The road ahead to automated vehicles

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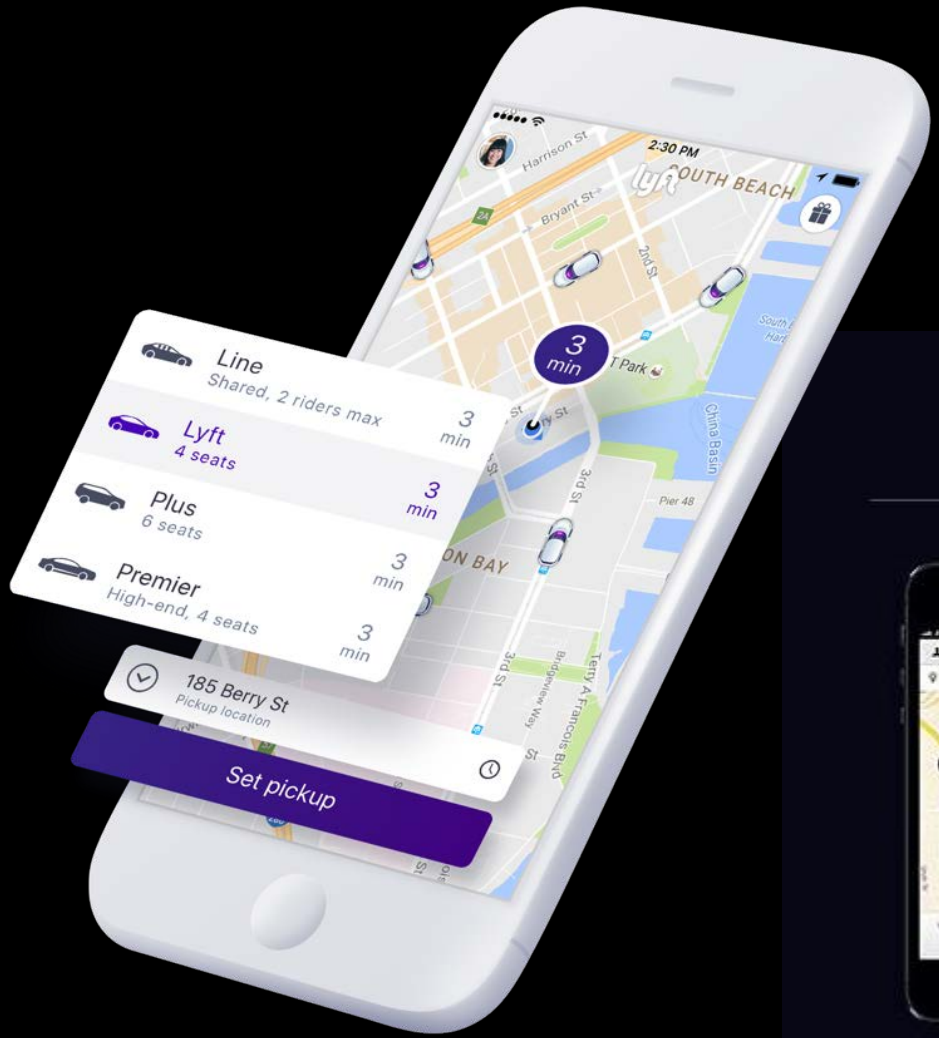
“The future is already here.
It’s just not very evenly distributed.”

William Gibson


UBER



UBER

The Uber app connects you with a driver at the tap of a button


NAVYA


GREAT
BRITAIN
CATAPULT


CityMobil2

The Opportunity

Reducing the 35,092 fatalities on our roads annually

Providing accessible transportation at low cost per mile

Making this mobility sustainable

Shifting Framework (credit to Adam Jonas, Morgan Stanley)

From

16,000,000 cars

To

3,000,000,000,000 miles

Which miles and how?

Three Basic Needs for Automation

Actuation

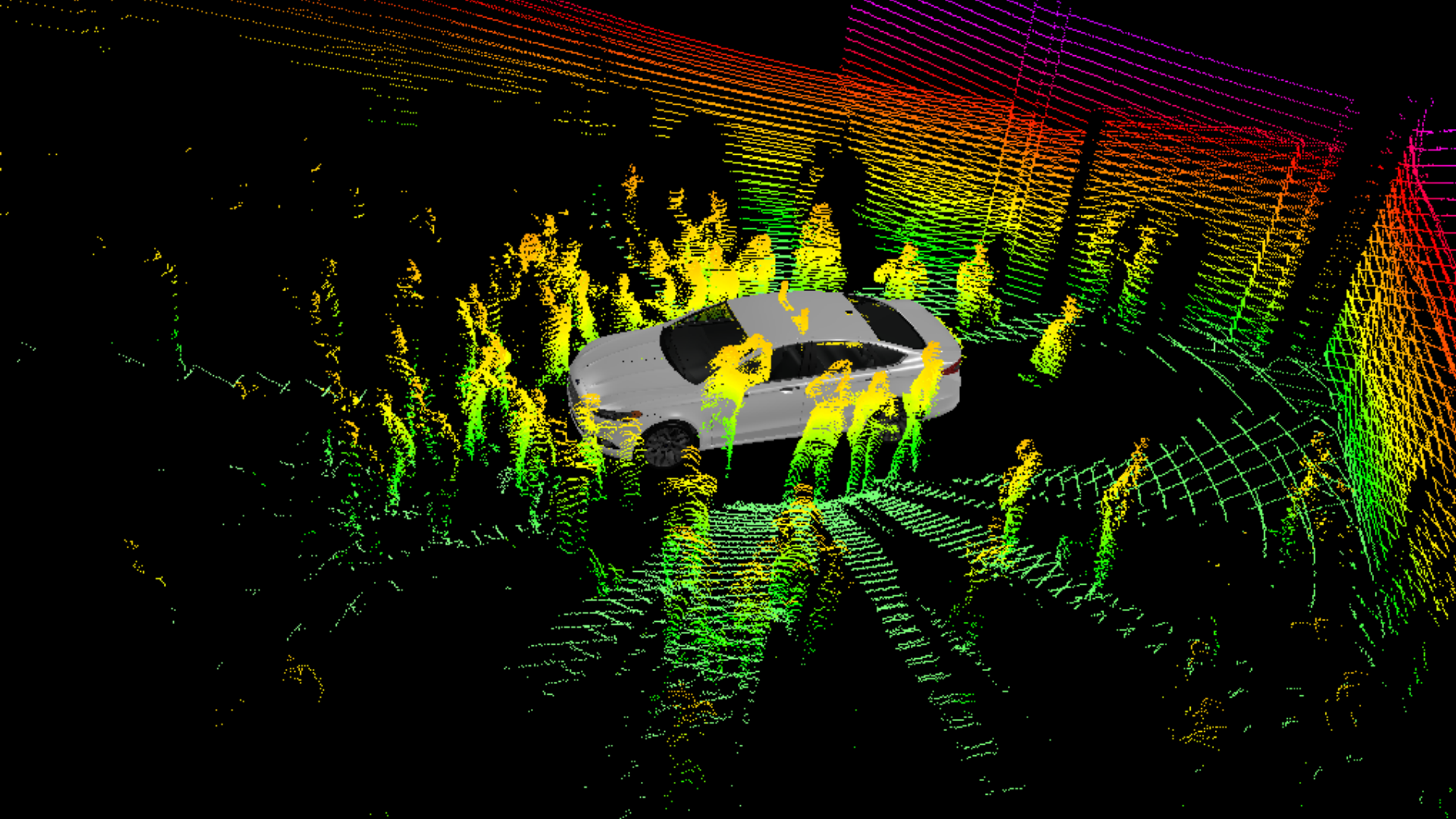
- Control of steering, propulsion and braking
- Largely a solved problem for new cars

Sensing and Perception

- Combinations of laser scanners, cameras and radar
- Sensing is here today, perception still developing

Motion planning and control

- Movement through required driving scenarios
- Control of the car in emergency situations



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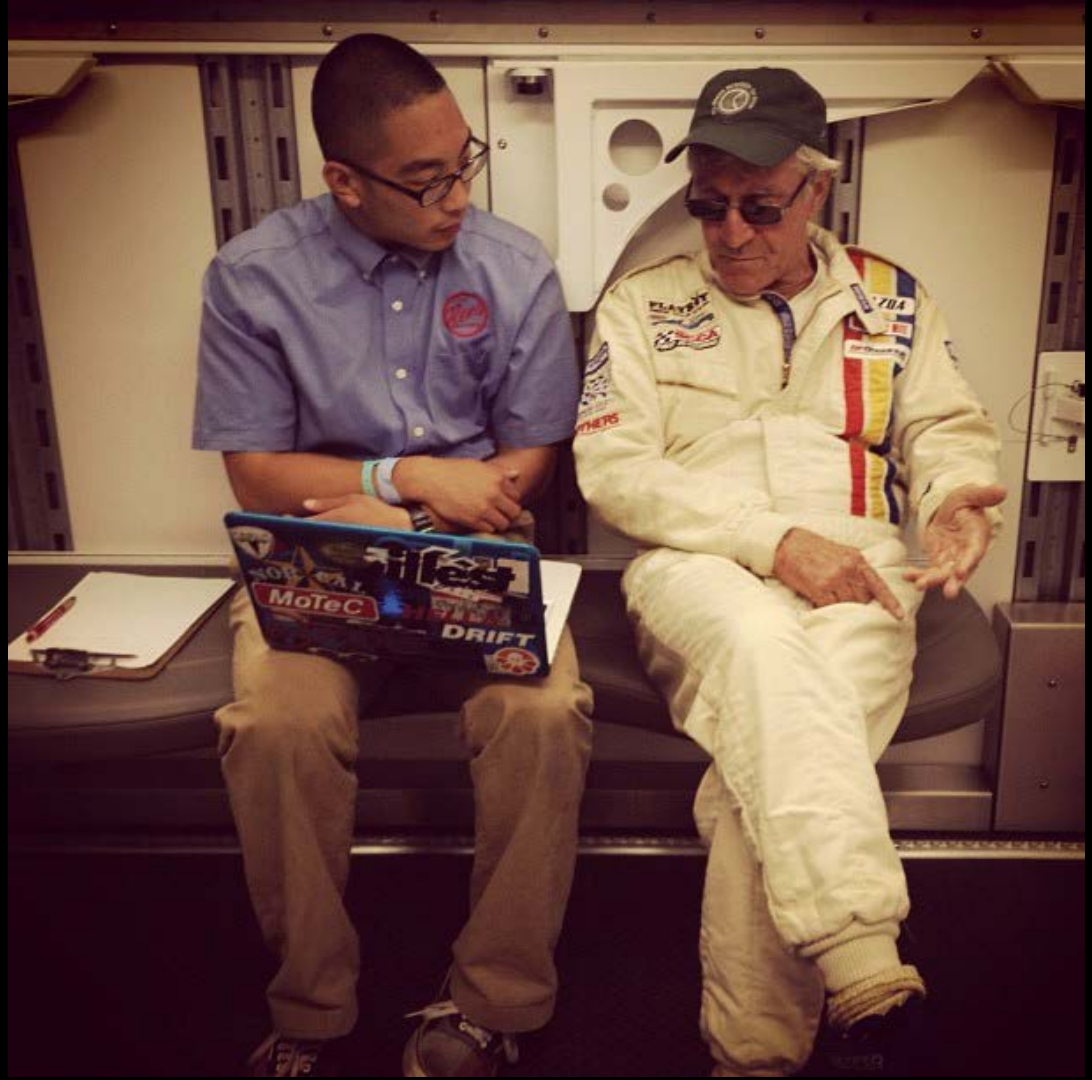
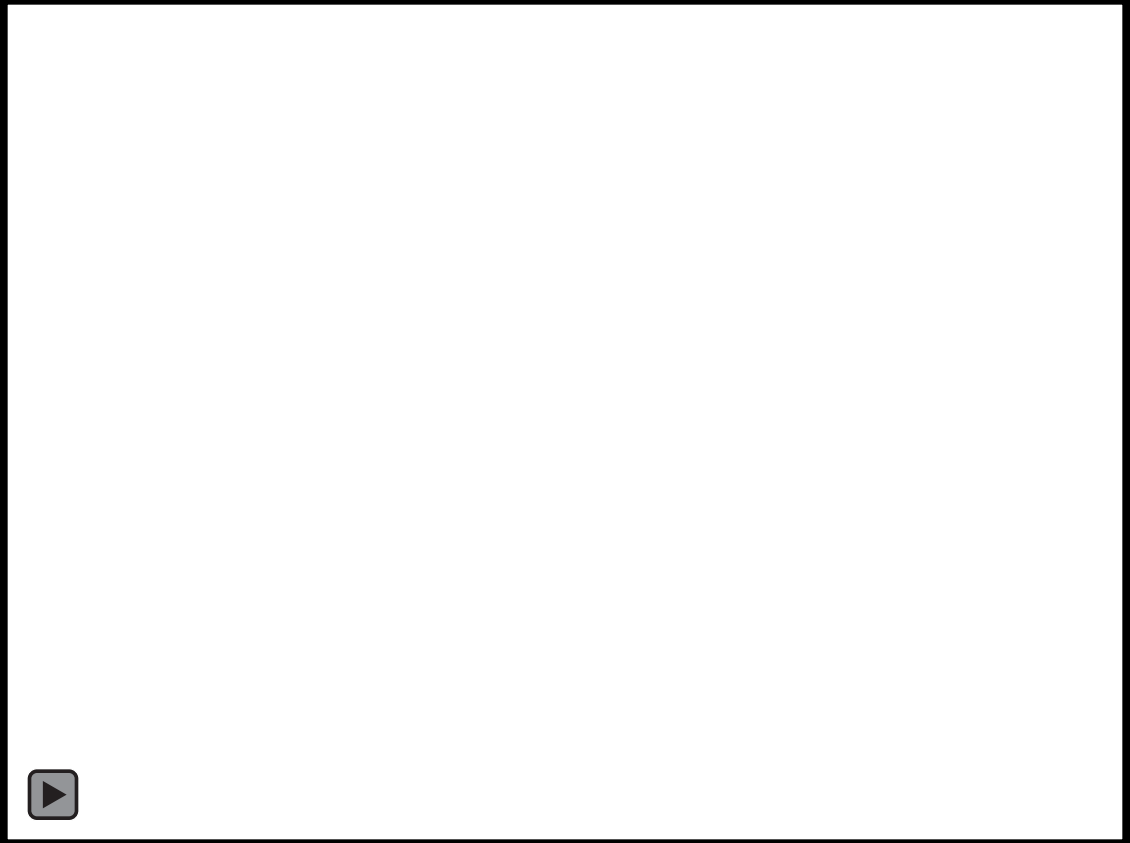
35
35
S-KH 17


Gulf
SONY
VAIO


MoTeC
DRIFT

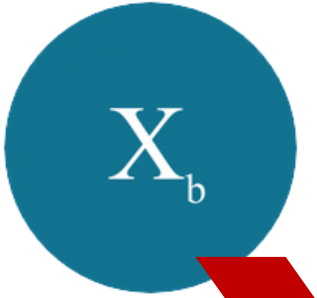

ERL
Audi


PYROTECT




NO
STOPPING
ANY
TIME
6CRA518
ODYSSEY


SPEED
LIMIT
25



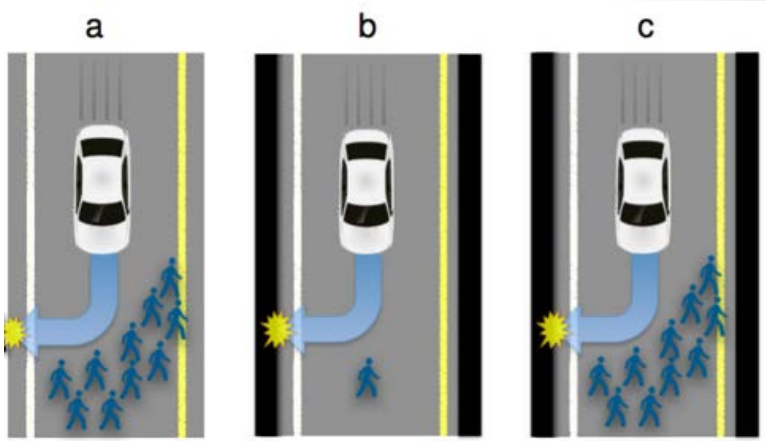
MIT Technology Review

A View from Em g Techno from the arXiv

Why Self-Driv Cars Must Be Programmed ill

Self-driving car e already sing the streets. But h e they can b e widespre rmakers must so n impossible ethical dilemma of algorithmic morality.

October 22, 2015



Ethical Considerations

Ethics covers broader issues

- Respect for human life and the law
- Helps resolve conflicts between safety, mobility and legality

What responsibility should automated vehicles have?

- Avoiding collisions with other road users following traffic laws?
- Compensating for errors made by other road users?
- Similar or greater than that of a human driver?

Federal Automated Vehicles Policy

- Guidance to developers prior to testing and deployment
- Use data from real world testing to determine regulations


4AE 426

15 Point Safety Assessment Letter

- Operational Design Domain
- Fall Back (Minimal Risk Condition)
- Consumer Education and Training
- Validation Methods
- Ethical Considerations
- Data Recording and Sharing
- Privacy
- System Safety
- Vehicle Cybersecurity
- Object and Event Detection and Response
- Post-Crash Behavior
- Federal, State and Local Laws
- Human Machine Interface
- Crashworthiness
- Registration and Certification

Operational Design Domain

Define for each automation system

- The domain where it operates
- How it ensures it is within the domain
- What fall back systems are in place
- How people are trained



Framing the Conversation

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