Regulating Connected and Autonomous Vehicles Through a Lens of Inclusivity

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Abstract

Following concurrent global enthusiasm and concern regarding the introduction into public spaces of connected and autonomous vehicles (CAVs), this paper critically examines the legal, regulatory, and policy frameworks around their introduction, focusing on the potential issues for the growing number of stakeholders with disabilities. Through adopting an internationally comparative approach, we apply the lens of inclusivity to explore these issues around CAV growth and deployment, specifically from a UK perspective, albeit we observe similar opportunities exist for legislators in Hong Kong. In so doing, we present recommendations for the development of a legislative framework adhering to key principles of consultation, collaboration, and communications with members of these stakeholder groups.

1. Introduction

Given increasing worldwide investment, legislation, regulation, policies, media interest, and public trials,[1] there is clear potential for connected and autonomous vehicles (CAVs) to generate a range of benefits for multiple stakeholder groups. Such advantages include: public health,[2] road safety,[3] road efficiency,[4] public transport,[5] lower pollution,[6] reduced levels of policing (given that CAVs would be automatically coded to observe road traffic laws); and increased opportunities for marketing (through in-car access to multi-media advertising whilst travelling[7] and downloadable content).[8] Equally, there are clear challenges associated with this

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[1] KPMG, "2019 Autonomous Vehicles Readiness Index: Assessing Countries' Preparedness for Autonomous vehicles" (2019) <2019-autonomous-vehicles-readiness-index.pdf> accessed 25 January 2021.

[2] David Rojas-Rueda, Mark, J. Nieuwenhuijsen, Haneen Khreis, and Howard Frumkin, "Autonomous Vehicles and Public Health" (2020) 41 *Annual Reviews* 329-345.

[3] *See,* for example, Maria Michałowska, and Mariusz Ogłoziński, "Autonomous Vehicles and Road Safety" in Jerzy Mikulski, (ed), *Smart Solutions in Today's Transport*. *TST 2017. Communications in Computer and Information Science* (Springer 2017) 191-202.

[4] Mark Ryan, "The Future of Transportation: Ethical, Legal, Social and Economic Impacts of Self-driving Vehicles in the Year 2025" (2020) 26 *Science and Engineering Ethics* 1185-1208.

[5] KPMG (n 1 above).

[6] *See,* for example, Taylor Stone, Fillippo Santoni de Sio, and Pieter E. Varmaas, "Driving in the Dark: Designing Autonomous Vehicles for Reducing Light Pollution" (2020) 26 *Science and Engineering Ethics* 387-403.

[7] KPMG (n 1 above).

[8] James Marson, and Katy Ferris, "Forget Red Dead and GTA Online, the Next-gen DLC will be in your Car" (March 6, 2021). Available at SSRN: https://ssrn.com/abstract=3799116.

phenomenon that need to be addressed; for example, around motor insurance,[9] data-sharing,[10] and cyber security,[11] (particularly as public/private boundaries become blurred).[12] Within the research context, there are calls for "a sorely needed broader program of work on the social, cultural, political, and design dynamics of connected cars internationally".[13] Against this backdrop, it appears that there are numerous opportunities for the strategic development of technology, infrastructure, and public engagement to benefit a range of key stakeholders.[14] Amongst these, and the issue focused upon in this paper, is how CAV development and deployment is likely to affect the "dramatically increasing" number of stakeholders with disabilities across the world.[15] In so doing, in Part 2 of this paper, we consider the international responses to CAV use and its impact, and potential for impact, on persons with disabilities. Part 3 examines CAV use through public transport systems given the ability for regulation and close scrutiny of its impact and effectiveness on various communities. It is in Part 4 where we offer a detailed critical examination of the United Kingdom's Equality Act and in which ways it is deficient for the incoming CAV transport systems. This allows us to present, at Part 5, the UN Convention on the Rights of Persons with Disabilities and discuss how this provides a model for inclusivity. Part 6 is the final substantive submission in this paper and here we offer a critique of existing legislation. We assert the need for a suite of strategic legislation as a method to ensure transport systems are viewed holistically and as a means for ensuring all members of society have access to the newly developing method of travel and connectivity. Such an approach will allow legislators to frame CAV deployment with the needs of every member of society in mind, rather than to wait and retrospectively attempt to fit CAV public transport systems with equality and inclusivity as an afterthought.

2. CAVs Potential to Impact on Persons with Disabilities: An International Response

The developing literature recognises how, for instance, an: "aging society… will place new and growing demands on transport systems" and potentially cause issues around "mobility…

[9] *See*, for example, James Marson, Katy Ferris, and Jill Dickinson, "The Automated and Electric Vehicles Act 2018 Part 1 and Beyond: A Critical Review" (2019) 41 (3) *Statute Law Review* 395-416.
[10] *See*, for example, de Joost C. F. Winter, Dimitra Dodou, Riender Happee, and Yke Eisma, "Will Vehicle Data be Shared to Address the How, Where, and Who of Traffic Accidents?" (2019) 7 (2) *European Journal of Futures Research* https://doi.org/10.1186/s40309-019-0154-3.
[11] Barry Sheehan, Finbarr Murphy, Martin Mullins, and Cian Ryan, "Connected and Autonomous Vehicles: A Cyber-Risk Classification Framework" (2019) 124 *Transportation Research Part A: Policy and Practice* 523-536. For more recent commentary as it pertains to mass-hacked CAVs see Matthew Channon and James Marson, "The Liability for Cybersecurity Breaches of Connected and Autonomous Vehicles" (2020) *Computer Law & Security Review*. In press.
[12] Serio Agriestib, Fausto Brevia, Paolo Gandinia, Giovanna Marchionnia, Rahul Parmarc, Marco Pontia, Luca Studer, "Impact of Driverless Vehicles on Urban Environment and Future Mobility" 49 *Transportation Research Procedia* 44-59.
[13] Gerard Goggin, "Disability, Connected Cars, and Communication" (2019) 13 *International Journal of Communication* 2748-2773, 2762.
[14] KPMG (n 1 above).
[15] World Health Organization, "Disability and Health" (1 December 2020), <www.who.int/news-room/fact-sheets/detail/disability-and-health> accessed 7 May 2021.

disability… societal responsibilities… isolation… and traffic safety".[16] There are also long-standing concerns about "injustices in access to personal mobility which the automobile introduced" and calls to avoid similar issues arising in the future.[17] Further, there exists a valuable opportunity for those involved with increasing CAV access across the world to respond by adopting a holistic perception of mobility as a "social amenity"[18] and addressing the need for accessible transportation.[19] There are also economic benefits to be gained from such an approach; for example, a study from the United States of America reports how the introduction of CAVs could create 2 million job opportunities for those with disabilities and save an annual sum of $19 billion on the cost of missed healthcare appointments.[20]

For a number of years, car manufacturers have been investigating various technologies to facilitate a better understanding of the needs of drivers with disabilities. In 1994, Ford began working with the University of Loughborough to create a suit that engineers could wear to mimic how they might feel as "an unfit 70-year-old".[21] Incorporating "a neck brace to impede head movements" and "arthritis-simulating gloves", the suit also comprised specially designed glasses to simulate a range of visual impairments.[22] Its adoption quickly led to the introduction of features including changes to door size to facilitate easier access and the development of reversing cameras. Evidencing the collaborative approach that car manufacturers are taking to the development of CAVs, the current incarnation of Ford's "Third Age Suit" has resulted from a collaboration with the Meyer-Hentschel Institute in Germany.[23] Through using the suit to improve understanding of the challenges faced by people with disabilities, engineers have developed a range of driver-assistance technologies including replacing the traditional car ignition key with a dashboard button, automatic parking and braking, and more accessible door handles.[24] One of the worldwide leaders in energy, Iberdrola similarly notes how the automotive industry is already proffering a range of other options for those with disabilities.[25]

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[16] Ching-Yao Chan, "Advancements, Prospects, and Impacts of Automated Driving Systems" 6 (3) *International Journal of Transportation Science and Technology* 208-216, 213.

[17] *See*, for example, Heather Bradshaw-Martin, and Catherine Easton, "Autonomous or "Driverless" Cars and Disability: A Legal and Ethical Analysis" (2014) 20 (3) *Web Journal of Current Legal Issues* no page number.

[18] P. A. Hancock, Illah Nourbakhshc, and Jack Stewart, "On the Future of Transportation in an Era of Automated and Autonomous Vehicles" *Proceedings of the National Academy of Sciences of the United States of America* 116 (16) PNAS (2019) 7684-7691, 7685.

[19] Henry Claypool, "2020-AAPD-Auto-Accessibility-Scorecard-Progress-Report" (2020) *Ruderman White Paper* <https://www.aapd.com/wp-content/uploads/2020/07/2020-AAPD-Auto-Accessibility-Scorecard-Progress-Report.pdf> accessed 25 January 2021.

[20] Henry Claypool, Arnitai Bin-Nun, and Jeffrey Gerlach, "The Ruderman White Paper. Self-driving Cars: The Impact on People with Disabilities" (2017), *Ruderman Family Foundation*, < https://rudermanfoundation.org/wp-content/uploads/2017/08/Self-Driving-Cars-The-Impact-on-People-with-Disabilities_FINAL.pdf> accessed 3 March 2021.

[21] Engineering and Technology, "Ageing Suit Helps Ford Engineers Think Differently" (2016) <https://eandt.theiet.org/content/articles/2016/02/ageing-suit-helps-ford-engineers-think-differently/ accessed 15 March 2021.

[22] Ibid.

[23] Ibid.

[24] Wonderful Engineering, "Ford's Age Suit Lets You Experience Life as a 104 Year Old Man" <https://wonderfulengineering.com/fords-age-suit-lets-you-experience-life-as-a-104-year-old-man> accessed 15 March 2021.

[25] Iberdrola, "Driverless Vehicles: The Future of Transport for the Disabled?" (2021) < https://www.iberdrola.com/innovation/disabled-vehicles> accessed 5 March 2021.

These include fitting vehicles with ramps, platforms, or lowered floors; rotating or sliding car seats to enable easier access; remote controls and voice recognition systems that trigger essential functionality including the vehicle's indicators; and "visual interfaces that project the dashboard's display on the windscreen" to accommodate drivers with auditory difficulties. More recently, Tesla has presented plans[26] for its next generation of Model S and Model X cars which feature a steering wheel more akin to an aircraft yoke (as Elon Musk has suggested that the steering wheel actually will not be used through the life of the product, being replaced through full autonomous driving) and without indicator stalks as the vehicle's Artificial Intelligence will predict what the driver intends to do based on the particular context of the driving activity being undertaken (on these Tesla vehicles, the driving stalk not only operates the vehicle's indicator/turn signal, they also house the gear selection too).[27] Therefore, the Original Equipment Manufacturers (OEMs) of cars and CAVs have, for years, been identifying ways in which their products can assimilate the needs of persons with disabilities to increase their accessibility to this demographic and to thereby enhance mobility as a service (MaaS). MaaS has further linked the needs of persons with disabilities and use of various forms of transport with a need for accessible information communications technology (ICT) and inclusive technology. Lazar and Stein[28] address these issues in the context of Articles 9 and 21 of the Convention on the Rights of Persons with Disabilities and find that despite readily available and low-cost technologies that would enable persons with disabilities to access ICT on an equal footing with consumers without a disability, practices across the globe continue to result in their exclusion. Their point that technologies often advance ahead of existing laws and policies, and legal norms are established but are yet to be implemented, or where legal rights are defined but clear technical implementations are not yet established are the very issues we question in this paper.

The impending influx of CAVs that is anticipated brings with it a range of legal and manufacturing issues for this form of vehicle and its stakeholders. One specific group which is likely to greatly benefit from the introduction of CAVs is persons with disabilities, thus their being at the forefront of the design stage is crucial. A new paradigm of travel not only presents difficulties in implementation, but also affords significant opportunities in implementing access by design. A recent report from the American Association of People with Disabilities (AAPD)[29] noted considerable scope for CAV manufacturers to mitigate the, sometimes, prohibitive costs of vehicle modification to meet the needs of those with disabilities. In a similar vein, the Disability Rights Education & Defense Fund (DREDF) produced a checklist that highlights the breadth of accessibility issues associated with CAVs.[30] These include

[26] https://www.motorauthority.com/news/1131112_musk-stalkless-tesla-model-s-and-model-x-to-guess-drive-direction-based-on-context accessed 12 May 2021.

[27] https://twitter.com/elonmusk/status/1354680585139187713?ref_src=twsrc%5Etfw%7Ctwcamp%5Etweetembed%7Ctwterm%5E1354680585139187713%7Ctwgr%5E%7Ctwcon%5Es1_&ref_url=https%3A%2F%2Fwww.motorauthority.com%2Fnews%2F1131112_musk-stalkless-tesla-model-s-and-model-x-to-guess-drive-direction-based-on-context accessed 12 May 2021.

[28] Jonathan Lazar and Michael Ashley Stein (eds), Disability, Human Rights, and Information Technology (2017, Philadelphia, University of Pennsylvania Press).

[29] American Association of People with Disabilities, "2020 AAPD Auto Accessibility Scorecard – Progress Report" <2020-AAPD-Auto-Accessibility-Scorecard-Progress-Report.pdf> accessed 25 January 2021. Statistics: Disability Facts and Figures <Disability facts and figures - GOV.UK (www.gov.uk)> accessed 25 January 2021.

considerations around: the human machine interface (such as CAV systems' compatibility with braille); hardware (including storage space to accommodate both technology and disability aids); and policy and legislative development (for example, in terms of liability, ethics, and funding for research and development in this area). Given the current high levels of interest in CAV-development and roll out, organisations including the AAPD[31] and the DREDF[32] argue that this is a pivotal time for manufacturers to ensure equitable accessibility of their vehicles. Findings from research conducted by the AAPD suggest that, whilst the challenges presented by the COVID-19 pandemic have impeded the pace of the process, CAV manufacturers are starting to work with disability groups (on the basis, and as required by disability-rights' groups, that no decisions should be reached without their contribution). Further work is needed to pinpoint, and address, the challenges faced across the sector in producing accessible CAVs for those with disabilities.

It might be concluded, then, that a collective effort is needed; for example, America's National Highway Traffic Safety Administration (NHTSA) and the Society of Automotive Engineers (SAE) have published both federal guidelines and an international standard respectively around CAVs. Yet, there seems to have been missed opportunities for such developments to address the needs of those with disabilities.[33] Following receipt of a $1million grant from the US Department of Transportation, Pittsburgh University is leading a consortium, including the Uniformed Services University of Health Sciences and The Catholic University of America, on the development of a new Tier 1 University Transport Center. This national project seeks to examine the "Implications of Accessible Automated Vehicles and Mobility Services for People with Disabilities"[34] and establish the Automated Vehicle Service for People with Disabilities – Involved Response Engineering (ASPIRE) Center. Through a combination of activities, the aim of the research is to engage stakeholders through "creat[ing]… a community of practice that accelerates accessible automated vehicles and mobility services in an inclusive manner, which will be beneficial to the plurality of stakeholders and both sensitive and responsive to the needs of edge users."[35]

Researchers in Australia have similarly highlighted "the transformative possibilities" presented by CAVs for those with mobility issues[36] and the importance of collaboration with

[30] Gov.UK, "Official Statistics: Disability Facts and Figures" <Disability facts and figures - GOV.UK (www.gov.uk)> accessed 25 January 2021.
[31] AAPD (n 29 above).
[32] Disability Rights Education & Defense Fund, "Comments Concerning Preparing for the Future of Transportation: Automated Vehicles 3.0 Docket Number: DOT-OST-2018-0149" <DREDF Comments DOT-OST-2018-0149 AV 3.0 113018.pdf> accessed 25 January 2021.
[33] University of Pittsburgh, "Tier 1 University Transportation Center (UTC) Grant" (2021) < https://www.herl.pitt.edu/university-transportation-center> accessed 11 March 2021.
[34] U.S. Department of Transportation, "U.S. Department of Transportation Announces Nearly $5 Million to 4 New University Transportation Centers" https://www.transportation.gov/briefing-room/us-department-transportation-announces-nearly-5-million-4-new-university-0> accessed 5 March 2021.
[35] University of Pittsburgh, "Human Engineering Research Laboratories" < https://www.herl.pitt.edu/university-transportation-center> accessed 5 March 2021.
[36] *See*, for example, Libby Porter, John Stone, Crystal Legacy, Carey Curtis, James Harris, Elliot Fishman, Jennifer Kent, Greg Marsden, Louise Reardon, and Jack Stilgoe, "The Autonomous Vehicle Revolution: Implications for Planning/The Driverless City?/Autonomous Vehicles – A Planner's Response/Autonomous

disability groups.[37] Preliminary findings from the first Australian National Survey of Public Opinion about Automated and Driverless Vehicles demonstrate how 82% of respondents agreed that CAVs would "allow mobility for people with driving impairments or restrictions".[38] Another national survey noted how only a "minority" of respondents perceived CAVs in a negative way as a result of both "cognitive and emotional factors".[39] To assuage such concerns, it highlighted the importance of communication and engagement,[40] making specific recommendations around: providing "crash statistics", emphasising the autonomous attributes of existing vehicles, and advertising the findings from worldwide CAV-trials.[41] Recognising the need for a collaborative approach, Australian governments have been working in partnership to ensure the safe and legal operation of CAVs, protect privacy, facilitate equitable access, develop appropriate legislation and policies, sustain suitable infrastructure provision, and protect consumers in terms of both insurance and liability.[42]

Across Europe, there have been a number of CAV-related, partnership programmes funded via Horizon 2020. These include ARCADE which seeks to "build consensus across stakeholders from all sectors for a sound and harmonised deployment of Connected, Cooperative and Automated Driving in Europe and Beyond."[43] In a similar way, the Mobility4EU project has been working to "identif[y] and assess… societal challenges that will influence future transport demand and supply."[44] Within a national context, Sweden has recently seen the introduction onto public roads of a prototype autonomous shuttle bus that is fitted with ramps to enable access for those with disabilities.[45]

3. CAV and Public Transport

Vehicles: Opportunities, Challenges and the Need for Government Action/Three Signs Autonomous Vehicles Will Not Lead to Less Car Ownership and Less Car Use in Car Dependent Cities – A Case Study of Sydney, Australia/Planning for Autonomous Vehicles? Questions of Purpose, Place and Pace/Ensuring Good Governance: The Role of Planners in the Development of Autonomous Vehicles/Putting Technology in its Place" (2018) 19 (5) *Planning Theory & Practice* 753-778.

[37] Goggin (n 13 above).

[38] Michael Regan, Mitchell Cunningham, Vinayak Dixit, Tim Horberry, Alex Bender, Kamal Weeratunga, Steve Cratchley, Leigh Dalwood, Desmond Muzorewa, and Asif Hassan, "Preliminary Findings from the First Australian National Survey of Public Opinion about Automated and Driverless Vehicles" (2017) https://s3-ap-southeast-2.amazonaws.com/cdn-advi/wp-content/uploads/2017/08/ADVI-Public-Opinion-Survey_Final_ISBN.pdf> accessed 3 March 2021.

[39] Simone Pettigrew, Caitlin Worrall, Zenobia Talati., Lin Fritschi, and Richard Norman, "Dimensions of Attitudes to Autonomous Vehicles" (2019) 7 (1) *Urban, Planning and Transport Research* 19-33, 30.

[40] Ibid.

[41] Ibid.

[42] Australian Government Department of Infrastructure, Transport, Regional Development and Communications, "Automated Vehicles in Australia" (2019) < https://www.infrastructure.gov.au/transport/automatedvehicles/index.aspx> accessed 11 March 2021.

[43] Connectedautomateddriving.eu, "ARCADE – Supporting the CAD Initiative" <https://connectedautomateddriving.eu/about/arcade-project/> accessed 5 March 2021.

[44] European Transport and Mobility Forum4EU, "Disabled People Spoke About their Benefits and Requirements on Autonomous Cars" < https://medium.com/@mobility4eu/disabled-people-spoke-about-their-benefits-and-requirements-on-autonomous-cars-232cdb73f197> accessed 5 March 2021.

[45] Iberdrola (n 25 above).

It is evident that OEMs in the private sector are considering the need for inclusivity in CAV design and to use this disruptive technology for the betterment of all potential users.[46] In the move towards the highest level of autonomy, where true driverless vehicles will be a reality, the benefits for independence and mobility to users who have hitherto had to rely on the assistance of others for transport purposes will be profound. Yet, given the nature of this paper and the consideration of the legal, regulatory, and policy structures, and their efficacy, in ensuring CAVs operate for the benefit of persons with disabilities, we focus our critical examination on the public sector and its readiness to facilitate CAVs introduction. We do this because of the legislation on transport requirements which relate to the public and quasi-public transport framework and infrastructure to which private CAVs will not be subject. We also regard this to be a more timely direction for the discussion given most people's interaction with CAVs is likely to be, first, through the public sector – buses, trams, robo-taxis and so on. This rolling-out of CAVs will be more mainstream, be amenable to insurance cover and liability regimes, subject to greater controls, and allow for better scrutiny of the effectiveness of CAVs and their impact on communities.

Across the United Kingdom (UK),[47] there are "over 11 million people with a limiting long term illness, impairment or disability".[48] As part of wider governmental policy to increase the number of disabled people in work by a million before 2027,[49] the Department of Transport developed a specific *Inclusive Transport Strategy: Achieving Equal Access for Disabled People*.[50] Since then, the UK Government has remained committed to its pledge to ensure that, by 2030, people with disabilities will have equitable access to transport, "with assistance if physical infrastructure remains a barrier".[51] This specifically includes "ensuring that new technologies and future transport systems are designed from the outset with disabled people in mind".[52] As part of this, the UK Government made a call for evidence through their *Future of Transport Regulatory Review: Moving Britain Ahead*.[53] Within that Review, they explain how the UK Government's approach to the future of the transport sector would be founded on a set of nine, core principles. These include that: "the benefits of innovation in mobility must be available in all parts of the UK and all segments of society" and "the marketplace for mobility must be open to stimulate innovation and give the best deal to customers". Through this call

[46] Autovista Group, "Top 12 Technology Companies Driving Mobility Change" (2019) https://autovistagroup.com/news-and-insights/top-12-technology-companies-driving-mobility-change accessed 12 May 2021.

[47] Throughout this paper, where we refer to UK law, we are referring to the law of England and Wales. However, some laws might apply to the entire UK in different guises and so for ease of reading, particularly for an international audience, we use the term UK and UK law unless the designation would cause confusion.

[48] Gov.UK, "Official Statistics: Disability Facts and Figures" <Disability facts and figures - GOV.UK (www.gov.uk)> accessed 25 January 2021.

[49] Gov.UK, "Strategy Seeks One Million More Disabled People in Work by 2027" www.gov.uk/govetnment/news/strategy-seeks-one-million-more-disabled-people-in-work-by-2027 accessed 25 January 2021.

[50] Department of Transport, *Inclusive Transport Strategy: Achieving Equal Access for Disabled People*, (2018) <inclusive-transport-strategy.pdf> accessed 25 January 2021.

[51] Gov.UK, "The Inclusive Transport Strategy – Summary of Progress" <The Inclusive Transport Strategy – summary of progress - GOV.UK (www.gov.uk)> accessed 27 January 2021.

[52] Ibid.

[53] Department of Transport, *Future of Transport Regulatory Review: Moving Britain Ahead,* (2020) <future-of-transport-regulatory-review-call-for-evidence.pdf> accessed 25 January 2020.

for evidence, the Department of Transport sought stakeholder views on a range of issues, including "ensuring inclusive future transport",[54] recognising how approximately 40% of those with limited mobility have no access to a private vehicle, rely more on public transport as a result, and make 40% fewer journeys.[55] In the Summary of Responses,[56] key findings on the theme of ensuring inclusive future transport included the significance of continued stakeholder engagement. On the basis of the responses, the Department for Transport has funded research to explore both CAV-related barriers and prospects for those with protected characteristics under the Equality Act 2010 and has also pledged to work with the Cabinet Office Disability Unit on "inclusive future transport opportunities" that support the forthcoming Strategy for Disabled People[57] which was due for publication in 2021 but may be subject to delay following the pandemic.[58]

This global, collective recognition by key stakeholders, including governments, car OEMs, and campaign groups, reflects evidence within the literature of the important role that the disability viewpoint plays in gaining insights into, and championing, inclusion.[59] Within the field of research around CAVs and disability,[60] this paper makes its contribution through drawing on an internationally comparative approach, through the lens of inclusivity, to examine the legal, regulatory and policy frameworks around CAVs, public spaces and those with disabilities. Whilst the concepts of inclusion and inclusivity have been long-recognised,[61] they remain subject to definitional difficulties.[62] This paper perceives inclusivity as an individual's ability

[54] Ibid at 26.
[55] Karen Lucas, Gordon Stokes, Jeroen Bastiaanssen, and Julian Burkinshaw, *Inequalities in Mobility and Access in the UK Transport System – Future of Mobility: Evidence Review*, (2019) Government Office for Science, <Future of Mobility: Inequalities in Mobility and Access in the UK Transport System (publishing.service.gov.uk)> accessed 27 January 2021.
[56] Department for Transport, *Future of Transport Regulatory Review Summary of Responses: Moving Britain Ahead*, <Future of Transport Regulatory Review (publishing.service.gov.uk)> accessed 27 January 2021.
[57] Ibid at 6.
[58] Gov.UK, "A National Strategy for Disabled People to Remove Barriers and Increase Participation" <A National Strategy for Disabled People to Remove Barriers and Increase Participation - GOV.UK (www.gov.uk)> accessed 27 January 2021.
[59] *See*, for example, Eric Emerson, Ros Madden, Janet Robertson, Hilary Graham, Chris Hatton, and Gwynnyth Llewellyn, "Intellectual and Physical Disability, Social Mobility, Social Inclusion & Health" (2009) *CeDR Research Report* 2009:2 < https://eprints.lancs.ac.uk/id/eprint/26403/1/Disability_Social_Mobility_Social_Inclusion.pdf> accessed 15 March 2021; *See*, for example, Brenda Gannon, and Brian Nolan, "The Impact of Disability Transitions on Social Inclusion" (2007) 64 (7) *Social Science & Medicine* 1425-1437; Michael Oliver, and Colin Barnes, *Disabled People and Social Policy: From Exclusion to Inclusion* (1998, London Longman).
[60] *See*, for example, Heather Bradshaw-Martin and Catherine Easton, "Autonomous or "Driverless" Cars and Disability: A Legal and Ethical Analysis" (2014) *European Journal of Current Legal Issues* 20(3); and Frank Douma, Adeel Lari, and Kory Andersen, "The Legal Obligations, Obstacles, and Opportunities for Automated and Connected Vehicles to Improve Mobility and Access for People Unable to Drive" (2017) 75 *Michigan State Law Review* 75-96; Rojas-Rueda et. al (n 5 above).
[62] *See*, for example, Alan Hodgkinson, "Inclusion: A Defining Definition" (2011) 3 (2) *Power and Education* 179-185.
[62] *See*, for example, Nabin Rawal, "Social Inclusion and Exclusion: A Review" 2 *Dhaulgiri Journal of Sociology and Anthropology* 161-180.

to completely take part in society[63] so that they feel "engaged, empowered and able to exercise and enjoy their rights on an equal basis with others."[64] Such a perception allows us to segue to the contributions that disability and accessibility have had on notions of inclusion and inclusivity. Pullin[65] has discussed the impact of design for people with disabilities on mainstream design language, and how each might inspire the other. He gives examples such as eyeglasses and prosthetics which have both inspired and been inspired by functional and fashion design, and extends this to new forms of braille signage where a simplicity of design should emerge, perhaps through collaboration between experience prototyping with clinical trials. This approach gives rise to a diversity of complementary and, perhaps contradictory, methods which can lead to benefits for all stakeholders. Hendren[66] has taken this further by reimagining spaces and exploring the concept that everything humans make and use are actually assistive technology. She asserts that it is only when a misfit between a person's body and the world is sufficiently acute to be understood as a disability, that consideration is given to how to challenge the assumptions on which our everyday environment is built. This specifically speaks to fostering interdependent, not just independent, living and aims to render our environment to better meet the collective needs of all members of society. To foster inclusivity, the UK's Department for International Development proposed a "Theory of Change for Disability Inclusion" within its most recent Strategy for Disability Inclusive Development.[67] It seeks, amongst others, to "empower people with disabilities" through investment in more "accessible environments", the development of "infrastructure… legislation, standards, principles and design integration", and the mitigation of any "barriers" presented by "audio, visual, intellectual and physical" elements.[68] It also encompasses a number of cross-cutting aspects including the key role that can be played by "assistive technology."[69] In assessing inclusivity, we can draw on the Policy Toolbox that has been put forward by the United Nations Educational, Scientific and Cultural Organization and the International Institute for Educational Planning.[70] Whilst it relates to the educational context, its key messages have broader relevance in facilitating the development of more inclusive laws, regulations and policies in relation to CAVs, public spaces, and stakeholders with disabilities.

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[63] *See*, for example, Brenda Gannon, and Brian Nolan, "Disability and Social Inclusion in Ireland" *Economic and Social Research Institute* (no date) <https://www.ihrec.ie/app/uploads/download-old/pdf/disability_and_social_inclusion_in_ireland.pdf> accessed 5 March 2021; and Cathy Little, Renske Ria deLeeuw, Elga Andriana, Jessica Zanuttini, and Evans David, "Social Inclusion through the Eyes of the Student: Perspectives from Students with Disabilities on Friendship and Acceptance" (2020) *International Journal of Disability, Development and Education*, DOI: 10.1080/1034912X.2020.1837352.

[64] Department for International Development, "DFID's Strategy for Disability Inclusive Development 2018-23" (2018) <Disability-Inclusion-Strategy.pdf (publishing.service.gov.uk)> accessed 7 May 2021 (no page number available).

[65] Graham Pullin, *Design Meets Disability* (2009, Cambridge, MA, MIT Press).

[66] Sara Hendren, *What Can a Body Do? How we Meet the Built World* (2020, New York, Penguin Riverhead Books).

[67] Department for International Development (n 67 above).

[68] Ibid.

[69] Ibid.

[70] United Nations Educational, Scientific and Cultural Organization and the International Institute for Educational Planning, "Equity and Inclusion in Policies and Legal Framework" (2021) < https://policytoolbox.iiep.unesco.org/policy-option/equity-and-inclusion-in-policies-and-legal-framework/> accessed 7 May 2021

The policy recommendations made include developing obligatory, essential inclusive practices; alleviating current impediments; and ensuring a cohesive statutory framework.[71]

Adopting this lens of inclusivity, we critically examine the international development of laws, regulations, and policies in relation to the advent of CAVs and examine the potential challenges and prospects for the increasing numbers of stakeholders with disabilities. To achieve this aim, we pose three research questions. First, to what extent do UK and international legal and regulatory frameworks around CAVs recognise the needs of drivers with disabilities within the context of public spaces? Second, how have related policy developments within these contexts taken account of these stakeholder groups? Third, what opportunities might there be for developing their laws, regulations, and policies around consultation, collaboration, and communications with this key stakeholder group?

We begin the legislative assessment with a focus on the UK's Equality Act 2010, and its role in protecting against discrimination on the basis of disability and the broader regulation of transport services. This continues with assessment of the regulation of buses which is especially relevant given their increasing implementation internationally for CAV trial-use and accessibility to the public.[72] The discussion continues with a comparison with the UN Convention on the Rights of Persons with Disabilities and the drawing of distinctions between these two sources and the implications they have for the advancement of inclusivity. We then present an assessment of where both of these sources could be improved through a detailed analysis of the needs of persons with disabilities in respect of physical, mental health and cognitive disabilities, and some more general issues which legislators and policymakers should include in their strategies for inclusive legislation in this area. Finally, recommendations are offered to help identify and explain their rationale and import in future law-making for this developing and uncertain form of transportation and mobility. It is this stage of the paper where, in particular, the legislative and regulatory provisions in many jurisdictions, including in Hong Kong as much as the UK, could benefit from a fundamental review. This is to ensure future law-making is fit for a transportation system where public transport is operated without a driver or conductor being present who could provide direct assistance to a passenger with a disability.

4. The UK Equality Act 2010

The Equality Act (EA) 2010 is the consolidating measure which, through nine *protected characteristics*, subject to *prohibited conduct* (offences which are actionable), imposes obligations on a variety of stakeholders to maintain the equality of individuals and members of designated groups. At part 3 of the EA 2010, these equality measures are applied to transport and travel services (which includes much of the land transport along with the infrastructure and

[71] Ibid.

[72] *See*, for example, Ryosuke Abe, "Introducing Autonomous Buses and Taxis: Quantifying the Potential Benefits in Japanese Transportation Systems" (2019) *Transportation Research Part* A, doi: 10.1016/j.tra.2019.06.003; Martin Kagerbauer, and Christian Klinkhardt, "RABus: The Autonomous Bus Trial Underway in Baden-Wurttemberg" (20 April 2021) *Intelligent Transport* < https://www.intelligenttransport.com/transport-articles/122746/rabus-trial/> accessed 7 May 2021; and Isabelle Roche-Cerasi, "Public Acceptance of Driverless Shuttles in Norway" (2019) *Transportation Research Part F* doi: 10.1016/j.trf.2019.09.002.

transport services). Further, part 12 and Sch 2 of the EA 2010 regulate accessibility for persons with disabilities when using public service vehicles – for example buses, travelling by rail, and accessing transport by taxis and private hire vehicles. The EA 2010 generally provides for protection against discrimination of persons with a disability, but in respect of transport/service providers, the definition and scope of the EA 2010 is broader and covers persons with reduced mobility – hence those who would not be considered "disabled" as defined in the EA 2010 are still protected in respect of being a service user of the transport and travel services.

Before advancing the discussion of this legislation, it is important to provide some definitions of the terms above to explain the parameters of who and what is covered by these equality and anti-discrimination provisions. In respect of a *service provider*, this includes legal persons and therefore includes individuals, businesses (private and voluntary organisations) and public bodies which are concerned with the provision of a service, goods and/or facilities to the public or a section of the public whether for payment or not;[73] or are concerned with the exercise of a public function.[74] Both *service providers* and *transport service providers* are subject to the same requirements. It is unlawful[75] for them to: discriminate on the terms on which a service is provided to the person with a disability; terminate the provision of the service; subject the person with a disability to any other detriment; harass or victimise the person requiring the service by, for example, not providing the service, through the terms on which the service is provided, or subjecting the person to any other detriment; and to fail to make reasonable adjustments to ensure persons with disabilities have the access as is enjoyed by the public (an anticipatory duty) – subject, as they are, to a reasonableness test. The service provider also acts unlawfully where they do not provide the quality of service to the person with a disability that they usually provide to the public (or a section of it which includes the person) or do not provide the person with a service in the manner in which, or on the terms which it usually provides to the public.[76]

A *service user*, as defined in the Equality and Human Rights Commission Services Code,[77] at para 1.23, is a person including customers of services; users of facilities; consumers or purchasers of goods; people who benefit from or are subject to public functions; and people who are members, associates and guests of associations. People who attempt to or want to use a service, benefit from a public function or join an association may also be "service users", even if they cannot actually use the "service" as a result of discrimination. A service user may not be discriminated against (having required a service or having been provided with the service) when seeking to obtain a service[78] and/or during the provision of that service.[79] This includes the denial of that service.[80]

[73] EA 2010 s 29(1).
[74] EA 2010 s 29(6).
[75] EA 2010 s 29.
[76] EA 2010 s 31(7).
[77] Equality Act 2010 Code of Practice: Services, Public Functions and Associations Statutory Code of Practice. Available at: https://www.equalityhumanrights.com/sites/default/files/servicescode_0.pdf.
[78] EA 2010 s 31(6).
[79] EA 2010 s 29.
[80] EA 2010 s 29(4).

Having provided the definitions of those legal persons who are subject to the regulation of the transport and service provision, we now explain the duties and obligations to which they are subject.

(a) Duty to Make Reasonable Adjustments

In the event that a person with a disability is placed at a "substantial[81] disadvantage" in comparison to a person who is not disabled, due to the provider establishing a provision, criterion or practice (a PCP); some physical feature; or their failure to provide an auxiliary aid, there exists a duty for the service provider to make reasonable adjustments.[82] This means that the service provider must take such steps as are *reasonable* to avoid the disadvantage, or it should adopt reasonable alternative methods to providing the service.[83] In respect to physical features that put (or would put) a person with a disability at a disadvantage, the duty to make reasonable adjustments applies to features in or on premises occupied by the provider, and physical features brought onto premises other than those occupied by the provider (by or on their behalf) while providing the service.[84] These duties do, however, vary depending on the type of vehicle being used to provide the service.

A particularly important point which is worth remembering throughout any discussion of the impact of CAV use for persons with disabilities, and one we return to in the recommendations section of this paper, was issued by the UK government which, in its instructions[85] to service providers, noted that they were not to view disabled passengers as a homogenous group. Rather they should recognise and provide services which acknowledge the marked differences between groups with singular disabilities and needs. This extended to the requirement for service providers to anticipate the wants of persons with different needs depending on the disability and to positively make reasonable adjustments to ensure parity of service provision for persons in such groups and the general public.[86] Indeed, a failure to anticipate the needs of persons with disabilities may result in the failure to have made an adjustment which was otherwise reasonable for it to have made. Hence, this is a prospective rather than a reactive duty.

The duty to make reasonable adjustments is not static and requires service providers to regularly review their provisions. This operates in respect of changes to regulation and legislation; policy and guidance issued by the government and charitable bodies; and in respect of changes to technology which impact on the provisions available and the needs of persons with disabilities who may use the service.

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[81] Which, under EA 2010 s 212(1) means more than minor or trivial.
[82] EA 2010 s 20.
[83] EA 2010 s 20 and Sch 2, para 2(3).
[84] EA 2010 Sch 2, para 2(6).
[85] Elizabeth Clery, Zsolt Kiss, Eleanor Taylor, and Valdeep Gill, *Department for Transport: Disabled People's Travel Behaviour and Attitudes to Travel*, November 2017, < https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/647703/disabled-peoples-travel-behaviour-and-attitudes-to-travel.pdf > page 5.
[86] EHRC Services Code, para 7.21.

(b) Limits to the Duty

The duty to make reasonable adjustments is subject to limits and these typically apply to situations where, by making an adjustment, such a step would fundamentally alter the nature of the service.[87] Of most concern to the transportation of persons with disabilities is EA 2010, Sch 2, para 3(2) which outlines special provisions for such persons' travel by land (although it also applies to air and water). Here, the general position is that it would not be reasonable for a transport service provider to have to take steps which mean altering or removing a physical feature of a vehicle used in providing the service;[88] affect whether the vehicles are provided[89] or what vehicles are provided;[90] or affect what happens in the vehicle when someone travels in it.[91] However, whilst this might appear at first instance to be prohibitive to CAV use where the vehicle is not designed to carry passengers with disabilities, an exception applies to the application of the provisions listed in EA 2010, Sch 2, para 3(2)(b)-(d). This is where a class of service users with disabilities are placed at a substantial disadvantage by a provider's PCP or failure to provide an auxiliary aid, and the vehicle concerned is contained within para 3(3)(a)-(i). These vehicles include private hire vehicles, public service vehicles and passenger hire vehicles with more than eight seats.[92]

(i) Taxis and Private Hire Vehicles

The term taxi is defined as a Hackney carriage (the traditional "black cab" as used in the UK), but the EA 2010 also includes private hire vehicles (PHV - those which carry fewer than nine passengers) such as minicabs which are booked through an operator. The duties applicable to taxis and PHVs include the requirement to make reasonable adjustments in the provision of their service; to accept passengers with assistance dogs[93] (and drivers must not charge extra for their carriage unless the provider holds an exemption certificate);[94] in some circumstances the vehicle must be wheelchair accessible (often applicable to taxis in larger cities – and all in London); and where the vehicle is identified as wheelchair accessible, the provider must accept passengers, must also be able to provide them with appropriate assistance, and must not apply an additional charge for this service.[95] Further, although not yet included in the legislation, newer taxis are being fitted with induction loops and intercoms for the benefit of persons who use hearing aids.[96]

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[87] EA 2010, Sch 2, para 2(7).
[88] EA 2010, Sch 2, para 3(2)(a).
[89] EA 2010, Sch 2, para 3(2)(b).
[90] EA 2010, Sch 2, para 3(2)(c).
[91] EA 2010, Sch 2, para 3(2)(d).
[92] Para 3(5).
[93] Assistance dogs include those used for persons who are blind or deaf, and those dogs trained to assist a person with epilepsy or a person with a disability affecting their mobility, manual dexterity, coordination, or ability to lift, move or carry everyday objects (EA 2010 s 173(1)).
[94] EA 2010 ss 168-171.
[95] EA 2010 s 165.
[96] *See*, for example, Transport for London, "People with Sight or Hearing Loss" <https://tfl.gov.uk/transport-accessibility/people-with-sight-or-hearing-loss> accessed 7 May 2021.

Local authorities, through their licensing authorities, are permitted (and are strongly encouraged to do so yet no requirement in the law exists) to produce a designated list of wheelchair accessible taxis and PHVs.[97] Without such a list, the requirements established in EA 2010 s 165 will not apply and drivers will be able to: refuse to carry wheelchair users; operate without having to provide such users with assistance; and may charge an additional fee for the carriage of these users.[98]

On the production of a list, the details should be such as to allow passengers to make an informed decision about the vehicle – its make, model and the accommodation of, for instance, larger wheelchairs.[99] The guidance document also allows for the designation of vehicles which are accessible to passengers in wheelchairs, but those who can transfer themselves from the wheelchair into the vehicle's seat (although this is not a requirement included in EA 2010 s 165 and therefore no transgression of the law applies for such an omission).

Section 165(4) of the EA 2010 requires the driver of a designated vehicle hired for or by a person who uses a wheelchair to, at no additional charge, allow the user to travel in their wheelchair, or to travel in a passenger seat with the wheelchair being carried in the vehicle; to ensure the wheelchair user is carried in safety and reasonable comfort; and to give the user mobility assistance (helping the user on and off the vehicle, stowing their luggage and wheelchair and so on) as and when reasonably required. An offence is committed for breach of these requirements.[100]

(c) Failure to Comply

Exemptions for drivers exist, and these usually apply because of the driver's physical condition which is supported on medical grounds.[101] In this eventuality, the licencing authority may issue a valid exemption notice to the driver's vehicle - which could be a private hire vehicle or a taxi.[102] Unless exempt, drivers of taxis and private hire vehicles who refuse to comply with the section 165 obligations may be subject to a fine.[103]

This section of the Act should also be read in conjunction with the designated vehicles list as these vehicles will not necessarily be capable of carrying all types of wheelchairs For instance, if the vehicle could not safely carry a powered wheelchair, the driver of such a vehicle has a defence against any offence under EA 2010 s 165(7). It is available to licensing authorities to instigate enforcement measures against a driver on the basis of alleged discrimination.[104]

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[97] EA 2010 s 167.
[98] Department for Transport, Access for Wheelchair Users to Taxis and Private Hire Vehicles: Statutory Guidance (2017) para 3.1.
[99] Department for Transport, Access for Wheelchair Users to Taxis and Private Hire Vehicles: Statutory Guidance (2017) para 3.10.
[100] EA 2010 s 165(7).
[101] EA 2010 s 165(9).
[102] EA 2010 s 166(3) and (4).
[103] EA 2010 s 165(7) and (8).
[104] Department for Transport (n 99 above) para 5.5.

(ii) Public Service Vehicles

The duties to provide accessibility in the provision of travel extends to public service vehicles which primarily include buses and coaches.[105] The relevant framework for the accessibility standards is contained within Chapters 2 and 2A of the EA 2010. These chapters are supplemented by *Regulation 181/2011/EC concerning the rights of passengers in bus and coach transport* (a retained European Union (EU) regulation) which provide additional rights for passengers with disabilities or who are persons with reduced mobility. The operators of public service vehicles are subject to a range of mandatory duties which include the obligation to make reasonable adjustments; the duty to provide designated wheelchair spaces to certain vehicles; and the requirement to allow passengers who wish to travel with an assistance dog to be accompanied by their dog for the duration of the journey. These provisions are supplemented by the Accessibility Regulations[106] which apply to all buses and coaches[107] and outline design standards[108] for the vehicles with the specific aim of ensuring passengers with disabilities, and in particular passengers who use wheelchairs, have access to public transport. In particular, this relates to modes of embarkation and disembarkation of the vehicle with safety and without unreasonable difficulty. It also provides that persons with disabilities must be permitted to travel safely and in reasonable comfort. Further to the aim of inclusive transport provisions, in 2017, the Bus Services Act led to guidance being issued by the Department for Transport to local authorities where they have responsibilities for the design of public transport services, to consult with a range of stakeholders when devising their strategies for transportation.[109] Persons with disabilities and representative groups are to be consulted at as early a stage in the process as possible to ensure that vehicles in use meet accessibility standards. This continues, adopting a *whole of journey* dimension, to include roadside infrastructure thereby meeting both legal duties and best practice standards for accessibility. It is also worthy of note that, in respect of an increasing measure being adopted globally, MaaS was also incorporated so enhanced accessibility qualities including flexible space for wheelchairs; the provision to carry motorised wheelchairs and mobility scooters; and the use of assistance cards for passengers with impaired communication skills can be accommodated and should all feature at the design and implementation phases. Thus, vehicles providing audible and visual systems for the communication of routes, stops and other relevant information; and ticketing systems, both online and in-person, should be made accessible to all passengers who require use of them.

(a) Failure to Comply

[105] EA 2010 ss 174 - 181D.
[106] The Public Service Vehicles Accessibility Regulations 2000, SI 2000/1970 – now part of the Equality Act 2010 following the Equality Act 2010 (Commencement No. 4 Savings Consequential Transitional Transitory and Incidental Provisions and Revocation) Order 2010 (SI 2010/2337), Sch 7.
[107] Reg 3.
[108] These, contained in Schedule 1 for general accessibility standards; Sch 2 for buses and Sch 3 for coaches, detail specifications for the numbers, sizes and locations for wheelchair spaces; the availability of ramps and lifts; details of priority seats for persons with disabilities and route and destination displays.
[109] At para 4.6 of the Guidance.

Enforcement of the Regulations is a role undertaken by two bodies – the Office of the Traffic Commissioner and the Driver and Vehicles Standards Agency. In the event that the operator of a vehicle in use fails to comply with the Accessibility Regulations, a fine may be levied against the transgressor on the current level 4 tariff.[110] An interesting aspect of the Regulations is the ability to hold company officers, including company directors and secretaries, and managers personally liable in the event that the transgression has occurred with their consent, neglect, or connivance.[111]

5. Existing Limitations and the Need for Further Action: The UN Convention as a Model for Inclusivity?

It is hoped that what is evident from the very brief review of the regulatory provisions existing in UK law is that mechanisms to assist persons with disabilities are well established and clearly thought out. Of course, that is not to say that the actual implementation and operation of the provision works in compliance and with no problems for the service user. Studies, commentaries, and governmental consultation exercises have ably demonstrated examples of situations where persons with disabilities have found no help available in their use of public transport and have experienced the very disorientating and concerning effect this can have on their confidence in using this form of transport. It is also clear that, in some respects at least, national law is inferior in scope and protective purpose than similar provisions internationally.

Under the UN Convention on the Rights of Persons with Disabilities, signatory states must ensure that a wide range of providers in both the public and private sectors are prohibited from discriminating. The purpose of the Convention is, *inter alia*, "to promote, protect and ensure the full and equal enjoyment of all human rights and fundamental freedoms by all persons with disabilities."[112] Signatories to the Convention are required to take appropriate measures to ensure that people with disabilities have equal access to transport.[113] This includes identifying and then removing obstacles to accessibility. The Convention goes beyond the prohibition of disability discrimination, rather it requires an equality norm that seeks to equalise the "lived reality of persons with disabilities."[114] Indeed, the duties cover all human rights, civil and political rights, and economic, social, and cultural rights. These equality rights are further applied to those bearing the duty in the public and private sectors to eradicate discrimination. Further, given the nature of the Convention rights being based on human rights, the signatory states must take all necessary measures to remove barriers which might otherwise hinder the participation and inclusion of persons with disabilities in their enjoyment of all human rights.

[110] Current rates and limits for employment lawyers: Criminal fines: £2,500.
[111] EA 2010 s 175(3) and (4).
[112] Article 1.
[113] Article 9.
[114] *See* Lisa Waddington, and Andrea Broderick, "Disability Law and the Duty to Reasonably Accommodate beyond Employment: A Legal Analysis of the Situation in EU Member States" (2016) Report Commissioned by the European Commission and the European Network of Legal Experts in Gender Equality and Non-Discrimination, p. 46. Available at: http://www.equalitylaw.eu.

(a) The Convention and Reasonable Accommodation, not Adjustment

It will be noted that under UK law, a requirement exists for service providers to make reasonable adjustments to avoid discrimination based on a person's disability. The Convention refers to signatory states ensuring that, for both public and private providers, reasonable accommodation must be provided. The essence of reasonable accommodation requires, in the present instance, service providers to promote equality and the elimination of discrimination so that the person with a disability does not encounter a disproportionate or an undue burden. The nature of the distinction between reasonable adjustments and the Convention obligation of reasonable accommodation is profound. To begin, a breach of the reasonable accommodation duty is a distinct form of discrimination rather than a sub-set of direct and indirect forms of discrimination. It is not a prohibited act but, as Waddington has observed, is a form of discrimination which may result in an increased awareness of the rights-based nature of the duty to accommodate, and a recognition amongst people with disabilities and service providers of the seriousness of a failure to comply with this duty.[115]

The definition of the word "reasonable" in reasonable accommodation has been discussed by the Convention Committee which concluded that whilst reasonable is a single term, the concept of reasonableness is not to be misread as an exception, distinct qualifier or modifier to the duty.[116] The Committee held that the reasonableness of an accommodation should be considered in light of the relevance, appropriateness and effectiveness for the person with a disability and that the accommodation will be reasonable where it achieves the purpose for which it is being made and is tailored to meet the requirements of the person with a disability.[117] Ultimately, this means that it is the suitability of the measures adopted by the service provider in respect of facilitating the participation of persons with disabilities that will be the overriding principle.

The Convention Committee has concluded that the reasonableness of accommodations is not to be assessed in relation to costs – rather the issue of cost would be an assessment under a disproportionate or undue burden defence argument. However, and albeit in an employment context, the Court of Justice of the European Union has held that the accommodation measures to which a person with a disability is entitled must be reasonable, yet must also not constitute a disproportionate burden on the employer (for example in respect of costs).[118] Consequently EU law operates differently to the requirements under the Convention and this could have negative implications for jurists and legislators particularly in the UK where the legislation and case law remains as a provision of retained EU law (albeit subject to the proviso that it could be subsequently changed during a review of the legal provisions in this area).

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[115] Lisa Waddington, "Equal to the Task: Re-examining EU Equality Law in Light of the United Nations Convention on the Rights of Persons with Disabilities" (2013) *European Yearbook of Disability Law*, vol. 4 (Intersentia), pp. 169-200, 190.
[116] Committee on the Rights of Persons with Disabilities (2018), General Comment No. 6 on Equality and Non-Discrimination, UN Doc. CRPD/C/GC/6, para 25(a).
[117] Ibid.
[118] Joined Cases C-335/11 and C-337/11 *HK Danmark (Ring and Skouboe Werge* ECLI:EU:C:2013:222, [58].

(b) Positive Action

The Convention allows for the positive action, at Art 5(4), of signatory states which includes specific measures necessary to accelerate or achieve de facto equality of persons with disabilities. Such actions shall not be considered discrimination. Importantly, and in respect to the requirement of reasonable accommodation, positive action is not a mandatory imposition under the Convention. However, it is also possible, particularly in respect of human rights and the Convention Committee's statements on the matter generally, where permanent positive action measures are required, dependent upon the circumstances and context, to circumvent particular impairments or the structural barriers of society. Yet, the nature of a non-mandatory Article results in a difficulty in using the particular "right" as a stand-alone mechanism to assert protection against a discriminatory act.[119]

It is also worth remembering the commentary offered by de Schutter[120] in respect of the structural forms of discrimination as these cut across different spheres – including transport, housing, access to healthcare and so on – which may result in a situation where the prohibition of discrimination in one or more of these spheres will not suffice to ensure effective equality. Thus, the advancement of special measures or indeed what may be otherwise termed privileges which are aimed at accelerating the attainment of de facto equality may indeed be necessary to avoid the very structural discrimination which the Convention seeks to end. Such a position is endorsed by the Human Rights Committee[121] and the United Nations Committee on Economic, Social and Cultural Rights.[122]

(c) Enforcement Measures

To comply with the Convention rules, signatory states are obliged to modify or abolish laws, customs, policies, practices, and regulations that constitute discrimination, and the states should adopt enforcement mechanisms to ensure the effective access to, and enjoyment of, equality. It is recommended that the remedies and sanctions available for transgression of discriminatory practices include criminal, civil and procedural measures to ensure the access to and enjoyment of Convention rights to equality and non-discrimination. It is also worthy of consideration that in the establishment of sanctions for breaches of this aspect of the Convention, the Convention Committee[123] recommended the adoption of punitive sanctions as a measure to dissuade providers from breaching equality rights as well as providing adequate remedies for the victims of the discriminatory behaviour. It has even gone so far as to make suggestions to signatory states as to the relative paucity of available measures available in the

[119] For example, *see Committee on the Rights of Persons with Disabilities, A.F. v Italy* UN Doc. CRPD/C/13/D/9/2012.
[120] Olivier De Schutter, "Positive Action", in: Dagmar Schiek, Lisa Waddington, and Mark Bell, (eds.) *Cases, Materials and Text on National, Supranational and International Non-Discrimination Law* (Oxford, Hart Publishing, 2007), p. 793.
[121] General Comment No. 18 (1989).
[122] General Comment No. 20 (2009).
[123] *See* General Comment No. 6 (2018) on Equality and Non-Discrimination, 26 April 2018. Available at https://tbinternet.ohchr.org/_layouts/15/treatybodyexternal/Download.aspx?symbolno=CRPD/C/GC/6&Lang=en.

civil law and suggested the adoption of equitable remedies including the use of injunctive relief to remedy a disadvantage encountered by a person with a disability.

Beyond the remedy of damages, the Convention Committee has urged signatory states to consider an extension of such remedies and implementation of "forward-looking" and even "non-pecuniary remedies" as part of a suite of legislative instruments to protect against discrimination carried out by public and private entities.[124] These would be particularly relevant measures to take in respect of discrimination which is systemic in nature and where the award of compensation to an individual would not have sufficiently detrimental effects in isolation on the discriminator/service provider to facilitate a change in behaviour. Consequently, a range of additional features including training, awareness-raising and guidance could be offered to the discriminator as a means of avoiding future transgressions and to positively influence behaviour as part of a broader package of equality promotion.

The Convention, then, contains a number of initiatives and features to encourage, but also to compel, signatory states and service providers within those states to place a premium on advancing the equality of persons with disabilities in respect of transport. Yet, as a form of international law, its practical implications for a reluctant signatory state remains limited – possibly aspirational, but prone to dilution given the competing demands on the public purse, public infrastructure, and the public and quasi-public transport service providers. Similarly, as a new form of transport being trialled and deployed, CAV use in the UK retains the use of, predominantly, existing laws. However, this has not stopped soft law from developing which also seeks to advance a more inclusive form of public, autonomous, transport system, yet much work is still needed.

6. The Need for Strategic Legislation

The UK, as part of its desire to be a leading country in the development of CAV use, has through its soft law, established the UK CAV Code of Practice.[125] The Code is primarily intended to be used by organisations and individuals planning to trial or pilot CAV technologies and services, and provides that, as a minimum, the engagement of the testing of CAVs should include considerations of those who might be affected by the trials. This includes groups such as members of the public (generally); highways authorities; transport authorities and local authorities, including county councils, district councils, unitary authorities, and metropolitan districts. This instruction permits these organisations in offering guidance and support on matters including advice about proposed routes, the impact on existing public transport networks, support with public communications and feedback from the public. These latter two aspects would be particularly apt for disability groups and organisations to provide information relevant to the testing of CAVs on public roads. Indeed, the Code notes how those conducting trials should "consider how to provide special consideration for more vulnerable road users

[124] Committee on the Rights of Persons with Disabilities (2018), General Comment No. 6 on Equality and Non-Discrimination, UN Doc. CRPD/C/GC/6, para 22.
[125] Gov.UK "Guidance: Code of Practice: Automated Vehicle Trialling" (6 February 2019) <https://www.gov.uk/government/publications/trialling-automated-vehicle-technologies-in-public/code-of-practice-automated-vehicle-trialling> accessed 7 May 2021.

including those with reduced mobility [and] those with visual or hearing impairments… and respond proactively to any incidents which may occur during a trial."

However, despite such positive moves to protecting the interests of persons with disabilities in respect of transport provision, there are areas for more work and direction. For instance, the UK Connected and Automated Mobility Roadmap to 2030**,** launched by Zenzic, a company established by the government and industry in 2018, advances provision for legislation and regulatory developments. Yet, in the 104 milestones it created to facilitate the testing, development, and deployment of connected and self-driving vehicles, perhaps significantly is the omission for specifically outlining disability as a factor in its "Golden Threads" of Legislation and Regulation; Safety; CAM Services; Public Acceptability; Infrastructure; and Cyber Resilience.

Hong Kong is, of course, preparing like other jurisdictions for the advent of CAVs. In legislative terms, this can be seen in GovHK. (2020) LCQ20: Facilitating the Application of Information Systems and Development of Autonomous Vehicles; GovHK. (2019) LCQ8: Development and Application of Autonomous Vehicles; and Hong Kong e-Legislation (2020) Road Traffic (Registration and Licensing of Vehicles) Regulations. There have also been guidance and instruction offered for Hong Kong's preparedness for this form of transport including Transport Department (2019) Guidance Notes on the Trials of Autonomous Vehicles; and Transport Department (2019) Smart Mobility Roadmap for Hong Kong. The Transport Department in 2016 provided a "Letter to SCMP in response to an article on electric vehicle's driver assistance features" and the Transport and Housing Bureau in 2019 issued its paper on "Smart Mobility Initiatives Relating to Road Transport."[126] In its Smart City Blueprint 2020,[127] similarly with the UK's policy roadmap to the incorporation of technology including CAV implementation, there is little specific identification and explanation of how persons with disabilities will be assisted through the development of protective rights or how prominently this demographic will feature in legislation to ensure public transport service providers will have to consider their needs with new and innovative modes of conveyance.

It seems that many disability standards currently in use remain "loose" on how to develop their current suite of protection in respect of the incoming CAV revolution, given that there is little in the way of definitive instruction, albeit with aspirational intents. The UK's Department for Transport, in its 2018 Inclusive Transport Strategy: Achieving Equal Access for Disabled People report, commits that by 2030, it envisages equal access for disabled people using the transport system, *with assistance* if physical infrastructure remains a barrier – but without explaining how and in respect to which modes of transport.[128] As an international

[126] LC Paper No. CB(4)1110/18-19(01).

[127] The People's Republic of China, the Government of the Hong Kong Special Administrative Region Innovation and Technology Bureau, and the Office of the Government Chief Information Officer, "Hong Kong Smart City Blueprint 2.0" (2020) < https://www.smartcity.gov.hk/modules/custom/custom_global_js_css/assets/files/HKSmartCityBlueprint(ENG)v2.pdf> Accessed 25 May 2021.

[128] *See*, for instance, the current exceptions with requirements on drivers/conductors to provide a person with a disability with assistance, and to allow them to refuse to carry a person with a disability. UK law allows for the driver / conductor of a bus to prevent a person with a disability from boarding or leaving the vehicle: in the

characteristic, not insignificant duties are currently placed on the drivers of various forms of public transport to offer assistance to persons with disabilities. Not only does this require training and (often) the physical ability to provide assistance, it is also a further responsibility placed on them in addition to their duties as drivers. Where a driver forgets to alert a passenger with vision problems about alighting the bus at a given stop, this might be understandable given their other responsibilities, yet the negative and broad consequences for the person with a disability are profound. The move to driverless vehicles needs to ensure that all passengers can have access, assistance, and support to make use of these vehicles where no driver/person in authority is present to help. The Strategy also envisages the future of inclusive transport having technological advances built in by design. Finally, it promises legislation to ensure the provision of on-board audible and visible upcoming stop and route information being installed on local bus services across the UK (such systems already being quite mainstream in London, and much more infrequent the further into rural areas transport systems operate).

The UK Public Service Vehicles (Conduct of Drivers, Inspectors, Conductors and Passengers (Amendment)) Regulations 2002 have since 1 October 2002 required the bus driver (or conductor) to provide reasonable assistance to disabled passengers, including wheelchair users, to board and alight (a matter furthered in, for example, the Equality Act 2010). Evidently, the move to CAVs [at levels 4 and 5 SAE[129] at least] will remove the driver who is present on the vehicle. It would be unlikely that given this movement away from a driver being present that this role would then be replaced by another human, perhaps offering assistance for persons with disabilities. In the United States, the National Highway Traffic Safety Administration in 2016 amended its position on automated vehicles by explaining how it was considering non-human drivers as "drivers" under the Federal Motor Vehicle Safety Standards. Thus, it may be argued that existing laws relating to the help and assistance required for persons with disabilities when using public modes of transport (public and quasi-public) could also extend to autonomous vehicles (so, at least, not to cause a bottleneck to the rolling out (and disability-accessibility obligations) of autonomous vehicles). It may be possible to use an existing definition of a driver to develop the requirements for assistance to persons with disabilities

event that a fault or failure of any equipment would mean that it is not safe to do so (Reg 15); if the number of passengers currently on board results in an insufficient capacity for a person with a disability to be accommodated; and situations exist where the driver / conductor may not be able to fulfil the duties outlined in the Conduct Regulations due to a potential risk to the health and safety of themselves, the person with a disability, other passengers or in respect of the security of the vehicle (Reg 17).

[129] The SAE has developed an internationally accepted grading system denoting the stages from driver assistance features to fully autonomous vehicle. Level 0, a human driver performs all driving tasks. At Level 1, an automated system on the vehicle can assist a human driver conduct some parts of the driving task (for example through an anti-lock braking system). At Level 2 (partial automation), an automated system on the vehicle can perform some driving tasks but a human continues to monitor the driving environment and perform the remaining driving tasks. At Level 3 (conditional automation), an automated system can both conduct parts of the driving task and monitor the driving environment. However, a human driver must be prepared to retain control when the automated system requests. At Level 4 (high automation), an automated system performs the driving task while monitoring the driving environment. A human must be present behind the wheel, as the automated system is only able to operate in specific environments and under given conditions. Finally, at Level 5 (full autonomation), the automated system performs all driving tasks across all driving modes and adheres to International Standard J3016. For commentary on the SAE standards and its implications on definitions used in legislation see James Marson and Katy Ferris, "The Lexicon of Self-Driving Vehicles and the Fuliginous Obscurity of 'Autonomous' Vehicles" (2021) *Statute Law Review* https://doi.org/10.1093/slr/hmab016.

from feedback received from disability charities and interest groups. Whilst this will provide some relief that the introduction of CAV public service vehicles would not remove existing protections and features (as limited as they may be in practical terms in some instances), this would lose the very opportunity that a transition to CAVs in the public transport sector might provide if they were not built upon specifically for the introduction of CAVs.

There will remain a need for generic codes of practice for passengers with disabilities, but also specific codes for different forms of disabilities and different forms of travel. Ensuring a "one size fits all" approach is removed from any considerations of future actions for equality laws as they affect transport and mobility is of paramount importance. To give just one example, people with hearing difficulties or those with social anxiety may appreciate information being available on public transport through the adoption of touch screens. Yet in several instances relating to persons with disabilities, this may cause and create as many problems as it seeks to solve. Deaf passengers may not possess high levels of proficiency in the English language; this same issue may be exacerbated for members of minority communities with disabilities; and passengers with cognitive impairments will require environments with lesser stimulus and with fewer objects with which they need to interact.

The design language used in the manufacture of public transport vehicles, and its infrastructure can be enhanced through strategic planning. For a passenger who uses a wheelchair, accessible vehicles with moveable furniture, leaning vehicles, and the use of cameras for the monitoring of passengers remotely can all feature in future legislative preparation. Indeed, the whole system of central and local government, the public, private and quasi-public sectors, OEMs and service providers, must come together to envisage and operationalise MaaS, an overriding principle where the whole of journey enables joined up transport systems – from booking, to the physical infrastructure and architecture of the bus and train stations, parking facilities, to the vehicles used, to the use of flexible pick up and drop off points (a many-to-many system), to the use of technological and non-technological aids to assist passengers to complete their journeys are crucial in the next phase of developing and implementing equality transport laws. MaaS platforms provide a layer between mobility providers and consumers. It integrates and analyses data from operators and the multiple modes of transport available to provide a choice of journeys, routes, and destinations to consumers. The aim of MaaS is to establish a best practice information source on journey options (price, speed, modes, routes) whilst instigating the seamless purchasing of end-to-end journeys.

The work of buses and taxis is interesting in this respect. Existing schemes in operation provide a "many to many" system where passengers can be picked up and set down anywhere within the area of operation or a "one to many" system where passengers are picked up from fixed stops outside the area of flexible operation and taken to different destinations within it. This has been shown to work in a case study of "ArrivaClick", systems operating in two cities in the UK - Liverpool and Leicester. Here there are no fixed routes, and the journeys are determined by the passengers who may "order" and track a vehicle from the app. The system provides the passengers with a guaranteed fare and allows them to choose their pick-up point and reserve a seat. Computer algorithms match passengers traveling in the same direction, dynamically routing vehicles in real time to find the optimal route for their trip. This system however, in order to be rolled-out more effectively, will require an updated regulatory

framework, especially to ensure compliance with anti-discrimination legislation and policies. Presently, when introducing, changing, or withdrawing a flexible bus service, the operator must provide at least 42 days' notice (for community bus services this is 14 days' notice) to the Traffic Commissioner. A further 28 days' pre-notification must be given to any local authority served by the service. This system is somewhat inflexible given that while a deviation to pick someone up within the flexible service area can be undertaken almost instantly, a small expansion of that area would require 70 days' notice. A Government Review[130] has been tasked with considering the efficacy of the current regulatory regime given that, a current problem with MaaS in the UK (which, admittedly, remains in its infancy) is that the legislation and regulation is spread across multiple levels of government and fragmented across modes. Local authorities, central government, transport authorities, and private operators will require coordinated regulation to ensure the system fulfils its function. For instance, standardisation and interoperability of data will be fundamental to its operation. One area, currently under consideration, is for the establishing of mechanisms to prevent anti-competitive behaviour[131] of existing mobility operators who refuse to share data and systems with emerging entrants. A further issue is of the potential to "locking-in" of customers again with the negative consequences for new entrants to the market.

Part of the incoming strategy for a whole of journey approach is to consider the use of vehicles and transport systems when, for instance, the passenger with a disability is dropped off at their destination in, for example, a city centre. It may be a policy choice that private forms of transport are to be discouraged in such venues and therefore it is for the public planners to consider how this passenger completes their journey within this space. One possible answer is to encourage the development of micromobility systems (which include electric scooters, electric skateboards, low-powered last-mile delivery solutions, and those devices specifically designed for people with disabilities). UK national law is presently a barrier here as most micromobility vehicles are considered "motor vehicles" and thus are subject to requirements to which they, as a form of transport, are unable to comply[132] (although exceptions do apply to mobility scooters referred to as "invalid carriages"). Further, in respect of mobility scooters, it is currently illegal to use these devices on the road or on a pavement. The UK government intended to determine the prevalence of these vehicles and their usefulness for individuals, and society generally. In particular, assessment was required as to whether micromobility vehicles are physically robust and safe by design; whether users have the skills to use them safely; how micromobility vehicles interact with other vehicles, road users and pedestrians; and how liability is handled when accidents occur. These factors are still to be determined, but it is encouraging that such issues are being considered pending their wider adoption.

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[130] Gov.UK, "Consultation Outcome: Future of Transport Regulatory Review: Call for Evidence on Micromobility Vehicles, Flexible Bus Services and Mobility-as-a-Service", <https://www.gov.uk/government/consultations/future-of-transport-regulatory-review-call-for-evidence-on-micromobility-vehicles-flexible-bus-services-and-mobility-as-a-service> accessed 7 May 2021.

[131] Albeit existing laws – the Competition Act 1998 and Enterprise Act 2002 – would have to be complied with and which, at least until 1 January 2021, followed EU anti-competitive behaviour laws.

[132] Meeting construction standards; requiring the registering and licensing the vehicle; requiring users to be in possession of a driving licence and holding a policy of motor insurance; and requiring the user to wear a helmet for vehicles with two-wheels.

7. Conclusions

In this paper we have attempted to lay the foundations for a review of how the current disability equality standards will need to be changed with the influx of CAVs into the public sector transport system. Our review of current laws in the UK, comparing those with standards internationally, and then looking forwards to the new transport paradigm which is set to be established with CAV use has allowed us to speculate on the legislative features of an inclusive future transport scheme. This includes inclusive transport and access to opportunity. Access to transport is vital to our health, wellbeing, and social cohesion, as well as to a productive economy. Transport can affect job opportunities, lifestyle, civic participation, and social connections, with potential consequences for individuals' physical and mental health. As a consequence, lack of access to transport and socio-economic inequality are often closely linked.[133]

The examples provided in this paper of the work of OEMs including Ford and of Tesla have heeded the call for "industry-academia" and "industry-government" research to "shap[e] future cities, formulat[e] vehicle safety standards, and draft… the laws and regulations that are pre-requisite to [C]AV deployment".[134] The transport options available to people, and the extent to which they can access these, are different for everyone. Access to transport in most regions across the world varies, often depending on local geography and population density. It also varies due to factors such as age, health, socio-economic status, or physical ability. Hence, what we see is an opportunity for governments in Hong Kong, the UK and US (for example), following the completion of internal reviews and through discussions with key stakeholders, to adopt equality, diversity, and inclusiveness in its forthcoming CAV-based public transport legislative roadmaps. CAV transport systems are developing and being rolled out at an incredible speed. The equality legislation governing this progression needs prompt action to ensure it is leading and guiding this innovative and disruptive system, not attempting to mitigate against any negative effects after the event.

[133] *See*, for example, Rojas-Rueda et. al (n 2 above).

[134] Asif Faisal, Tan Yigitcanlar, Md Kamruzzaman, and Alexander Paz, "Mapping Two Decades of Autonomous Vehicle Research: A Systematic Scientometric Analysis" (2020) *Journal of Urban Technology*, doi: 10.1080/10630732.2020.1780868, 20.