To the contrary, there is an obsession with new problems generated by new technologies, even as old systems receive less attention. For example, by 1858 when the railroad system was in its infancy, two treatises on railroad law had been published in the United States.[24] These dealt with a variety of then-current issues including property rights over track and eminent domain as well as liability for damages to employees, passengers, stock and land. No doubt, railroads continue to be guided by law and have legal officers or external firms advising on corporate responsibilities, liability for accidents, duties to employees and so forth. But there are no longer railroad lawyers, a term used to describe the pre-presidential career of Abraham Lincoln,[25] and railroad law courses are rare. In contrast, there are increasing numbers of courses and articles focusing on issues related to digital platforms, artificial intelligence, telecommunications, biotechnology and so forth. At least in selecting professional labels and areas of specialty, lawyers prefer to situate themselves on the technological frontier. Indeed, legal imagination of new technological possibilities is often wildly adventurous, as captured in Beebe's description of golden age space law scholarship.[26] Perceptions that law is falling behind are thus not based on outmoded fashions in legal scholarship.[27]

Rather, law is seen to fall behind because there are real challenges for those seeking to evaluate, interpret, enforce or obey laws applied to new technologies. There are always new legal problems that arise at the frontier of socio-technical change. Legal rules are designed for things, activities and relationships that are envisaged by their creators. Linked to the limits of legal interpretation, statutes and judgments are worded within the limits of their author's conceptions of what might be created, what might happen and how interactions might occur. While the human imagination can project some way forward on the dimension of time, forecasts are imperfect, and law sometimes stumbles when applied to situations that were unexpected. Even if words are interpreted generously in light of changed circumstances,[28] interpretation of statutory language in particular has limits – courts cannot change what a statute says to optimise outcomes for unforeseen circumstances.[29] Socio-technical change can thus result in calls for new law (to prohibit,

22 GN Mandel, 'Legal Evolution in Response to Technological Change' in Brownsword, Scotford and Yeung (eds) (n 16) 226, 238.

23 L Bennett Moses, 'Agents of Change: How the Law "Copes" with Technological Change' (2011) 20 *Griffith Law Review* 263.

24 EL Pierce, *A Treatise on American Railroad Law* (Baker Voorhis, 1857); IF Redfield, *A Practical Treatise upon the Law of Railways*, 2nd edn (Little, Brown and Company, 1858).

25 beyondthehistorytextbooks.com/2015/05/12/abraham-lincoln-railroad-lawyer-extraordinaire/ (last accessed 24 September 2019).

26 B Beebe, 'Law's Empire and the Final Frontier: Legalising the Future in the Earlyorpus Juris Spatialis' (1999) 108 *Yale Law Journal* 1737.

27 For a broader discussion of trends in the legal academy, see SK Stadler, 'Essay: The Bulls and Bears of Law Teaching' (2006) 63 *Washington and Lee Law Review* 25.

28 Cockfield (n 19).

29 See, eg, *National Rugby League Investments Pty Ltd v Singtel Optus Pty Ltd* (2012) 201 FCR 147, 170 [96] '…no principle of technological neutrality can overcome what is the clear and limited legislative purpose of s 111 [of the *Copyright Act 1968* (Cth)]. It is not for this Court to re-draft this provision to secure an assumed legislative desire for such neutrality'.

regulate or encourage these new possibilities), clarification of rules (where interpretation in the light of new possibilities is unclear, re-targeting of rules (where new conduct falls inside or outside existing language in undesirable ways) and repeal of rules (where the justification for those rules no longer holds, or the rules are no longer necessary or cost-effective).[30]

There is much discussion in the literature about the timing of legal interventions, mostly in the context of discussions about the best time to introduce new laws that prohibit, regulate or encourage new activities. Many of these refer to the 'Collingridge dilemma', an articulation of the challenge in regulating in a shifting space.[31] Move too early and there is a risk that new laws will be poorly designed, failing to match the final form that technology takes. Move too late and socio-technical systems are less flexible – the changes needed to comply with new regulation make them very expensive or even impossible.[32] The regulation of the Internet is a good example to illustrate this tension.[33] For instance, laws regulating copying using digital tapes failed to deal with Internet file-sharing and thus became irrelevant, while, by failing to incorporate early cyber-security standards, it is difficult to retro-fit the Internet for security today. As Murray points out, new regulations are influenced by an existing regulatory framework rather than operating from scratch.[34] There is thus path dependence in socio-technical and regulatory states and some regulatory options prove difficult in practice once socio-technical systems have reached particular states of development. The choice of regulatory timing thus ought to be made with awareness of the diffusion pattern of the technology concerned so that there is, for example, greater urgency where technology diffuses exponentially after reaching a critical mass of users.[35]

It is not only law that is called on to adapt to socio-technical change, but also technologies that are called on to adapt to (that is, comply with) changing laws. Compliance with new regulations will often require adjustments, as where the law requires the installation of seatbelts or better fuel efficiencies in automobiles. Such laws may not only require changes in the physical artefact (the car) but also in the physical factories, human workers and research laboratories of automobile manufacturers. Just as law may be based on an old understanding of socio-technical systems, so too socio-technical systems may have been designed for obsolete legal requirements or be based on designs that did not account for new legal requirements. This is discussed further in the following section.

Institutionally, there are a variety of players whose mission includes navigating the socio-techno-legal frontier.[36] From the legal side, Law Reform Commissions (popular in the Anglo-Australian sphere) have, as part of their mission, the task of ensuring the adaptation of law to

30 Bennett Moses (n 2).
31 D Collingridge, *The Social Control of Technology* (St Martin's Press, 1982).
32 See also A Knie, 'Yesterday's Decisions Determine Tomorrow's Options: The Case of the Mechanical Typewriter' in M Dierkes and U Hoffmann (eds), *New Technology at the Outset: Social Forces in the Shaping of Technological Innovations* (Campus Verlag, 1992).
33 M Mueller, *Networks and States: The Global Politics of Internet Governance* (MIT Press, 2010); J Goldsmith, 'Regulation of the Internet: Three Persistent Fallacies' (1997) *Chicago-Kent Law Review* 73, 1119.
34 AD Murray, *The Regulation of Cyberspace: Control in the Online Environment* (Routledge-Cavendish, 2007) 240.
35 G Bernstein, 'The Paradoxes of Technological Diffusion: Genetic Discrimination and Internet Privacy' (2006) 39 *Connecticut Law Review* 243.
36 Bennett Moses (n 23).

manage socio-technical change. As one former Commissioner observed, '[a]lmost every task of the Commission evidenced the impact of science and technology on the law'.[37] From the technological side, technology assessment bodies, particularly in the European Union, seek to understand and develop policy around new technologies.[38] European institutions, such as the European Commission, have also played a strong role in developing policy in response to emerging possibilities. Other bodies with different expertise also emerge or take on challenges. In the context of the case study in section IV, the National Transport Commission (NTC) has taken the role of developing policy for advances in automated driving systems and related technologies.[39]

As time moves forward, law and technology are called on to adjust to the expectations of the other. While much of the literature focuses on law needing to keep up with technology, this is but one thread of a broader need for cross-adjustment. In particular, technological design is often shaped by law and may itself become a regulatory force that furthers a particular policy. The next section explores these issues, both at a general conceptual level and through the lens of time.

III. Design-Based Regulation in the Dimensions of Law and Time

A. Regulatory Effects of Technology

Law and technology do not simply exist at particular time-states, they are forces that exert influence and shape social affairs. One way of expressing this is that law and technology are forms of regulation, which can be defined as 'the sustained and focused attempt to alter the behaviour of others according to standards or goals with the intention of producing a broadly identified outcome or outcomes, which may involve mechanisms of standard-setting, information-gathering and behaviour-modification'.[40] The regulatory nature of law is widely acknowledged. There are also a variety of ways in which technology can be regulatory through all three mechanisms articulated within Black's definition above. In the context of automated driving systems, for example, data analytics can be used to optimise safety features for standard-setting, embedded cameras could be used for information-gathering, and eye movement trackers may sound an alarm when a driver seems drowsy for behaviour-modification. Similarly, technology can force compliance through, for example, automatic braking at stop signs or vehicle software that prevents manual entry while in motion. These examples demonstrate that while law specifies what is permitted, encouraged, controlled or prohibited, technology can de facto shape what is easy, possible, difficult or impossible.

37 M Kirby, 'Law, Technology and the Future' (1989) 21 *Australian Journal of Forensic Sciences* 112, 112.
38 European Parliamentary Technology Assessment, eptanetwork.org/ (last accessed 24 September 2019).
39 NTC, *Roads / Technology / Automated Vehicles in Australia,* www.ntc.gov.au/roads/technology/automated-vehicles-in-australia/ (last accessed 24 September 2019).
40 J Black, 'Critical Reflections on Regulation' (2002) 27 *Australian Journal of Legal Philosophy* 1.

B. Conceptual Lenses on the Regulatory Effect of Technology

Scholarship discusses regulatory effects of technology through a variety of conceptual lenses and approaches, such as 'code is law', 'design-based regulation,' 'values sensitive design', 'compliance by design' and 'compliance through design'. In addition to such general approaches that we discuss below, context specific labels and terms such as 'RegTech'[41] and 'privacy by design',[42] are also abundant. The meanings of these terms are subtly different, and each is also multivocal. Nevertheless, they all describe a common idea, namely that technological choices, like just law, have the capacity to shape societal behaviour.

i. Code is Law

Lessig was the first to bring these ideas to the forefront of legal scholarship.[43] Lessig's core idea was that there are different modalities of regulation – legal rules, social norms, market and architecture or, in the world of cyberspace, code. Hence the famous statement that 'code is law', which expressed the position that computer code controls interactions in cyberspace in a potentially more powerful manner than traditional statutes. Benkler expanded on this idea by describing the ways in which networked information infrastructure enhances possibilities for broad, diverse communication and cooperative enterprises, which law may oppose but only at great cost.[44]

The role that technology can play in a regulatory system, however, extends well beyond computer code, and may include, for example, speed humps that encourage drivers to travel at slow speeds on residential roads, which can be more effective than a sign displaying a legal speed limit.[45] Approached through such lens, societal behaviour can thus be regulated not simply through legal prohibitions but also through technological prescriptions, and technology companies as well as states can be regulators. In the literature, the ability of law and code to regulate is often described in terms of relative power, fluctuating over time. Johnson and Post believed that the power of national laws would wane in the context of the Internet,[46] while Wright and De Philippi believe that, despite the potential for blockchains to operate as autonomous systems, there are ways in which law's power can be preserved.[47] There is a time dimension to such arguments – new techniques of legislative intervention and new technological means to work around laws or avoid detection and enforcement are in constant competition, with different victors at different moments in time. The extent to which regulation by law or regulation by code dominates may thus be time-dependent.

41 DW Arner, J Barberis and R Buckey, 'FinTech, RegTech, and the Reconceptualization of Financial Regulation' (2016) *Northwestern Journal of International Law and Business* 37, 371.
42 A Cavoukian, 'Privacy by Design: The 7 Foundational Principles'. Information and Privacy Commissioner of Ontario, Canada (2009) 5. Marc Langheinrich, 'Privacy by Design—Principles of Privacy-Aware Ubiquitous Systems' International Conference on Ubiquitous Computing (Springer, Berlin, Heidelberg, 2001).
43 L Lessig, *Code and Other Laws of Cyberspace* (Basic Books, 1999).
44 Y Benkler, *The Wealth of Networks: How Social Production Transforms Markets and Freedom* (Yale University Press, 2006) 9, 130, 139, 149, 212, 271–72, 385.
45 B Latour, 'On Technical Mediation – Philosophy, Sociology, Genealogy' (1994) *Common Knowledge* 29, 38–41.
46 DR Johnson and DG Post, 'Law and Borders – the Rise of Law in Cyberspace' (1996) 48 *Stanford Law Review* 1367.
47 P De Filippi and A Wright, *Blockchain and the Law: The Rule of Code* (Harvard University Press, 2018).

ii. Value Sensitive Design

The idea of 'value sensitive design' is related to the 'code is law' approach, but the focus is less on attaining a particular regulatory outcome and more on 'building in' or 'embedding' values as an aspect of technological design. Value sensitive design has been defined as a 'theoretically grounded approach to the design of technology that accounts for human values in a principled and comprehensive manner through the design process'.[48] The focus thus seems to be on process (in particular the design process) rather than on power to influence behaviour. Nevertheless, value sensitive design will have regulatory effects and will also influence society's relationship to the embedded values.

iii. Compliance by Design

Another related conceptual lens is the notion of 'compliance by design'. This involves extracting and modelling legal requirements, then integrating them within business processes.[49] There is thus a literature seeking to identify and interpret legal requirements in order to convert them into machine-readable conditions.[50] Compliance by design assumes that law already exists at a particular point in time, and the goal is to ensure that systems support, or even guarantee, compliance with that law. In the financial services industry, this is often marketed as 'RegTech', although that term also encompasses the use of technology *by regulators* to enhance compliance and reconceptualise the nature of financial regulation itself.[51] It also encompasses the development of software or software specifications *by regulators*, where use of the software replaces rules written in ordinary English as the compliance requirement.[52]

iv. Compliance through Design

Beyond compliance by design, 'compliance through design' encompasses social and institutional aspects of legal compliance, recognising that there is an element of choice in how institutions respond to legal rules.[53] For example, some institutions may wish to go further than formal legal requirements for risk management reasons. Others may wish to do no more than is necessary due to competing policy or business objectives. Compliance through design builds these choices into the design process, also incorporating into the compliance process manual elements where human interpretation is required.

48 B Friedman, PH Kahn and A Borning, *Value Sensitive Design: Theory and Methods* (University of Washington, Technical Report 02-12-01).

49 P Casanovas, J González-Conejero and L de Koker, 'Legal Compliance by Design (LCbD) and through Design (LCtD): Preliminary Survey' *Proceedings of the 1st Workshop on Technologies for Regulatory Compliance* (2018).

50 *Ibid.*

51 Arner, Barberis and Buckey (n 41).

52 E Micheler and A Whaley, 'Regulatory Technology: Replacing Law with Computer Code' (LSE Law, Society and Economy Working Papers 14/2018). Available at SSRN: https://ssrn.com/abstract=3210962 or http://dx.doi.org/10.2139/ssrn.3210962

53 Casanovas et al (n 49).

v. Design-Based Regulation

In 'design-based regulation', the influence of design of technology is not limited to situations where design elements are imposed to achieve legal compliance or even promote shared social values. Design can also 'nudge' users to make choices in directions preferred by the architect of technology.[54] The idea of using design architecture to nudge users was made famous by Thaler and Sunstein, who described how 'choice architects' could influence people's behaviour in ways that were (in the choice architect's view) beneficial to those people.[55] In their conception, nudges were beneficial but also cheap, easy to avoid and transparent. This is not always the case where design is used to influence behaviour. An example of behaviour-altering technology that has no alignment with a legal rule or beneficent objective is the Mosquito which emits sound at a particular pitch uncomfortable for young people, thus discouraging them from loitering nearby.[56] There is potential for such design choices to be non-transparent, manipulative and/or deceptive and generally advantage powerful actors (for example, corporations developing platforms) over users.[57] However, design-based regulation may also be deployed in line with goals based on shared social values, law or policy.

C. Overlap of Approaches: Example of Privacy by Design

There is an important overlap among the various approaches and associated literature. This overlap is well illustrated by the notion of 'privacy by design', where privacy becomes a 'default setting' internalised in the design of systems for preventative, end-to-end lifecycle protection.[58] On the one hand, this emerges as a particular case of value sensitive design, where the value being promoted is privacy. However, because data privacy laws exist in most jurisdictions, privacy by design straddles the 'value sensitive design', 'compliance by design' and 'regulation by design' scholarship.[59] Embedding the value of privacy in technologies bolsters the regulatory objectives of data privacy law and enhances compliance with that law. Our focus in this chapter is limited to what we refer to as 'data privacy' or the 'informational' subset of privacy, also known as 'data protection', rather than on the general question of privacy. A general right to privacy has a history spanning centuries,[60]

54 K Yeung, '"Hypernudge": Big Data as a Mode of Regulation by Design' (2017) 20(1) *Information, Communication and Society* 118, 119. See generally R Thaler and C Sunstein, *Nudge* (Penguin Books, 2008).

55 RH Thaler and CR Sunstein, *Nudge: Improving Decisions about Health, Wealth and Happiness*, updated edition (Penguin Books, 2009).

56 B Bowling, A Marks and C Murphy, 'Crime Control Technologies: Towards an Analytical Framework and Research Agenda' in R Brownsword and K Yeung (eds), *Regulating Technologies: Legal Futures, Regulatory Frames and Technological Fixes* (Hart Publishing, 2008) 51.

57 Yeung (n 54) 123–31.

58 A Cavoukian, *Privacy by Design: The Seven Foundational Principles*, revised edn (Information and Privacy Commissioner of Ontario, 2011), iapp.org/resources/article/privacy-by-design-the-7-foundational-principles/ (last accessed 24 September 2019).

59 D Klitou, *Privacy-Invading Technologies and Privacy by Design: Safeguarding Privacy, Liberty and Security in the 21st Century*, Information Technology and Law Series 25 (TMC Asser Press, 2014) 262.

60 See M Zalnieriute, 'An International Constitutional Moment for Data Privacy in the Times of Mass-Surveillance' (2015) *International Journal of Law and Information Technology* 23.2, 99–133, at 6–7, explaining that already in 14th century England, the Justices of The Peace Act Of 1361 (34 Edw 3 C.1) established some sense of individual privacy. Also by the end of the 19th century in the USA, Warren and Brandeis in their famous 'The Law of Privacy' (1890–91) 4 *Harvard Law Review* 195 formulated the right to privacy in terms of 'The Right to be Let Alone'. A

and has been recognised as a constitutional right in many countries and in most prominent international human rights instruments.[61] *Data* privacy as a policy issue, however, has emerged only in the wake of the information technologies revolution in the late 1960s and early 1970s.[62] The term 'data protection' is mainly used in Europe, where it became a prominent epithet since the enactment of initial data protection laws in the 1970s. In other parts of the world, such as the USA, Canada and Asia-Pacific, policy debate is about 'privacy' protection. Both definitions are argued to be problematic and, in part, misleading.[63] Thus, the newer term 'data privacy' has been gaining traction among scholars since the mid-2000s, and 'its use can be seen as an attempt to signal more accurately than the other two terms the focus, thrust, and rationale of the relevant norms'.[64] We therefore, use the term data privacy in this chapter.

With an optimistic lens, privacy by design suggests that 'Technology …, in theory, can apply privacy laws and principles constantly, consistently, objectively, mechanically and without errors, improving the rate, quality and effectiveness of privacy compliance.'[65] But the idea of privacy by design, if not its enactment as part of the EU data privacy law, also extends beyond legal requirements.[66]

Various types of privacy-enhancing technologies can be deployed as part of privacy by design. The first type is essentially target hardening, employing cyber security techniques to make it more difficult for criminal actors to obtain data to which they are not entitled. This is sometimes also called 'security by design'.[67] Another example is where systems require users to comply with privacy laws when collecting, accessing or using data in those systems.[68] This enhances compliance with the existing law (to the extent it can be built into design), possibly to the level where non-compliance becomes practically impossible or extremely difficult. This is the aspect of privacy by design that most closely resembles the idea of compliance by design. A third type consists of techniques that encourage data minimisation, for example forms that do not collect data that are not essential to a particular transaction, systems that enable anonymous transactions, and software that allows consumers to manage multiple pseudo-identities.

constitutional right to privacy was formulated by the US Supreme Court in *Griswold v Connecticut*, 381 US 479 (1965). For more on the history of privacy, see JQ Whitman, 'The Two Western Cultures of Privacy: Dignity Versus Liberty' (2004) *Yale Law Journal* 1151–221.

61 See universal instruments: Art 12 of the The Universal Declaration of Human Rights 1948; Art 17 of the International Covenant on Civil and Political Rights 1966; regional instruments: Art 8 of the European Convention on Human Rights 1950; Art 11 of the American Convention on Human Rights 1969. Note, however, that the African Charter on Human and People's Rights 1981 is exceptional in omitting an express right to privacy or private life.

62 See M Zalnieriute (n 60) 99–133, at 6–7.

63 LA Bygrave, *Data Protection Law: Approaching its Rationale, Logic and Limits* (Kluwer Law International, 2002) 21–23.

64 LA Bygrave, *Data Privacy Law: An International Perspective* (Oxford University Press, 2014) 26. See also G Greenleaf, *Asian Data Privacy Laws: Trade & Human Rights Perspectives* (Oxford University Press, 2014); C Kuner, *Transborder Data Flow Regulation and Data Privacy Law* (Oxford University Press, 2013).

65 Klitou (n 59) 295.

66 A Cavoukian, 'A Regulator's Perspective on Privacy by Design' (Future of Privacy Forum, 2012), www.futureofprivacy.org/privacy-papers-2012 (last accessed 24 September 2019).

67 LA Bygrave, 'Hardwiring Privacy' in Brownsword, Scotford and Yeung (eds) (n 16) 754, 756–57.

68 Klitou (n 59) 267.

D. Limitations of Design-Based Regulation

Design-based regulation suffers from similar limitations as legal rules. For example, design-based regulation may be over- or under- inclusive with respect to a regulatory goal and this may be exacerbated by new technologies. Yeung gives the example of enforcing a quiet carriage law through a device that blocks mobile phone reception.[69] Noise is not generated exclusively or necessarily by mobile phones, and changes in telecommunications networks may alter the operation of the device. Deployment of the device is thus both over- and under-inclusive with respect to its regulatory goal of maintaining silence in a carriage, and risks becoming obsolete as telecommunications technologies evolve.

Over-inclusiveness of design-based regulation can be harmful to the protection and exercise of fundamental rights. One example is in the context of Internet content filtering technologies, designed to work as effectively as legal regulation of off-line content, enhances censorship of legitimate speech.[70] Over-inclusiveness can also compound with legal rules as where technologies over-protect copyright works (for example, without allowing for copyright exceptions) and those technological measures are then protected by law.[71]

As well as being potentially over-inclusive, design-based solutions will often fail to resolve all compliance challenges. For example, in the context of privacy by design, any translation between words (found in statutes or case law) and design is likely to be imperfect. Privacy law is typically principles-based and human interpretation is thus an important aspect of its application, whereas built-in processes must of necessity be unambiguous.[72] The compliance through design scholarship recognises this dilemma but only by simultaneously recognising the need for human interpreters in the process so that technical design is not the sole mechanism for achieving compliance.

There are also additional concerns about design-based regulation, such as Brownsword's concerns about the loss of moral community that comes from eliminating the practical option of doing the wrong thing.[73] In the context of privacy by design, Brownsword raises additional concerns including the impossibility of moral balancing (where agents may perceive a greater moral good from sacrificing privacy to another value or interest) and removal of the option to reach different individual or collective conclusions about what privacy means and the relative value of privacy and other rights and interests.[74] In addition to general limitations of design-based regulation, there are more specific questions about how such systems fare along the dimension of time, and we discuss them in the following section.

E. Design-Based Regulation Along the Dimension of Time

Race-based metaphors of law and technology uniformly place technology in the lead. Nevertheless, there are circumstances where technology can fall behind law and policy. Just like the law, design

69 K Yeung, 'Towards and Understanding of Regulation by Design' in Brownsword and Yeung (eds) (n 56) 79, 92.
70 L Bennett Moses, 'Creating Parallels in the Regulation of Content: Moving from Offline to Online' (2010) 33 *University Of New South Wales Law Journal* 581.
71 L Lessig, *The Future of Ideas: The Fate of the Commons in a Connected World* (Random House, 2001) 200–202.
72 Bygrave (n 67) 767–68; Klitou (n 59) 284.
73 R Brownsword, *Rights, Regulation and the Technological Revolution* (Oxford University Press, 2008) 258–82.
74 R Brownsword, 'Law, Liberty and Technology' in Brownsword, Scotford and Yeung (eds) (n 16) 41, 62–64.

has a temporal dimension. Science and Technology Studies – widely known as STS – are helpful in understanding the inflexibility of technological design. In particular, once design choices are made, they may be difficult to reverse due to 'technological momentum' where costs associated with changes in technological choices, particularly when embedded into broader socio-technical systems, create a path dependence.[75] In other words, a technological choice made today may be hard to reverse even if future socio-technical or legal change renders that choice redundant or counter-productive. For example, the Anglosphere still uses QWERTY keyboards despite the fact that keys no longer jam – a choice that reduced typist muscle strain in the past may now be increasing it.[76] Similarly, it is unlikely that every data collection, data storage and data processing system operating in Europe complied with the new rules in the General Data Protection Regulation ('GDPR') on the day that law was enacted; it inevitably took some companies a long time to redesign or replace older systems.[77] As time passes, technologies themselves can become obsolete and design choices made to achieve particular functional, legal or policy objectives may not meet new objectives.

There are technological features that help predict whether a design choice is more or less adaptable to future change. For example, features may be static (like a speed hump that prevents all cars travelling quickly) or dynamic (like software that automatically controls the speed of a car with reference to its location, weather conditions, time of day, vehicle type, traffic).[78] Software is also more 'plastic' or adaptable than either law or physical architecture; it can be updated relatively easily.[79] Software may be updatable centrally (through remote updates) whereas hardware updates will generally require action on the part of a user (although interchangeable physical parts may be shipped from a central location). Diffusion patterns may help predict the persistence of technological design in the face of regulatory and legal pressures.[80] The extent to which technology is inflexible or adaptable will thus depend on context.

Where it exists, inflexibility in technological design means that technological choices, like legal ones, may be a poor fit for the future. Technologies built to be compliant need to adapt both to changes in the rules with which they seek to comply, changes in user behaviours that affects the situations in which non-compliance is likely, and changes in other technologies (as where 'data security by design' can only be achieved by continual updates as new methods of compromising security are discovered). Technologies built to have a regulatory effect need to build in feedback loops in order to monitor the regulatory effect over time and adjust course as required, not only in response to the matters raised above, but also to changes in regulatory objectives as broader social and political objectives evolve.[81] Such feedback loops take account of the fact that design choices

75 TP Hughes, 'Technological Momentum' in Merritt Roe Smith and Leo Marx (eds), *Does Technology Drive History? The Dilemma of Technological Determinism*' (MIT Press, 1994) 112.
76 PA David, 'Clio and the Economics of QWERTY' (1985) 75 *The American Economic Review* 332.
77 Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation or GDPR) [2016] OJ L119/1.
78 Yeung (n 54) 121–22.
79 J Grimmelmann, 'Note: Regulation by Software' (2005) 114 *Yale Law Journal* 1719, 1723.
80 Bernstein (n 35).
81 Murray (n 34).

made at one point in a socio-technical system may cease to be optimal as the broader system evolves.

As this section has sought to demonstrate, the evolution of socio-techno-legal landscapes over time involves complex interactions. At a given point in time, particular elements may seem to fall behind others (in that they fit best with activities, technologies or legal frameworks of the past rather than the present). There are, however, legal and technical choices that can be made in the present to maximise adaptive behaviour over time. For example, centrally updateable software can ensure that necessary adaptations are implemented swiftly, just as administrative regulations are generally easier to update than legislation. The ways in which law and technological design combine to achieve particular regulatory effects and interact over time can be explored in practical settings. In the following section, we draw on a more concrete example, self-driving cars, to illustrate some of the issues discussed above.

IV. Self-Driving Cars and the Complexity of Regulation over Time

Self-driving cars or automated vehicles ('AVs') are vehicles that include an automated driving system capable of performing the entire dynamic driving task (steering, acceleration, braking and monitoring the driving environment) on a sustained basis.[82] Research suggests that such vehicles will have some initial benefits, such as reducing the risk of accidents and improving fuel efficiency, although broader and longer-term benefits and risks remain unclear.[83] What is apparent is that policy-makers and regulators have recognised that existing laws are not able to cope with these new technologies and that new regulation may be necessary to ensure safety and assuage potential user and societal concerns. The full range of legal issues is too extensive to be covered in this chapter; rather we draw out some examples of the phenomena discussed above.

In particular, our focus is on the complexity of building a regulatory system, which consists of both legal and design features, and which could withstand the waves of time. We are interested in how decisions made in one area (such as safety) can impact on a separate policy debate (such as data privacy), resulting in constant evolution of law over time to adapt to the changing needs of the present. These shifts in law also affect technological design, with design features introduced to comply with law at one point in time needing to keep up with subsequent legal change. Technology falls behind the law just as law is constantly struggling to keep up with new technology. The entire socio-techno-legal system is in a constant state of flux and adaptation to the evolving needs of the present.

A. Law 'Out of Time' and Behind Technology

The development of AVs raises a variety of challenges to the current legal regime, which are illustrative of how law and technology could be 'out of time' and behind one another. For example,

[82] NTC, *Regulating Government Access to C-ITS and Automated Vehicle Data: Discussion Paper* (September, 2018) 8.
[83] D Milakis, B van Arem and B van Wee, 'Policy and Society Related Implications of Automated Driving: A Review of the Literature and Directions for Future Research' (2017) 21 *Journal of Intelligent Transportation Systems* 324

the NTC notes that '[c]urrent Australian transport legislation assumes there is a human driver'.[84] Existing law, including driving laws, safety regulations and rules regulating government access to data, lag behind the development of new AV technologies. For example, driver licensing is the primary mechanism of ensuring that vehicles are driven safely under existing laws, but there is no equivalent regulatory mechanism in the absence of a human driver.[85] The NTC is thus engaged in an extended process of identifying legal challenges and making concrete recommendations for reform.[86]

On the safety side, various options have been proposed, most of which (including the ultimate recommendation) will require an entity bringing automated driving technology into the Australian market to self-certify against 11 principles-based safety criteria in a Statement of Compliance.[87] In addition, such entities will be required to outline the data that will be recorded and how it will be provided to relevant parties, including to ensure real time monitoring of driving performance and incidence, including event data records collected in the lead-up to a crash.[88]

Whether for compliance with safety criteria and related reporting requirements or for operational reasons (providing equivalent functionality to human eyes and ears), automated driving systems are likely to collect, process, store and share across the transportation system significantly more personal data than is the case for traditional cars. Such data is likely to include video and audio data from sensors within and outside a vehicle, data concerning vehicle location and movement, data concerning operation of vehicle features (such as airbags), and even biometric data of the individual in control of a vehicle.[89] Such enhanced data collection, processing, storage and transmission raise significant data privacy challenges.

Australia's data privacy regime is a combination of federal law (the Privacy Act 1988, applying to the Federal Government and corporations over a particular size) and state and territory laws.[90] Like other areas of law, there is a perception that data privacy law is 'increasingly becoming outdated' in the context of modern digital technologies.[91] In particular, existing laws may provide insufficient protections against corporate and government surveillance, defined as the 'focused, systematic, and routine attention to personal details for the purposes of influence, management, protection or direction'.[92] There is also concern that simplistic distinctions between personal and

84 NTC, *Safety Assurance for Automated Driving Systems: Decision Regulation Impact Statement* (November, 2018), www.ntc.gov.au/Media/Reports/(A7B4A10F-22A5-2832-1A11-6E23E1BB7762).pdf (last accessed 24 September 2019) 8. See, in particular, Australian Road Rule 297, which provides that 'a driver must not drive a vehicle unless the driver has proper control'.

85 *Ibid*, 22.

86 The full scale of this can be seen in a figure representing 'Creating an end-to-end post-trial regulatory system' in *ibid*, 10.

87 *Ibid*, 49.

88 *Ibid*, 69.

89 NTC (n 82).

90 The primary privacy legislation is: *Privacy Act 1988* (Cth); *Information Privacy Act 2014* (ACT); *Privacy and Personal Information Protection Act 1998* (NSW); *Information Act 2002* (NT); *Information Privacy Act 2009* (Qld); *Personal Information Protection Act 2004* (Tas); *Privacy Data and Protection Act 2014* (Vic). In SA, see Information Privacy Principles Instruction (IPPI) published as Premier and Cabinet Circular No. 12, June 2016. . Some jurisdictions have separate privacy regimes for particular categories of data (for example, health data).

91 Klitou (n 59) 3.

92 D Lyon, *Surveillance Studies: An Overview* (Polity, 2007) 14.

non-personal information fail to take account of developments in re-identification techniques that demonstrate that these categories lie along a scale rather than in two buckets. In Australia, the Privacy Act 1988 (Cth) defines personal information as 'information or an opinion about an identified individual, or an individual who is reasonably identifiable' and information is either regulated (because it is personal information) or completely unregulated (because it is not personal information). The challenge is that the identifiability of an individual in a data set is relative, so that some entities may be able to identify an individual in a data set whereas others will not.[93] Australian law seems to assume an understanding of personal information (as an objective category) that pre-dates developments in re-identification techniques that allow some entities to re-identify information that others might have thought was not personal.

The NTC has expressed a tentative view that new laws are needed to limit government collection, use and disclosure of AV information due to the insufficiency of existing legal framework.[94] These laws would apply to AV information and cooperative intelligent transport system information only, and those terms would need to be clearly defined.[95] The new rules would not be incorporated into data privacy legislation, in those jurisdictions where it exists, but would rather be part of a separate AV regulation.[96]

B. Technology 'Out of Time' and Behind Law

In the context of AVs, it is not only the law that needs to catch up with technology, but also technology that is 'out of time' and behind law in certain contexts or jurisdictions. For example, in the European Union, data privacy laws are often assumed to be 'ahead' of Australian laws in the sense that they provide stronger protections against corporate and government surveillance. The GDPR creates an obligation on data controllers to comply with principles of 'data minimisation' and 'data avoidance' which require that personal data be adequate, relevant and *limited to what is necessary* in relation to the purposes for which those data are processed.[97] This means that those manufacturing or importing to Europe automated driving systems must limit personal data collection only to what is needed for their legitimate business purposes and delete it when it is no longer 'necessary'. Complying with this provision may require manufacturers to change vehicle design to keep up with law, in particular by reducing the volume of data collected and processed.

Moreover, the GDPR articulates the so-called 'right to be forgotten', formally known as the 'right to erasure', which entitles individuals to require data controllers to delete their data when it is no longer necessary for the purposes for which it was collected, or when the individual withdraws their consent and there is no other legal ground for processing personal data.[98] Right to erasure, which does not have an equivalent under the Australian Privacy Act 1988, could cover image data internal to the vehicle, audio data, and data covering biometric and biological factors in particular, which could be argued to be not necessary after a short period of time after their

93 Australian Computer Society, *Data Sharing Frameworks: Technical White Paper* (September, 2017)
94 *Ibid*, Ch7.
95 *Ibid.*
96 *Ibid.*
97 GDPR (n 77) Rec 39, Art 5(1)(c).
98 GDPR (n 77) Art 17.

collection. If not already built into system design, systems would need to be modified to ensure prompt deletion.

These examples suggest that technology *can* fall behind evolving legal requirements, and thus be 'out of time'. Whether or not this is the case for any particular automated driving system would need to be tested against technical specifications. Of course, it is usually possible to change the design of vehicles and infrastructure to adapt to new legal rules such as the GDPR (subject to economic and practical considerations). The point is merely that this requires something *of technology* – whether that takes the form of software updates, new hardware components or refitted factories. Before those changes are made, technology lags behind the law, just as the law lags behind technology in the period relevant statutes are amended. This is so even if design decisions were made at an earlier point in the process in order to comply with earlier versions of the law.

C. Surfing the Waves of Change: Legal and Technical Solutions in the Dimension of Time

As demonstrated in subsections A and B above, socio-techno-legal systems are constantly changing, with changes in one sphere, such as law, requiring changes in others, such as technology. In this section, we consider the relative flexibility and longevity of proposed solutions to existing challenges.

i. Context-Specific Legal Rules in the Dimension of Time

One potential response to the data privacy challenges raised by AV technologies, which appears to be favoured by the NTC in Australia, is to introduce a new, context specific data privacy law. However, this proposal encounters two main challenges.

The first challenge is one of fragmentation. If data protection law is adapted for all of the different domains for which this is proposed or developed, including regulation of AVs and consumer rights in the banking sector,[99] there will be an increasing complexity of the legal landscape. The consequences of this complexity are likely to increase over time, particularly as technologies often tend towards convergence. Just as it has become less helpful to think about content regulation separately for radio, television and the Internet, it will become less useful to regulate data differently in different domains. This is particularly so as data will flow across distinct domains, as where vehicle data accessed by banks who lent money to purchase vehicles and is thus incorporated into a customer's profile.

The second challenge relates to the discussion in section II of this chapter, namely that laws designed to operate in a narrow domain defined by reference to particular technological practices are more likely to face obsolescence as those practices evolve over time. This has been experienced with many formerly new technologies, where regulations on digital tapes, nanotechnology, assisted reproductive technologies have become obsolete or artificially narrow as

[99] See the consumer data right proposed by the Australian Competition and Consumer Commission: *Competition and Consumer (Consumer Data) Rules 2019* (Exposure Draft, 29 March 2019), www.accc.gov.au/system/files/Exposure%20draft%20CDR%20rules%2029%20March%202019.pdf (last accessed 24 September 2019).

those technologies have themselves evolved.[100] A similar fate could await laws designed specifically for data privacy issues relating to specific types of driving systems.

ii. Broad Legal Rules in the Dimension of Time

Rather than reforming Australian privacy law in the context of a particular technology, such as AVs, one could update generally formulated data privacy laws with awareness of, but not an exclusive focus on, technological challenges that need to be addressed. For example, the GDPR regulates processing of personal data in a technologically neutral way and will govern the processing of data generated by automated driving systems. In the context of the challenge for which context-specific laws are proposed in Australia, both the GDPR and the Law Enforcement Directive (protecting personal data processed for law enforcement purposes) are relevant.[101] Essentially, the GDPR explicitly allows for exceptions to its provisions when they are necessary for 'the prevention, investigation, detection or prosecution of criminal offences ...',[102] so that any further processing of such data by the law enforcement agencies for criminal purposes is addressed separately in the Law Enforcement Directive.[103]

The GDPR and Law Enforcement Directive only apply to 'personal data', which is defined as any information relating to an identified or identifiable natural person ('data subject').[104] Personal details such as the name of a vehicle occupant, address and contact details, as well as occupants' biometric and biological data will be uncontroversially classified as personal data. It also includes geo-location data,[105] and it is irrelevant whether such data is technical, generated by the technology or provided by the data subject. Contrary to European automotive industry association

[100] See generally L Bennett Moses, 'Sui Generis Rules' in Marchant, Allenby and Herkert (eds) (n 3).

[101] Directive (EU) 2016/680 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data by competent authorities for the purposes of the prevention, investigation, detection or prosecution of criminal offences or the execution of criminal penalties, and on the free movement of such data, and repealing Council Framework Decision 2008/977/JHA, [2016] OJ L119/89. Member States are also offered a derogation allowing legacy processing systems to remain in place until 6th May 2023, with the option of a three-year extension to 2026, where there is a 'disproportionate effort' required to bring them into compliance. Additionally, a new ePrivacy Regulation proposed in 2017 (not yet adopted) would cover machine to machine communications, and thus may become relevant in the future, see European Commission, 'Proposal for a Regulation of The European Parliament and of The Council concerning the respect for private life and the protection of personal data in electronic communications and repealing Directive 2002/58/EC (known as the 'e-Privacy Directive')' COM/2017/010 final - 2017/03 (COD).

[102] GDPR (n 77) Art 23.

[103] The GDPR and Law Enforcement Directive do not apply to data processing by the institutions, bodies, offices and agencies of the European Union (as an organisation), whose data processing is governed by a separate EU legal framework under Regulation 45/2001 of the European Parliament and of the Council of 18 December 2000 on the protection of individuals with regard to the processing of personal data by the Community institutions and bodies and on the free movement of such data [2000] OJ L8/1. The processing of personal data by special EU law enforcement agencies such as Europol and Eurojust are governed by tailor-made data protection regimes and processing outside the scope of EU law such as in the context of national security are not included here.

[104] GDPR (n 77) Art 2.

[105] GDPR (n 77) Art 4(1) explicitly clarified the status of geo-location data by expressly stating that an individual can be identified directly or indirectly by reference to 'location data'. See Article 29 Data Protection Working Party – *Opinion 13/2011 on Geolocation services on smart mobile devices,* available at ec.europa.eu/justice/data-protection/article-29/documentation/opinionrecommendation/files/2011/
wp185_en.pdf 22 (last accessed 25 September 2019), which states location data collected by smartphones is considered personal data because individuals can be directly or indirectly identified through their patterns of movement.

arguments,[106] data generated by vehicle sensors such as information about speed, acceleration and use of brakes, which could be either supporting the operation of automated functions, communication with other vehicles and infrastructure or collected by Event Data Recorders (EDR), *could* constitute personal data in the opinion of the EU Court of Justice,[107] the EU Commission,[108] EU data protection authorities and the Article 29 Working Party.[109]

Unlike in Australia, the definition of 'personal information' in the European Union is contextual and adapted to changes in re-identification techniques. In particular, classification of data as 'personal data' depends on whether the data subject is identifiable which in turn depends on the knowledge of the data controller[110] and the reasonable means they are able to deploy to re-establish the identity of the data subject.[111] This recognises that classification of information as personal is contextual: as long as an entity may link a data item to a unique identifier that can be associated with a person, the data qualifies as personal data in relation to that specific manufacturer or government agency.

The EU framework under the GDPR thus articulates a technology-neutral approach for addressing data privacy challenges, including in the context of AVs. This achieves similar regulatory objectives to those identified by the NTC through a general rather than context-specific law,

106 German Association of the Automotive Industry - *Verband der Automobilindustrie (VDA),* 'Data Protection Principles for Connected Vehicles' (3 November 2014), available at www.vda.de/en/- topics/innovation-and-technology/network/data-protection-principles-for-connected-vehicles.html (last accessed 25 September 2019); VDA, in 'Position – Access to Vehicle and Vehicle Generated Data' (19 September 2016) p 1, available at www.vda.de/en/topics/innovation-and-technology/network/access-to-the- vehicle.html (last accessed 25 September 2019). See also European Automobile Manufacturers Association – (ACEA), 'ACEA Principles of Data Protection in Relation to Connected Vehicles and Services' (September 2015) p 4, available at www.acea.be/publications/article/acea-principles-of-data-protection-in-relation-to-- connected-vehicles-and-se (last accessed 25 September 2019); ACEA, 'ACEA Strategy Paper on Connectivity' (April 2016) p 4, available at www.acea.be/uploads/publications/ACEA_Strategy_
Paper_on_Connectivity.pdf (last accessed 25 September 2019); British Society of Motor Manufacturers and Traders (SMMT), 'Connected and Autonomous Vehicles – Position Paper' (February 2017) p 6 et seq, available at www.smmt.co.uk/wp-content/uploads/sites/2/SMMT-CAV-position-paper-final.pdf (last accessed 25 September 2018).

107 C-582/14 *Patrick Breyer v Bundesrepublik Deutschland* [2016] ECLI:EU:C:2016:779.

108 EU Commission, 'A European strategy on Cooperative Intelligent Transport Systems, a milestone towards cooperative, connected and automated mobility' COM(2016) 766 final, 30 November 2016, available at ec.europa.eu/energy/sites/ener/files/documents/1_en_act_part1_v5.pdf, 8 (last accessed 25 September 2019). See also EU C-ITS Platform Final Report (September 2017), available at https://ec.europa.eu/transport/sites/transport/files/2017-09-c-its-platform-final-report.pdf, 28 (last accessed 25 September 2019).

109 Article 29 Working Party, Opinion 03/2017 on Processing personal data in the context of Cooperative Intelligent Transport Systems (C-ITS), ec.europa.eu/newsroom/article29/item-detail.cfm?item_id=610171, 6 (last accessed 25 September 2019). The Working Party was set up under Article 29 of Directive 95/46/EC (n 77). It is an independent European advisory body on data protection and privacy. Its tasks are described in Article 30 of Directive 95/46/EC and Article 15 of Directive 2002/58/EC (n 101).

110 Article 4(7) of the GDPR (n 77) defines 'controller' as 'the natural or legal person, public authority, agency or other body which, alone or jointly with others, determines the purposes and means of the processing of personal data; where the purposes and means of such processing are determined by Union or Member State law, the controller or the specific criteria for its nomination may be provided for by Union or Member State law'.

111 GDPR (n 77) Art 2; *Breyer* (n 107). The Court in *Breyer* further states, that for a qualification of data as personal it is not required 'that all the information enabling the identification of the data subject must be in the hands of one person'.

offering greater likelihood that it will be relatively future-proof over time.[112] The GDPR also introduces a requirement of privacy by design, which we discuss below.

iii. Mandatory Compliance by Design in the Dimension of Time

The GDPR explicitly incorporates an obligation for data controllers to comply with principles of 'privacy by design' and 'privacy by default'.[113] Privacy is one of the most prominent fields in which a 'by design' solution operates alongside statutes. As it was discussed earlier in this chapter, it is seen as a way of moving the regulatory focus from data processors to those manufacturing or developing systems for data processing.[114] It aims at ensuring that privacy protections are built into the design and development of new technologies and services, as opposed to being implemented subsequently as part of a legal review process. In relation to automated driving systems, 'privacy by design' would mean, for example, an interactive dashboard, allowing the driver to customise and turn on/off the technology's ability to collect different types of personal data, thereby giving the data subject more control over their personal data. It may also include elements like automatic deletion of data no longer relevant to the operation of a vehicle or automatic anonymisation of data communicated to transportation infrastructure. Similarly, a 'privacy by default' approach would mean having sensors that collect personal data switched off by default (a so-called 'opt-in' approach). This would help to ensure that data subjects' personal data are not processed automatically without their consent.

'Privacy by design' elements can be embedded in hardware or software and in components of each that are updated with different frequencies. This choice has an important impact on the ability of systems to remain adaptable and protective over time. For example, when there are changes to transportation infrastructure that impacts how data is collected and used, this could be communicated to users through a software update that requires users to make new decisions on the interactive dashboard. Where data collection systems are embedded in hardware, such as cameras, it may be more difficult to ensure that updates are incorporated over time.

If manufacturers want to avoid technological design choices falling behind evolving legal requirements, they need to be proactive. Just as lawmakers need to understand the risk of framing law in terms of particular technologies in order to ensure ongoing adaptability to technological change, designers need to consider the ease with which systems can be changed in order to ensure ongoing adaptability to legal change. Allowing for remote software updates is one means that manufacturers are using to achieve this.

V. Conclusion

Scholars working on the issues at the intersection of law and technology have recognised the need for an interdisciplinary socio-techno-legal approach to problems brought about by new technologies.[115] This chapter makes a similar plea, anchoring its argument on the need to consider

[112] See chapter 16 of this book by Ranchordás and 't Schip on future-proofing.

[113] GDPR (n 77) Recital 78. The Recital requires that the producers of the products, services and applications be encouraged to take into account the two principles to make sure that the controllers and processors are able to fulfil their obligations.

[114] Klitou (n 59) 4.

[115] Dizon (n 7).

the evolution of socio-techno-legal landscapes over time in making decisions about the appropriate form of regulation in the present. As both the theory and the example of AVs discussed in this chapter suggest, the design of regulatory frameworks (through law and technology) that takes place in the present should reflect an awareness of the need for adaptability in the future. Legal and technical solutions that solve the problems of the past or keep up with the present may themselves become obsolete in light of future legal, technological or social change. Both technical design and legislation need to adjust over time in response to the rapid evolution of the socio-techno-legal systems as a whole. In other words, while the extent and nature of issues is not symmetric, technology and law can both lag behind. Both choices in how law is formulated and how design choices are enacted will affect adaptability over time.