
Automated Road Vehicles: A Technology of the Future (for a long time to come)

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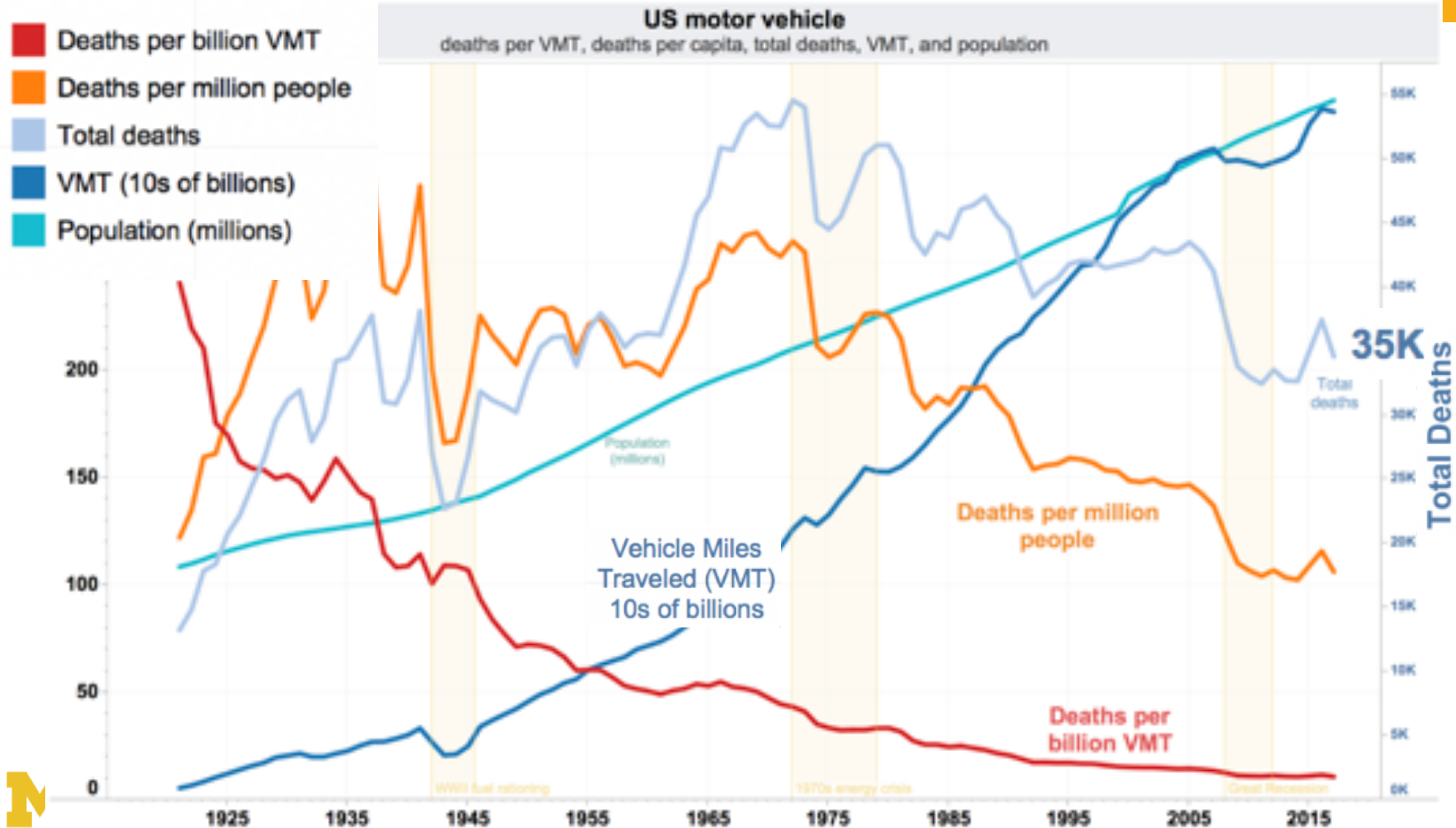


**KEEP
CALM
AND
DRIVE
ON**

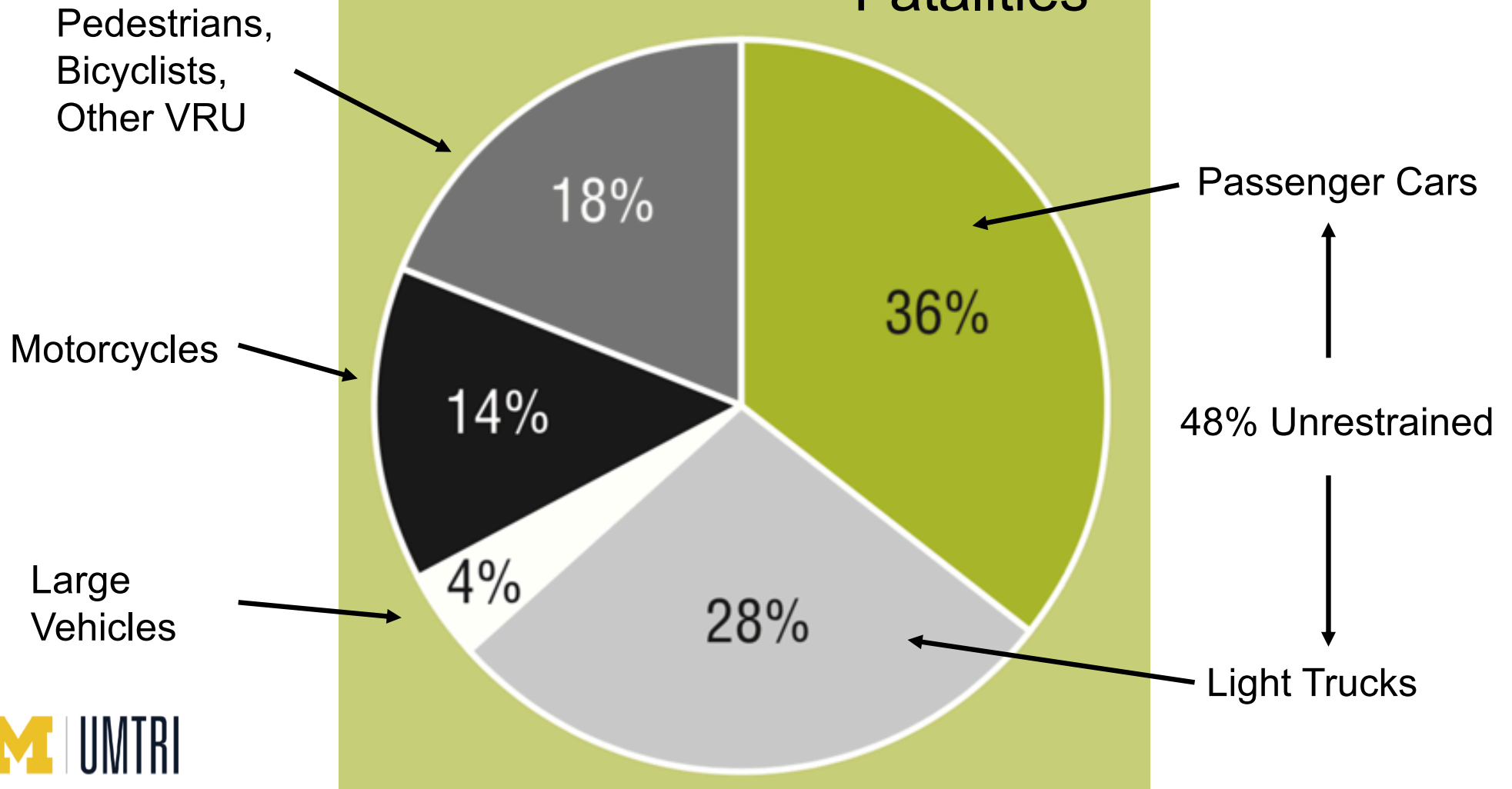
Driving (Cars) is Really Hard

And people are really good at it
(because it has been designed for them)





2016 Fatalities



Care About Safety?

What's easier and faster?

1. driving better than humans
2. seat belt interlocks & zero BAC*



This isn't about safety

* Is zero tolerance for alcohol a possible political goal for ride-hailing companies?

But Elon Musk Said!

“Google is working on self-driving cars, and they seem to work. People are so bad at driving cars that computers don’t have to be that good to be much better.” ~Marc Andreessen (2011)

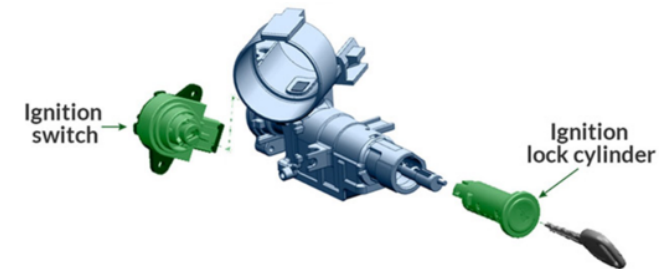


Government Ends Criminal Case Over GM Handling of Ignition Switch Defect

By David Shepardson | September 20, 2018

A federal judge in New York on Wednesday dismissed a criminal case brought against General Motors Co. in 2015 over the largest U.S. automaker's handling of an ignition-switch defect linked to 124 deaths.

GM has paid more than \$2.6 billion in penalties and settlements, including the fine, over faulty ignition switches that could cause engines to stall and prevent airbags from deploying in crashes. The defect was linked to 124 deaths and 275 injuries, and prompted a recall that began in February 2014 of 2.6 million vehicles.



This is life for companies that actually make cars

The evolving legal landscape will constrain deployment

The Law of Unintended Consequences: Safety Version



Experience with automation in other fields suggests we can expect:
de-skilling, mode confusion, humans called upon only in extreme conditions that lead to automation failure, and low acceptance of machine failure



The Law of Selling Vehicles: Safety Version

Federal Motor Vehicle Safety Standards will still apply
→ Particularly the 571.2XX crash standards



Absurd Interiors

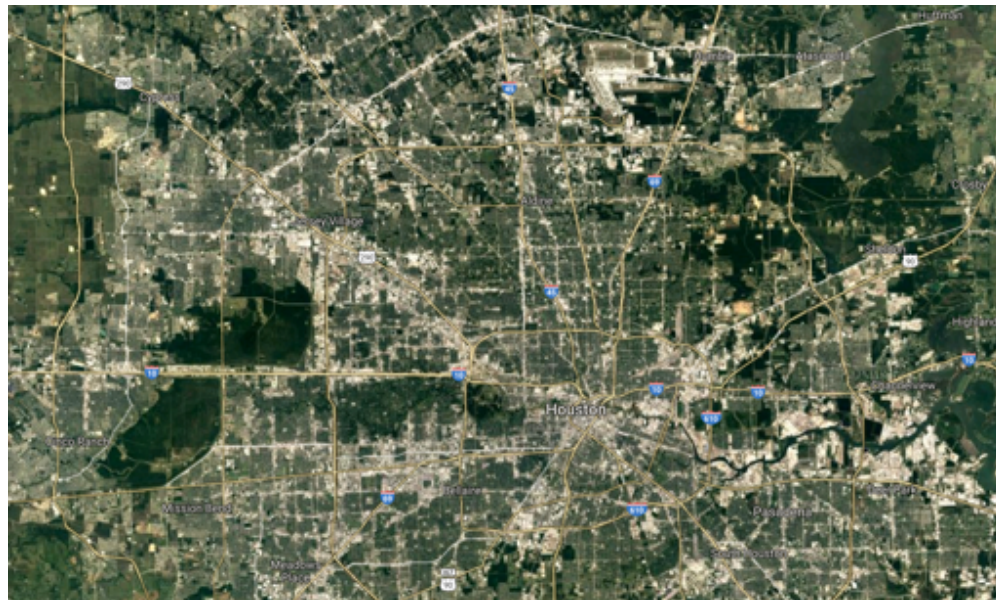
AUTOMATED DRIVING SYSTEMS

2.0



But Elon Musk Said!

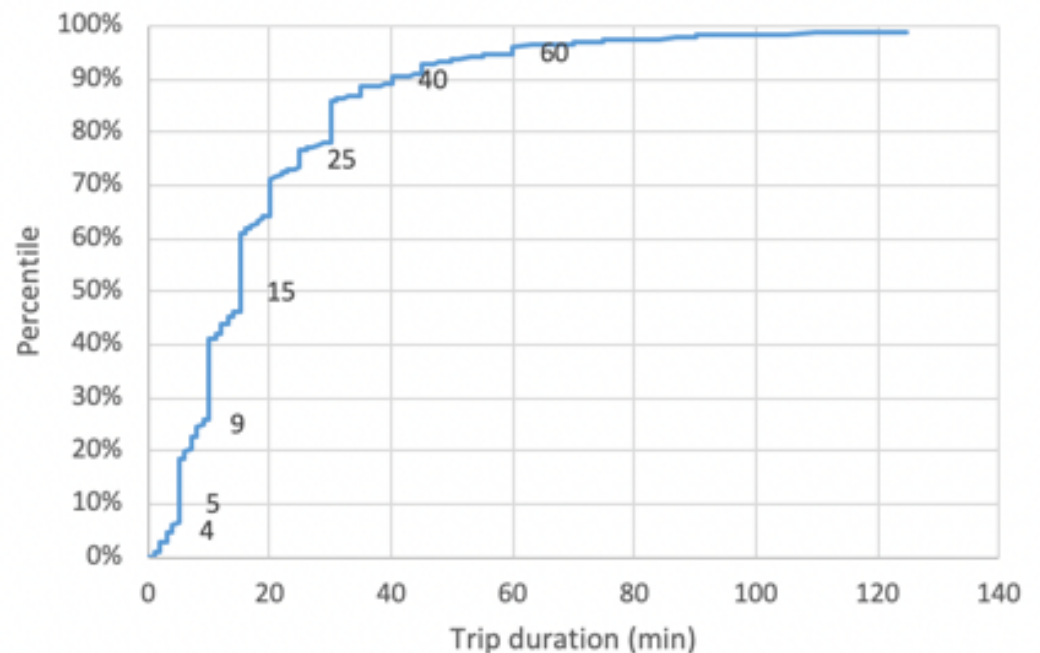
“Self-driving cars will enable car-sharing even in spread-out suburbs. A car will come to you **just when you need it**. And when you are done with it, the car will just drive away, so you won’t even have to look for parking.” ~Sebastian Thrun



2017 Data Now Available!

Half of trips (stop to stop) are less than 15 mins

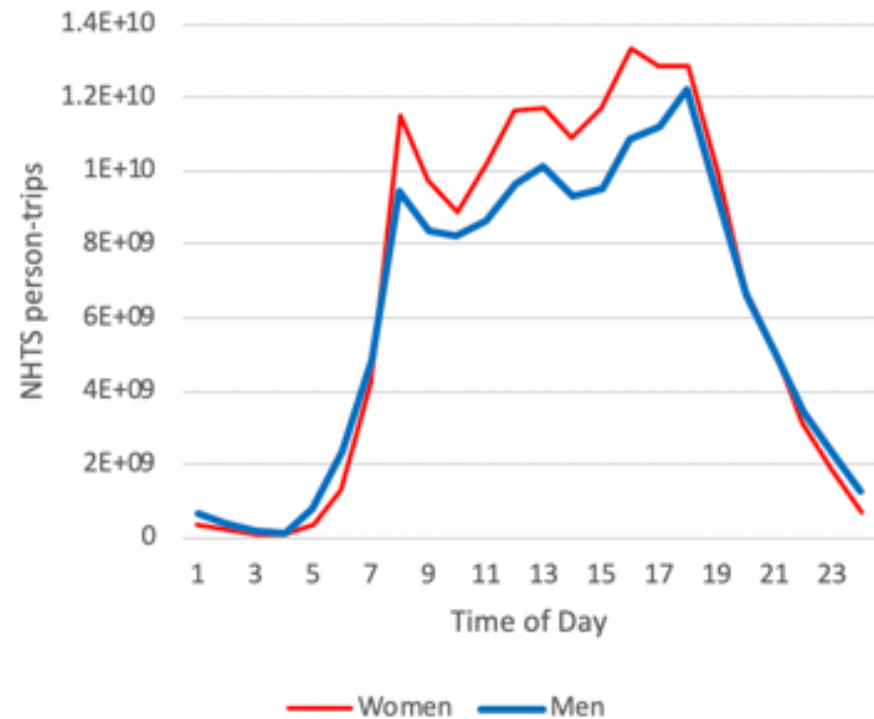
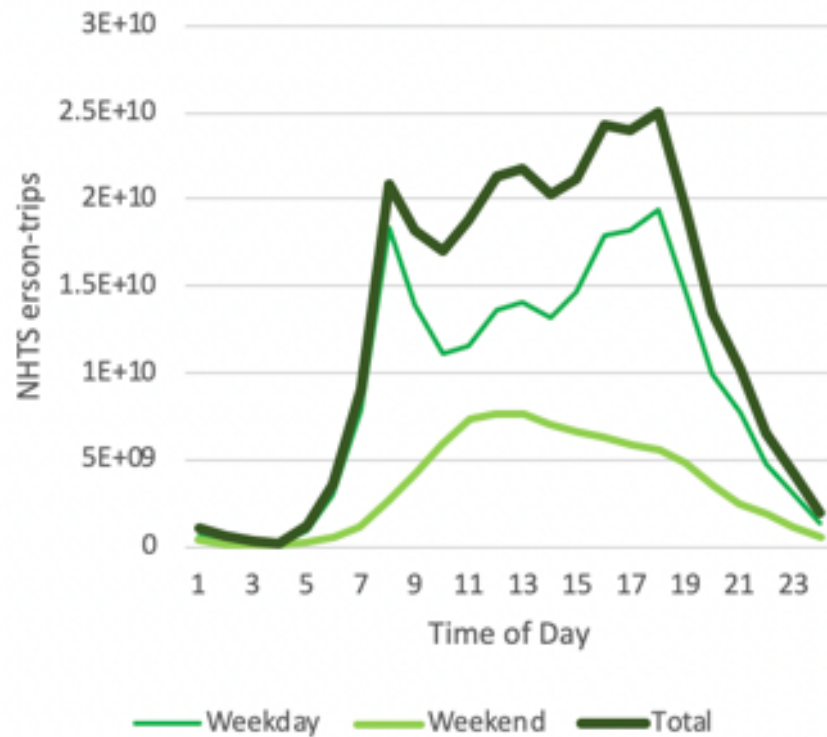
How long does it take for your ride-hailing car to arrive?



2009: Uber launches in San Francisco

2017: 0.8% of trips in rentals, taxis, and ride-hailing

National Household Travel Survey



Pew Research:

Only **one-in-ten** users of ride-hailing services say they use these apps at least weekly, including just **2%** who say they use them every day or almost every day. Another 22% are monthly users, while a majority of users (67%) utilize these services less than once a month.



Cost is Critical

Everything proposed for AVs can be done currently with a driver

Currently people will drive you around for less than minimum wage (if you live in an urban area, have a cell phone and credit card, and are willing to wait for your ride)

(and it's still less than 1% of trips)

Maybe it's not **just** cost?



A lot of people really don't want to ride around in the back of a car* when they could be driving

* And they REALLY don't want to ride around rear-facing (who does?)

Dr. Monica Jones (tomorrow morning)



But Elon Musk Said!

In 2016:

“Ford plans to make self-driving cars for commercial ride-sharing or on-demand taxi services by 2021, a target the automaker says it will reach by expanding its Silicon Valley research lab as well as investing in or buying autonomous vehicle technology startups.”

“This decade, for the auto industry, will be defined by the automation of the vehicle,” [Ford CEO Mark] Fields said.”

But Elon Musk Said!

In 2019:

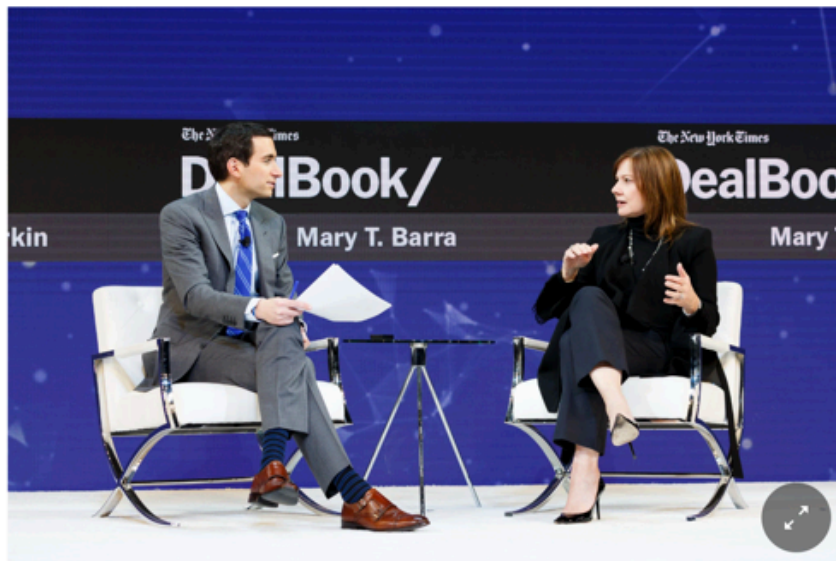
“We overestimated the arrival of autonomous vehicles.”
~ Ford CEO Jim Hackett



But Elon Musk Said!

2018

Mary Barra Says G.M. Is 'on Track' to Roll Out Autonomous Vehicles Next Year



M | UMTRI

2019

Cruise postpones plan to launch driverless taxi service in 2019

The GM subsidiary had planned to debut a self-driving ride-hailing service in San Francisco by the end of 2019

By Andrew J. Hawkins | @andyjayhawk | Jul 24, 2019, 8:51am EDT

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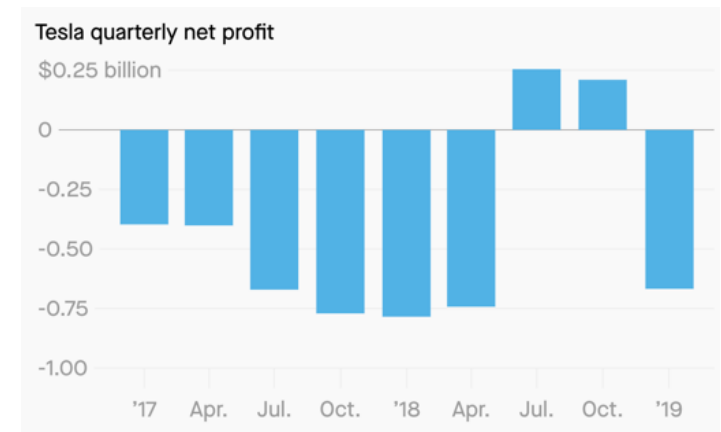


But Elon Musk Said!

In April 2019:

I feel very confident predicting autonomous robotaxis for Tesla by next year. Not in all jurisdictions, because we won't have regulatory approval everywhere. But we will have regulatory approval at least at some point next year," Musk said toward the end of the presentation. "From our standpoint, if you fast forward a year, maybe a year [and] three months*, but next year for sure, we will have over a million robotaxis on the road

* This time next year



Advanced Driver Assistance Moves the Goalposts

Electronic
Stability
Control

Lane-
Departure
Warning



Automatic
Emergency
Braking

Forward
Collision
Warning

Level 2:



Lane-keeping Assist (don't call it autopilot)

Adaptive Speed Control



Traffic Jam Assist

The comparative advantages of automation will be greatly reduced by the time it arrives



GM Super Cruise is pointing at the future of ADAS

Where Does Autonomy Make Sense?

Ride-Hailing (Taxi Service)?



Private Vehicle?





Real-World Value of Truck Platooning Questioned as Support Wanes



February 26, 2019 by [Alan Adler](#), [@AlanAdler](#)



AUTONOMOUS MINING TECHNOLOGY



What's a “Low Speed Vehicle”?

FMVSS 500 establishes a class of vehicles to which most FMVSS do not apply:

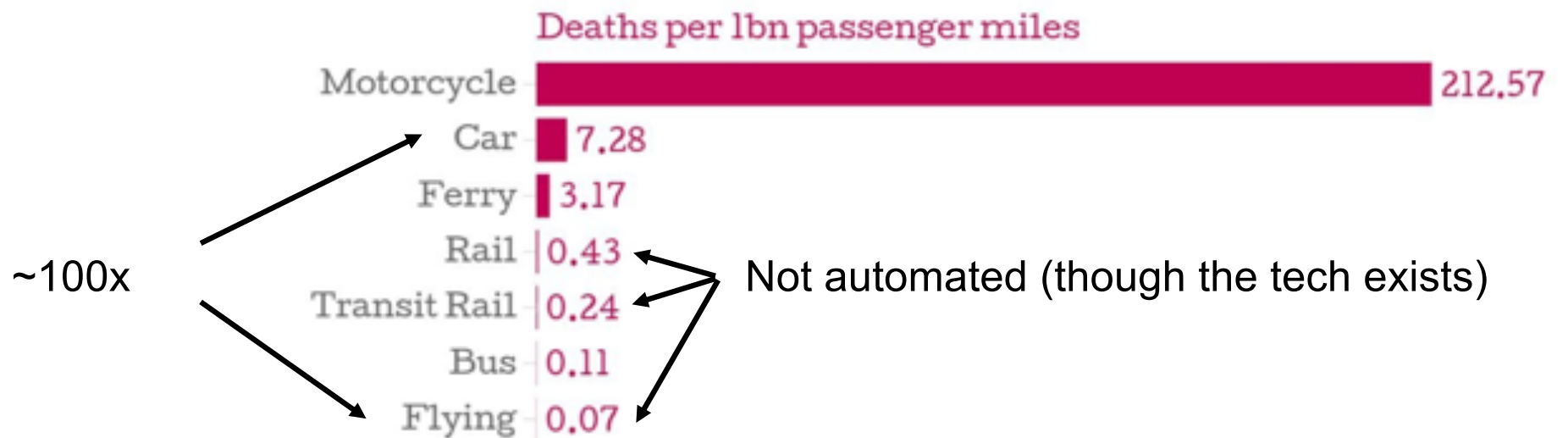
- <25 mph
- access to roads **locally regulated**
- seatbelts, headlights, a few other safety features are required
- many opportunities to add automation
- seating opportunities?



aka Neighborhood Electric Vehicles



Automated travel needs to be at least 100x safer to be accepted (after a while)



Figures: 2000 - 2009, US

Data: Northwestern University

OK, What About Interiors?

1. Focus on fixing things in current cars that will still be relevant in an automated future:
 - Rear seats are too long and uncomfortable
 - Recline is neither safe nor comfortable: can a head restraint also be a head rest?
 - Rear seats aren't as safe as front seats for many people
 - Cars are hard to get in and out of for people with mobility impairments
 - Our cars don't support our devices



OK, What About Interiors?

2. What does a dedicated ride-hailing vehicle (with or without a driver) look like?
3. How can children travel in ride-hailing vehicles with the same level of safety they have in privately owned vehicles?
4. Can we stop talking about rear-facing seats?





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