Transforming Mobility

Driverless in SF

What can we learn from Waymo and Cruise in San Francisco?

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Connected & Automated Mobility

KIVI congres, autonoom rijden
Arnhem
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Why CCAM?

(CCAM: Connected, Cooperative & Automated Mobility)

If done right, it can contribute to

- Increased safety, towards vision zero
- Increased accesibility of mobility services
- Reduced harmful emissions from transport
- Increased value of time

However, these challenges have to be addressed

- Key technologies are still being developed: they need to be safe, tested, validated
- The right legal framework has to be set up and adopted at Member State and EU-level
- CAVs will have to be integrated into the broader transport system and interact with other forms of mobility
- Acceptance and trust in CCAM technology, by users and society, has to be nurtured every step of the way

Demo ‘98 – Rijnwoude, Netherlands

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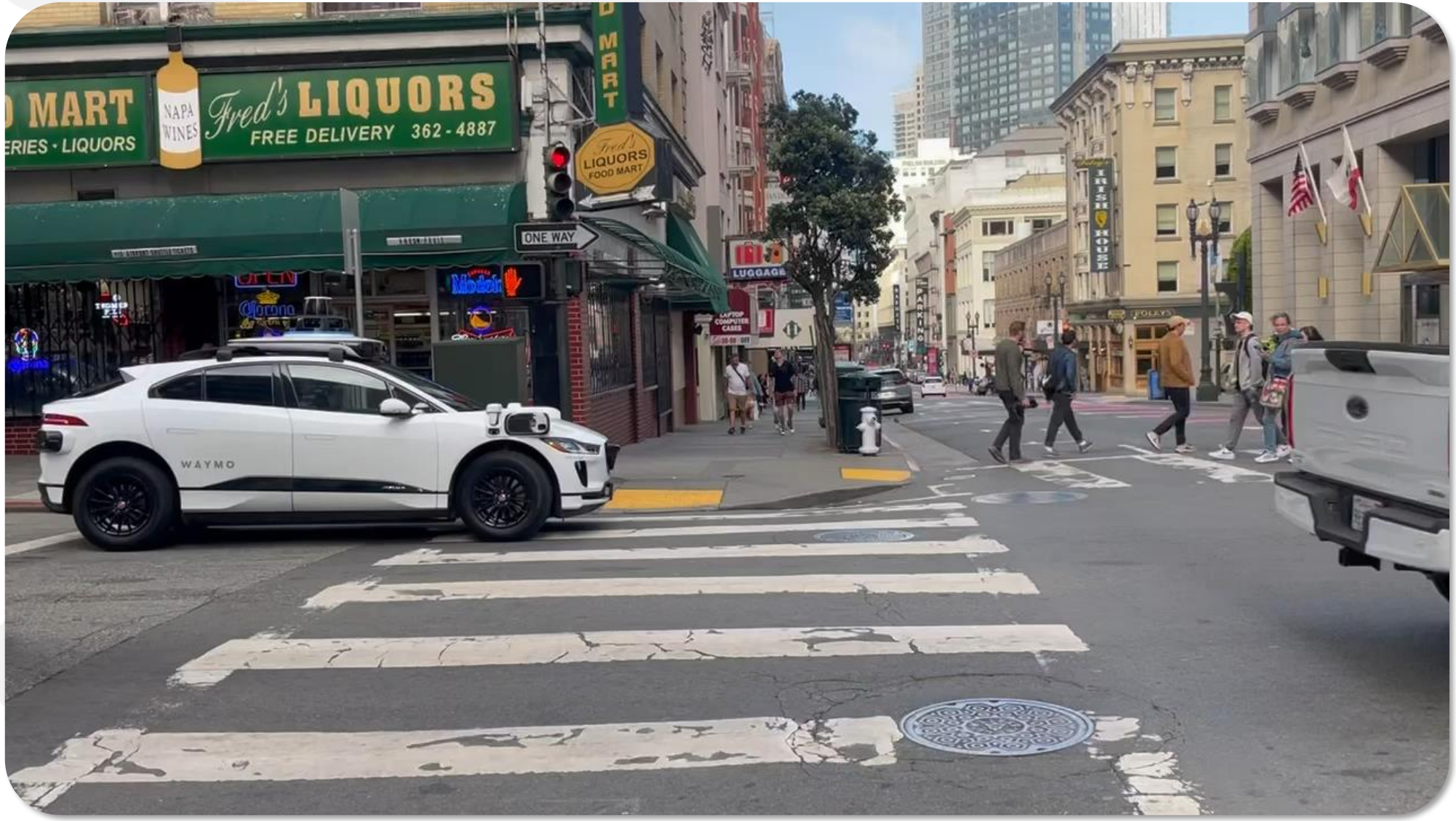
Reality 2023 - San Francisco, United States

San Francisco, 14-15 September 2022

Waymo visit 2023 - San Francisco, United States



Waymo and Zoox in the streets of San Francisco, July 2023

First world leader in a Waymo, Phoenix, December 2023

Opportunity to ride with Cruise and Waymo

Events in San Francisco, summer 2023

- ITFVHA - https://itfvha.maptm.nl/
- ARTS23 - https://trb.secure-platform.com/a/page/automatedroadtransportationsymposium

Many European experts who attended these events also had the opportunity to ride with Cruise and Waymo. We asked them about their experiences, 20 responses

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San Francisco, July 2023

Questions asked

- How many rides with self driving vehicles did you take during your visit to SF and with which vehicles?
  - 4,3 rides per expert
- Was this first time you had such a ride? (not counting demos with prototypes and safety drivers under controlled conditions)
  - Yes 16 / No 4 (80%)
- What was your experience? Can you give some positives and negatives?
- Has it changed your perspective on automated vehicles and the work you do?
  - Yes 18 / No 2 (90%)
- Can you share some pictures and/or videos of your rides?

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Find answers

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How sustainable is Connected, Cooperative and Automated Mobility?

Connected, cooperative and automated mobility (CCAM) sets the stage for a transformative shift in mobility paradigms, extending its impact from technological realms to social aspects and the practicalities of large-scale deployment. Priorities are usually set around safety, user acceptance and inclusiveness. However, sustainability implications are of increasing relevance also in the transport sector, making it […]

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Seeing is believing: Riding with Cruise and Waymo in San Francisco

This summer, many European CCAM experts, including some FAME representatives, attended two events in San Francisco; the annual Automated Road Transportation Symposium (ARTS)1 and the International Task Force on Vehicle Highway Automation (ITFVHA)2. This proved to be a great opportunity to catch rides with Cruise and Waymo, which now both have commercial deployments of level […]

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A new form of collaboration on automated mobility in Austria

Advancements in ITS and the Path to CCAM: challenges and opportunities

https://www.connectedautomateddriving.eu/blog/seeing-is-believing-riding-with-cruise-and-waymo-in-san-francisco/

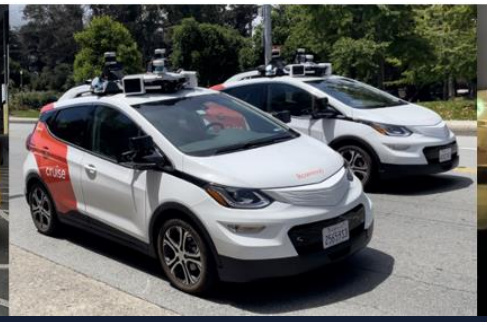
Some quotes

- “I was amazed at how safe the ride is and how quickly you get used to not having a driver behind the wheel”
- “I was really struck by the smooth driving experience”
- “the vehicles and their capabilities are much more advanced than I would have thought”
- “I saw with my own eyes what I have been regulating for years, helps me in my work”
- “We drove 3 times around the block before activating a drop-off request manually”
- “It was a really exciting experience, the driving was smooth and I felt totally safe inside the vehicle”
- “The SF visit has shown that on-road testing and learning is valuable but controversial. Sound arguments and some self-criticism (e.g. about limitations of driving repertoire) are required”
- “After the second drive I felt fully confident and even safer than with a human driver as I quickly learned to trust the system”

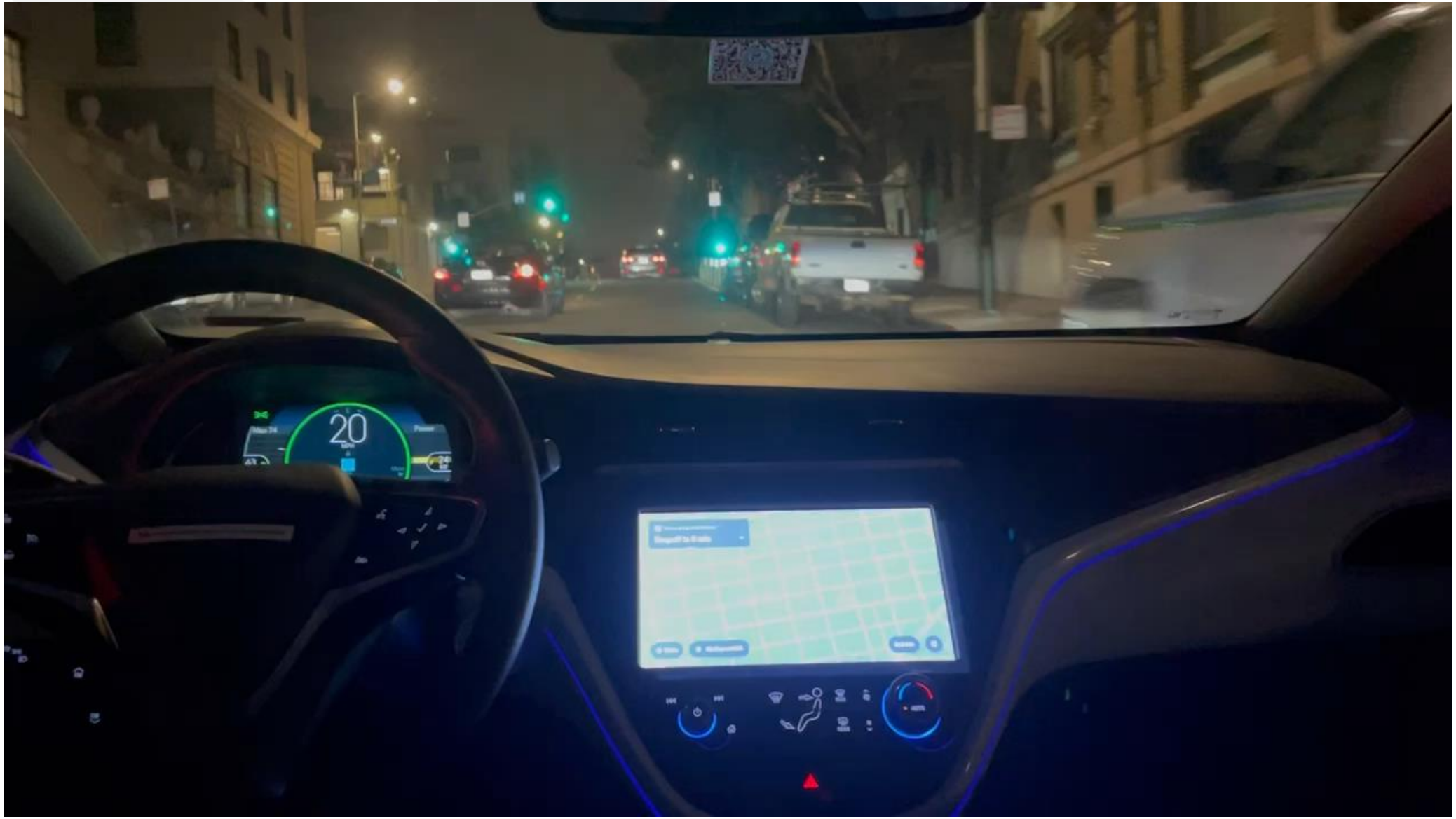
Positive and negative experiences

- Smooth driving
- Feels safe
- Assertive
- Stops for pedestrians
- Sticks to the rules

- Sticks to the rules…
- Mobbed / attacked
- Pick up & drop off issues
- Illogical routes
- Bricking
- Interaction with first responders



Interaction with fire truck, San Francisco, July 2023

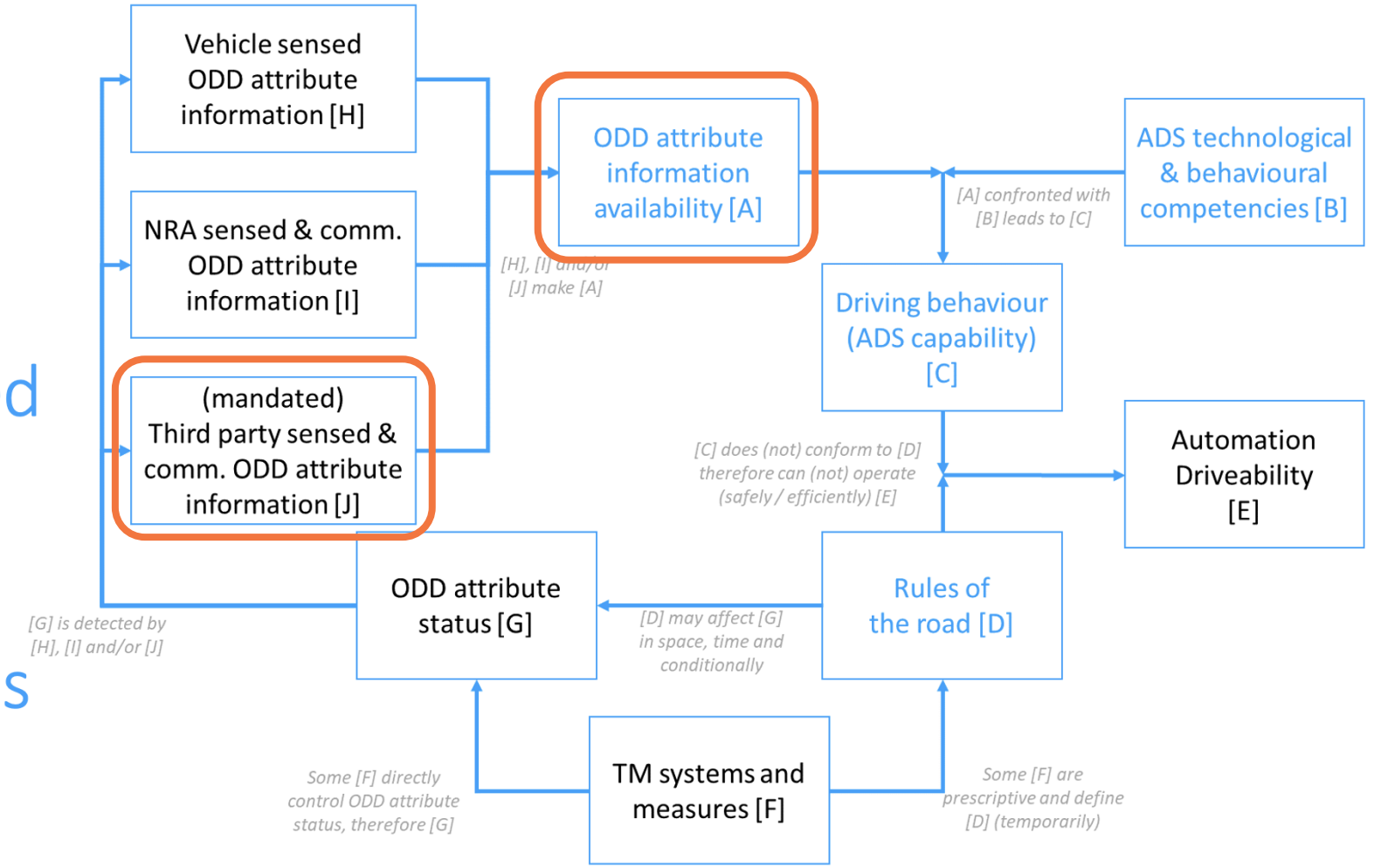


Close encounter, San Francisco, July 2023

“roadside assistance” for CAVs, connectivity is key

DOVA

Distributed ODD Attribute Value Awareness



How to solve these negative experiences?

- Necessity of remote monitoring and remote support
- Connectivity is key to Facilitate and/or enhance automated driving
- Future traffic management for AVs
- use externally sourced information to close / overcome ODD gaps or deal with them (ToCs)
- Managing the curb is essential, PUDO locations, dynamic use
- Plans to create mobility hubs where AVs can strategically wait / charge
- Multistakeholder and multidisciplinary challenge(s), cooperation is key

Transforming Mobility

Thank you for your attention

Let’s discuss!

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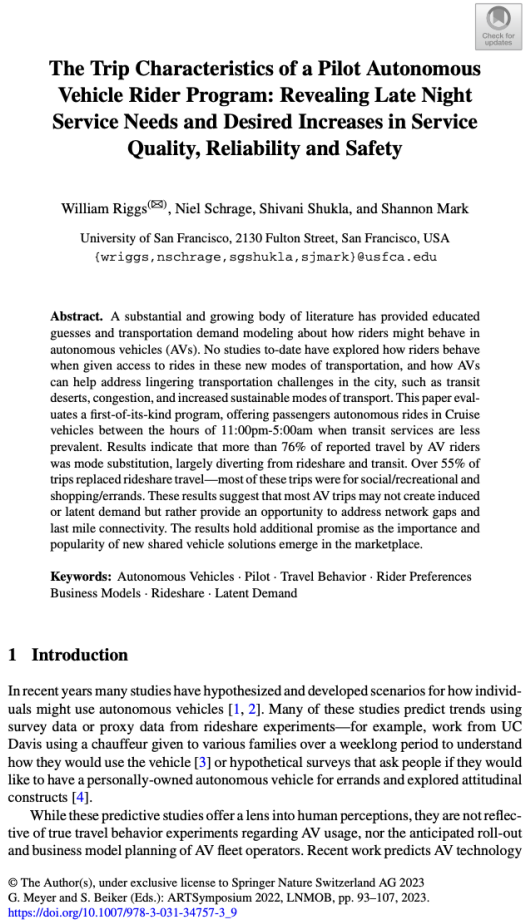
Rider behaviour study

- most AV trips may not create induced or latent demand but rather provide an opportunity to address network gaps and last mile connectivity
- majority of students rely on rideshare (57%) services for evening transportation, especially after hours when transit options are limited
- cost of rides was a major factor driving its use, as it is cheaper compared to other alternatives in locations where transit is not conveniently accessible during late-night hours
- increase in total travel observed is consistent with other studies and does not indicate a "runaway" increase in vehicle miles traveled (VMT). (See work from Kara Kockelman which shows 10x reduction in travel)
- Most papers demonstrating a dramatic increase in VMT with AVs relate to privately owned AV technology, which is not reflective of the current market direction.



The Trip Characteristics of a Pilot Autonomous Vehicle Rider Program: Revealing Late Night Service Needs and Desired Increases in Service Quality, Reliability and Safety

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Abstract. A substantial and growing body of literature has provided educated guesses and transportation demand modeling about how riders might behave in autonomous vehicles (AVs). No studies to-date have explored how riders behave when given access to rides in these new modes of transportation, and how AVs can help address lingering transportation challenges in the city, such as transit deserts, congestion, and increased sustainable modes of transport. This paper evaluates a first-of-its-kind program, offering passengers autonomous rides in Cruise vehicles between the hours of 11:00pm-5:00am when transit services are less prevalent. Results indicate that more than 76% of reported travel by AV riders was mode substitution, largely diverting from rideshare and transit. Over 55% of trips replaced rideshare travel—most of these trips were for social/recreational and shopping/errands. These results suggest that most AV trips may not create induced or latent demand but rather provide an opportunity to address network gaps and last mile connectivity. The results hold additional promise as the importance and popularity of new shared vehicle solutions emerge in the marketplace.

Keywords: Autonomous Vehicles · Pilot · Travel Behavior · Rider Preferences Business Models · Rideshare · Latent Demand

1 Introduction

In recent years many studies have hypothesized and developed scenarios for how individuals might use autonomous vehicles [1, 2]. Many of these studies predict trends using survey data or proxy data from rideshare experiments—for example, work from UC Davis using a chauffeur given to various families over a weeklong period to understand how they would use the vehicle [3] or hypothetical surveys that ask people if they would like to have a personally-owned autonomous vehicle for errands and explored attitudinal constructs [4].

While these predictive studies offer a lens into human perceptions, they are not reflective of true travel behavior experiments regarding AV usage, nor the anticipated roll-out and business model planning of AV fleet operators. Recent work predicts AV technology

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https://doi.org/10.1007/978-3-031-34757-3_9

Publications on CO2 emissions and empty miles

- Economic Incentives for AV Companies to Reduce VMT (Riggs & Beiker, 2019)
  - https://www.semanticscholar.org/paper/Business-Models-for-Shared-and-Autonomous-Mobility-Riggs-Beiker/d6497f504ba26e9ebaefd7ed1c2650d949af6f61
- Designing for street livability in the era of driverless cars, AV Circulation without Passengers: A Rule of Thumb (Appleyard & Riggs, 2023)
  - https://www.sciencedirect.com/science/article/pii/S259019822300115X
- Relationship between vehicle kilometers traveled (VKT), greenhouse gas (GHG) emissions, and street grid network design (Boeing & Riggs, 2023)
  - study of San Francisco, with 1 million modelled trips showed that empty miles are predominantly influenced by network design -> a more efficient street grid design can reduce VKT for both human and automated vehicles
  - https://journals.sagepub.com/doi/10.1177/0739456X221106334 (converting one-way streets into two-way streets)
  - https://transfersmagazine.org/magazine-article/issue-11/rethinking-the-one-way-street/