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## Autonomous Vehicles and Embedded Artificial Intelligence: The Challenges of Framing Machine Driving Decisions

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### Synopsis

Artificial Intelligence has been around for some time but due to advances in machine learning and perception, machine functionality is now overcoming the classic challenges of real-world problems. This now presents commercial opportunities to provide machine intelligence solutions to what were until now solely the domain of human intelligence and decision capacity. The variety of AI applications, the ubiquitous scale and the commercial ownership of the technologies present a complex socio-technological scenario. Furthermore, the introduction of many forms of embodied AI, such as artificial intelligence assistants, social robots, and autonomous vehicles, offer many societal benefits but due to the radical nature of AI technologies, they will also disrupt many aspects of our world. Therefore, there is now a pressing need to determine how best to identify, assess, manage, and mitigate the risks relating to society's robot future.

impacts and disruption from embodied AI technologies via the large-scale deployment of socially embedded robotics in the form of Autonomous Vehicles (AVs). AV technologies will radically change mobility, transportation, the movement of goods and the autonomy of citizens. Transportation and the benefits of mobility permeate all aspects of our lives and AVs will present many benefits. AVs are important for many reasons, but perhaps the most underappreciated relates to how AVs present a test case to society regarding how this introduction, and outsourcing of human decisionality impacts society and governance mechanisms. Moreover, because AVs relate to a variety of social contexts, many of the engagements will also introduce new forms of human and machine relations. Some of these may present new and interesting contexts, while others will trigger new concerns regarding the introduction and reliance upon machine agency and decisionality.

The societal benefits of AVs often appear obvious in terms of mitigating risks relating to human driving and decision risks, but the introduction of AVs will also present many societal risks and many new forms of risks. AVs are presented as a continuation

### Introduction and Background

Society is now facing the first and most significant example of technological

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of the narrative of vehicle automation and safety, but it is important to also consider that AVs also introduce new risks. Some of the new risks require careful assessment and further risk mitigation strategies may be required. The hottest issue concerns the possibility of AVs making decisions that will ultimately entail tangible life and death consequences. One topical example concerns the possibility of AVs making decisions to reduce quantifiable harms to group (a) but must cause some harm to group (b), this decision model is claimed to be akin to targeting and intentionally causing harm to innocents. Although, such decisions may save more lives than no action, such machine decisions are problematic in terms of existent frameworks of risk, ethics, law, and liability.

### Issues and Questions Considered

The research consists of a qualitative methodology built upon research outputs as part of our roles working on two large multi-national Horizon 2020 projects on AV technologies; Cloud LSVA<sup>1</sup> (Large Scale Video Analytics) and VI-DAS<sup>2</sup> (Vision Inspired Driving Assistance Systems). Part of the research focused on anticipatory governance regarding contexts of AV perception and decisionality. More specifically, it concerned consideration of AV use cases regarding questions of societal risk and ethics. A key benefit to the research and the anticipatory governance context related to the direct and regular access to hardware, software and social science researchers. A cross disciplinary research environment afforded hardware, software and legal insights into informing future projections of AV decisionality. The industry led research context was also instrumental in comprehending the contrasting framings of AV decisionality in wider research literature. There were clear inconsistencies concerning how AV decisionality is framed by the two dominant narratives, the safety

argument regarding machine decision superiority, and the ethical challenge, that claims AVs present important examples of machine decisionality risks and limitations. Accordingly, there is disagreement and a lack of clarity in the literature regarding the activity of modelling AV decisionality in terms of anticipatory governance.

The research focuses on the meta question of anticipatory governance and whether AV decisionality presents a new risk phenomenon that cannot be accurately captured by current anticipatory governance analytic apparatus. Either AV decisionality can fit the current paradigm of anticipatory governance or it does not. The analysis maintains current analytical apparatus that informs anticipatory research is unlikely to accurately capture the complexity of future AI and machine decisionality. Therefore, at very least this meta-question needs to be considered and new anticipatory research methods are required.

### Outcomes and Findings

A new paradigm of socio-technological relations is emerging as digital innovation results in greater complexity, sophistication, autonomy, and scale. The difficulty this scenario presents relates to questions of how society can access the benefits of AI while also mitigating the risks. Many stakeholders from regulators, policy writers, insurance actors, to end users depend upon anticipatory governance research to facilitate the necessary foresight to accurately model, capture, frame and communicate this new risk phenomenon. The research develops a critical engagement with technology in terms of combining conceptual analysis, risk, ethics to assess the possibility of developing context specific anticipatory governance frameworks. All this is an essential step on the road to self-driving cars.

<https://cloud-lsva.eu/>

The VI-DAS project is an Horizon 2020 research and innovation program (under grant No. 690772) dedicated to the joint monitoring of both (1) the external traffic environment (i.e. exterior of the vehicle) and (2) the car driver's status (i.e. interior of the vehicle). Form this "720\_" of monitoring, it is expected to design advanced driving aid systems based on vehicle automation, to be supported by adaptive HMI (i.e. context-dependent). To support these innovations regarding future HMI based on monitoring functions, a working group of experts (including HMI designers, insurance partners and liability specialists) was created, with the aim to define a common "conceptual framework" allowing them to jointly considering liability issues introduced by vehicle automation. This paper presents an overview of VI-DAS (<http://www.vi-das.eu/>) interdisciplinary effort <https://www.sciencedirect.com/science/article/pii/S1369847818308556>

The underlying study was published in Taylor & Francis Online and a copy may be obtained at:

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Forthcoming Research Bulletin

Title: Savouring nature and progressive muscle relaxation as energising respite interventions at work

Authors: Anna Steidle, M. Gloria Gonzalez-Morales, Annekatri Hoppe, Alexandra Michel & Deirdre O'shea

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