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# *Automated Driving Systems as a New Frontier for Information Systems Research*

*Panel*

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## Abstract

*This panel discusses the emerging socio-technical design challenges associated with autonomous driving systems (ADS) that have become increasingly common at least in specific circumstances both in on and off the road situations. Specific issues addressed include 1) How Safe Should Automated Vehicles Be? How should we organize and agree on appropriate norms to evaluate the safety and related measures associated with ADS? Who, or what is liable if the ADS is at fault with significant human and economic consequences?; 2) What Data Should Be Shared?; and 3) What New Human and Machine Behaviors Might Emerge? The panel will discuss emerging research issues and challenges associated with each topic and what current practice and research suggests how they will be addressed. The role of information system scholarship to contribute to this interdisciplinary field is also discussed.*

**Keywords:** Autonomous driving systems, socio-technical systems design, level of autonomous driving, safety, data and communication standards

## Introduction

Information systems community has traditionally focused for the last four decades on digital artifacts that address organizational coordination and communication needs including MIS, e-mail, coordination systems, ERP, and so on. Integration of digital capabilities to physical products and their features and capabilities has received lesser attention and noted mostly as a side story in areas like computer aided manufacturing, some work in robotics, and so on. The recent wave of digital innovation enabled by multiple and fast networks, data storage and computing in cloud and across the 'edge' and new AI and analytics capabilities has introduced new wave of product focused digital innovation (Yoo et al 2010; Lyytinen et al 2016). One paragon example of such innovation followed with a hype over the last decade is automated driving systems (ADS) commonly known as autonomous vehicles (SAE 2014, SAE 2016, Nickerson et al 2022). These systems were touted to become common by 2020-2023 about a decade ago but such outcome has not realized. Some make still optimistic estimates that ADS systems will be common in 2025 (NHTSA 2020). Some argue that these systems are a fad, another example of a failed technology prediction and hyperbole, just like AI in healthcare, and just like early generation expert systems. This panel seeks to discuss the slow pace of adoption from a socio-technical perspective and addresses how IS scholars can

contribute to the ongoing debate of their application and use. We predict that automated driving system features will become more and widely common over time and they will advance with the evolution of more intelligent transportation systems and 'smart cities' as on the critical infrastructural elements. ADSs most likely will emerge first in specific application areas including fleet management (trucks, taxis), specialized services (food distribution) and in off road applications such as mining, agriculture, and forestry. Specific reasons for such adoption paths will be discussed.

## Questions Addressed in the Panel

Significant technical challenges remain to make ADSs operational associated with architecture, capabilities, and choice of appropriate technical solutions: for example, there is an ongoing industry debate over the effectiveness of pure video versus combined video and lidar-systems (Cosner et al 2016). Ultimately many of them will be addressed in the coming decade as shift towards electronic cars take place. At the same time challenges in designing *socio-technical systems and transportation infrastructures* in which such autonomous components are effectively embedded calls for specific learning at multiple levels of transportation system design. The purpose of this panel is to discuss specific emergent and big socio-technical issues associated with growing introduction of ADS into current transportation environments. The specific topics covered during the panel are:

1) **How Safe Should Automated Vehicles Be? How should we organize and agree on appropriate norms to evaluate the safety and related measures associated with ADS? Who or what is liable if the ADS is at fault with significant human and economic consequences?**

Currently there are no common standards or agreed on ways to measure and evaluate the safety of ADSs, and there are multiple different ways to address safety issues and consequent concerns for accountability and legal liability affecting e.g. car manufacturers, insurance and regulatory bodies. Many companies claim that ADSs are safer than traditional directly human operated cars but examples of AV traffic accidents tell a different story: the mistakes made are not the same mistakes made by human drivers. Similarly accountability and legal liability is likely to be more difficult to assess and are likely to create a tussle between drivers, OEM manufacturers, algorithm developers, data owners, and insurance.

2) **What Data Should Be Shared?**

Significant progress in improving safety and operations of ADSs would emerge if more data were shared among OEMs and also among ADSs and other vehicles and infrastructure during ADS operation. However, capabilities and standards for such sharing has been slow due to lack of standards, disagreements among manufacturers what and how data should shared and the challenge of involving all involved stakeholders in developing standards and regulations for data sharing. International cultural differences also appear to be playing a role in disagreements about how to proceed. We will examine different alternatives for how data sharing would benefit ADS operation and how more sustainable data sharing principles could be developed.

3) **What New Human and Machine Behaviors Might Emerge?**

Integrating ADSs into current transportation infrastructure will introduce a significant amount of emergent and new behaviors on the social side that will trigger new types of machine behaviors. One element is trust targeted to the capabilities of the AI system and similarly can the AI system be trained to trust on different drivers (Shmidt et al 2020). Many of these behaviors and attitudes are social, individual difference based or cultural or outcomes of different regulatory traditions. Examples are violent behavior towards ADSs, ignoring or treating ADSs as secondary 'citizens' in driving, how to police them as part of the normal control of traffic and so on. We do not know how such behaviors will emerge and how they can be anticipated or mitigated. We will address some such examples and discuss how they may lead to new levels of learning how man-machine system as hybrid systems operate in transportation systems of the future.

The perspective adopted within the panel is that autonomous driving systems even at the level of L5 (fully autonomous operation) will remain essentially metahuman systems where humans will adopt monitoring,

delegating, reflecting and cultivating roles (Lyytinen et al. 2020). ADS will become also critical infrastructural elements in enabling the design and implementation of intelligent transportation systems through interconnectivity and interaction protocols and critical enablers for creating 'smart cities' where transportation is treated as infrastructural service. Humans will always form part of the design of such systems and the role of institutional and social design and learning associated with the growth of the ADS and its capabilities forms the key aspect of the panel discussion. Our focus is on articulating useful socio-technical research agendas at different level of ADS system design. One aspect of this involves building better theories and models for what happens as machines and humans learn together, at different rates in different ways and how such components can learn and trust one another other.

The panel will be organized in several rounds of discussions around each topic. It will start with a short outline and history of ADSs and their current status and evolution over the last 15 years. It will also cover a short review why ADSs form an interesting socio-technical system design challenge associated with IS scholarship. (10-15 minutes). Then each of the questions and topics will be covered in an organized debate between panel members. Each of the members will offer a distinct perspective to the topic. Prof Lyytinen will cover the history and will organize the debates and will articulate the positive prediction around ADS evolution. Prof. Nickerson will discuss the ADS challenges from the socio-technical perspective. Dr Straub will discuss the issues from the perspective of industry practice and standardization challenges. Prof Svahn will discuss challenges related to developing industry based solutions and related design aspects. Each round will take about 15 minutes. The remaining 30 minutes will be allocated to discuss research challenges and what the IS scholarship can do to engage in a meaningful way with this important and challenging topic.

## Panel Members

### *Kalle Lyytinen (Case Western Reserve University)*

Kalle Lyytinen (PhD, Computer Science, University of Jyväskylä; Dr. h.c. mult) is Distinguished University Professor at Case Western Reserve University and a distinguished visiting professor at Aalto University, Finland. He is among the top five IS scholars in terms of his h-index (96); he has the highest network centrality among the IS scholars. He AIS Fellow (2004) and the LEO Award recipient (2013), and the former chair of IFIP WG 8.2 "Information systems and organizations". He has published over 400 refereed articles and edited or written over 30 books or special issues. He has won several best paper awards from AoM, AIS/ICIS and other societies and served as SE and editor to all IS journals and several leading organization theory and innovation journals. He currently conducts research on digital innovation concerning its nature, dynamics and organization, complex design work, requirements in large systems, and emergence and growth of digital infrastructures.

### *Jeff Nickerson (Stevens Institute of Technology)*

Jeffrey V. Nickerson is the Shulman Chair for Business Leadership and Professor of Digital Innovation at Stevens Institute of Technology. His research focuses on how work and skills are evolving as autonomous technologies become more prevalent. He is currently an investigator in a National Science Foundation-funded project in the Future of Work program.

### *Edward Straub (Vice President, Land Systems at SAE ITC)*

Dr Ed Straub has worked for last 15 years on automated driving technologies- first in DoD- and then in SAE to influence positive societal change. He is one of the leading experts in ADS development and he currently works with a number of global OEMs, suppliers, technology companies, researchers, regulatory bodies, and global standards organizations to advance autonomous mobility solutions and develop related standards and solutions.

### *Frederik Svahn (University of Gothenburg)*

Frederik Svahn is Associate Professor at the University of Gothenburg and researcher at Swedish Center for Digital Innovation. He has an industrial background, with experience from defense, telecom, and

automotive industries. His research addresses digital innovation in incumbent firms, including studies of organizational capability, resource management, and generativity.

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