Revisiting the Topic - The Future is Autonomous Driving - But Are “We” on a Near Term Collision Course?

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An Unexpected Uptick?

In an automotive ecosystem with rapidly increasing automation (assistance and mitigation systems), why aren’t the roads safer?

• Preliminary estimates from the National Safety Council indicate 40,200 motor-vehicle deaths on US roads in 2016
  - 6% increase over 2015
  - 14% increase over 2014
  - Highest in 9 years
• Motor-vehicle mileage up 3% in 2016

Data and Figure drawn from the National Safety Council 2016, 2017 and The Boston Globe 2017
Automation as an Evolving Process

We are talking about it more but the ship set sail decades ago!

Automatic transmissions reduce drivers’ operational workload. Drivers have used the “freed up” resources to do other things!
The Advanced Vehicle Technology Consortium

• **Originators:** MIT AgeLab, Touchstone Evaluations & Agero

• **Founding Members:** Delphi, Liberty Mutual, Jaguar Land Rover, Autoliv, Toyota

• **Full Members:** TBD

• **Affiliate Members:** Consumer Reports & TBD

• **Focus:** To collect cutting edge data that objectively characterizes the behavioral and safety benefit of advanced driver assistance systems, higher levels of automation, and other in-vehicle technologies under real-use conditions

• **Outcomes:** A data driven understanding of drivers’ utilization of advanced vehicle technologies & the development of data and analytic methods necessary for answering important member common questions about AVT
Investigating Automated Technology Use in the Wild

MIT AVT
Naturalistic Data

Study months to-date: 18  
Participant days: 4,929  
Drivers: 60  
Vehicles: 24  
Trips taken: 27,843  
Hours driven: 7,565  
Miles driven: 138,188  
Video frame: 2.6 billion  
Video pixels: 2.4 quadrillion

Study data collection is ongoing.  
Statistics updated on: July 2, 2017
Technologies are Improving Post-Production

Improved Volvo Pilot Assist performance with a dealer delivered upgrade.
Use Outside of the Operational Design Domain, Is It Foreseeable Misuse?

It is difficult to design and test for all use conditions; is a learning approach or geofencing critical?
The Perils of Misuse Outside of the Operational Design Domain

How do experiences impact willingness to use, trust, safety?
Insight on Tesla Autopilot Use

16,422 transfers of control across 454 hours of Autopilot use

- **Human to machine**
  - From available – 7,308
  - From ACC – 903

- **Machine to human (human initiated)**
  - To manual – 6,911
  - To ACC – 1,300

- **Machine to human (system initiated)**
  - AI assistance required – 17
  - ODD speed boundary (90 MPH) exceeded – 12
  - Intersection (slow speed car following through turn) – 5
  - Automated lane change (e.g. lane characteristic changes) – 4
  - Other - 4

GPS points with Autopilot engaged (blue) overlaid on manual control
When has a driver accepted a transition? regained full awareness? Further, drivers demonstrate different use styles.

Using Naturalistic Data to Teach Robots to Drive

Approach: End-to-end deep neural networks for perception and steering control

Arguing Machines

Goal: Predicting the resumption of control from Autopilot.

90% accuracy in a 6 sec window
The Future May Be One of Relatively “Novice” Drivers

Vehicle Miles Traveled (VMT)  Vehicle Miles Driven (VMD)

Today
VMT ≈ VMD

Tomorrow?
VMT ≠ VMD
Is Driving a Privilege or a Right?

It is plausible some drivers will exploit the bounds of risk under many (if not all) driving contexts.

The challenge is engineering for all!
Do we now need to be designing to the outliers?
Many Factors will Influence the Speed of Deployment

Human centered technologies and proactive policy will play a key role
The Future May Be Autonomous, But...

Humans will continue to have a role for some time

- Level II systems introduce a number of use challenges
- Reported experiences combined with quantitative data tell a story
  - Mode confusion
  - Role confusion
  - Misplaced trust
- Investment in human centered engineering throughout the automotive ecosystem is critical to a safe mobility future
  - Improved communication with the driver
  - Fused decision models that consider driver state
  - Consumer education and training (dealer delivery and coaching)