

DROWNING IN TECH?

IMPLICATIONS FOR DEALERS OF THE TECHNOLOGICAL WAVES
SWEEPING OVER THE AUTOMOTIVE INDUSTRY

Glenn Mercer

NAMVBC Fall Workshop in Denver
September 15, 2016

Agenda

❖ Introduction

- Purpose of this talk, my credentials, forecasting issues

❖ Observations

- Nature of change, three-part change framework

❖ Implications

- Impact to date, implications for dealers

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Purpose of this talk

Dealers are facing waves of change in:

- Connected cars,
- Autonomous cars, and
- Ridesharing services.

And I've got 55 minutes.

No problem!

Speaker credentials (current and past)

- Consulting: two decades at McKinsey & Co. (automotive)
- Public equities: Alliance Bernstein advisor
- Private equities: Greenbriar, KKR, Sterling, others
- Venture capital: Kleiner Perkins, others
- Academia: Director, IMVP*; member, GERPISA, others
- Automotive Products: Director at Rimstock, Stackpole, &tc.
- Automotive Services: Ricardo Consulting Advisory Board
- Journalism: *Supplier Business*, *Auto Retail Network*, &tc.
- *Owes a car*

* International Motor Vehicle Program

Forecasting issues: people tend to over-predict change.



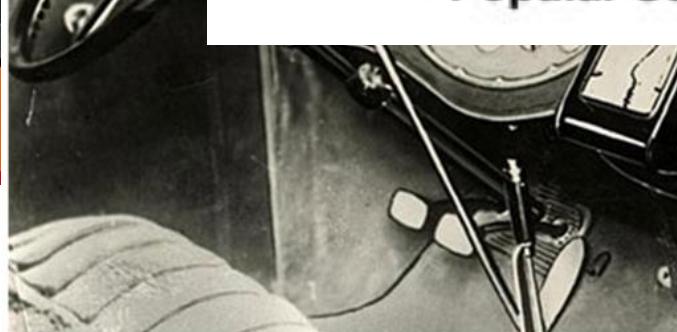
This is despite a history of failed predictions, including about cars.



"Like it or not, the robots are slowly

"In an effort to limit traffic congestion, the government banned vehicular traffic in Rome's city center, from 6 AM to 4 PM."

By order of Julius Caesar, in 45 BC.



- Popular Science, 1958



The driver, who is to
toot its horn, and it
s" the policeman at
mind" that will guide
it prowls in and out
he will be a radio set
Commanding waves
second machine will
receiving set in the

most car.
The tour, conducted by the Achen
Motor company, will start at 11:30
a. m. from the company's rooms
at Oneida and Jackson streets, will
go west on Oneida to Broadway,
north to Martin, west to Eighth,
south to Grand, west to viaduct,
where it will "bout face" and return
on Grand to Eighth, south to Sycamore,
then east to Broadway and
back to the sales rooms. Tomorrow
the car will visit Milwaukee-Dow-
ner and the Normal school.

Cream City Laundry. Hello Bdwy. 330.

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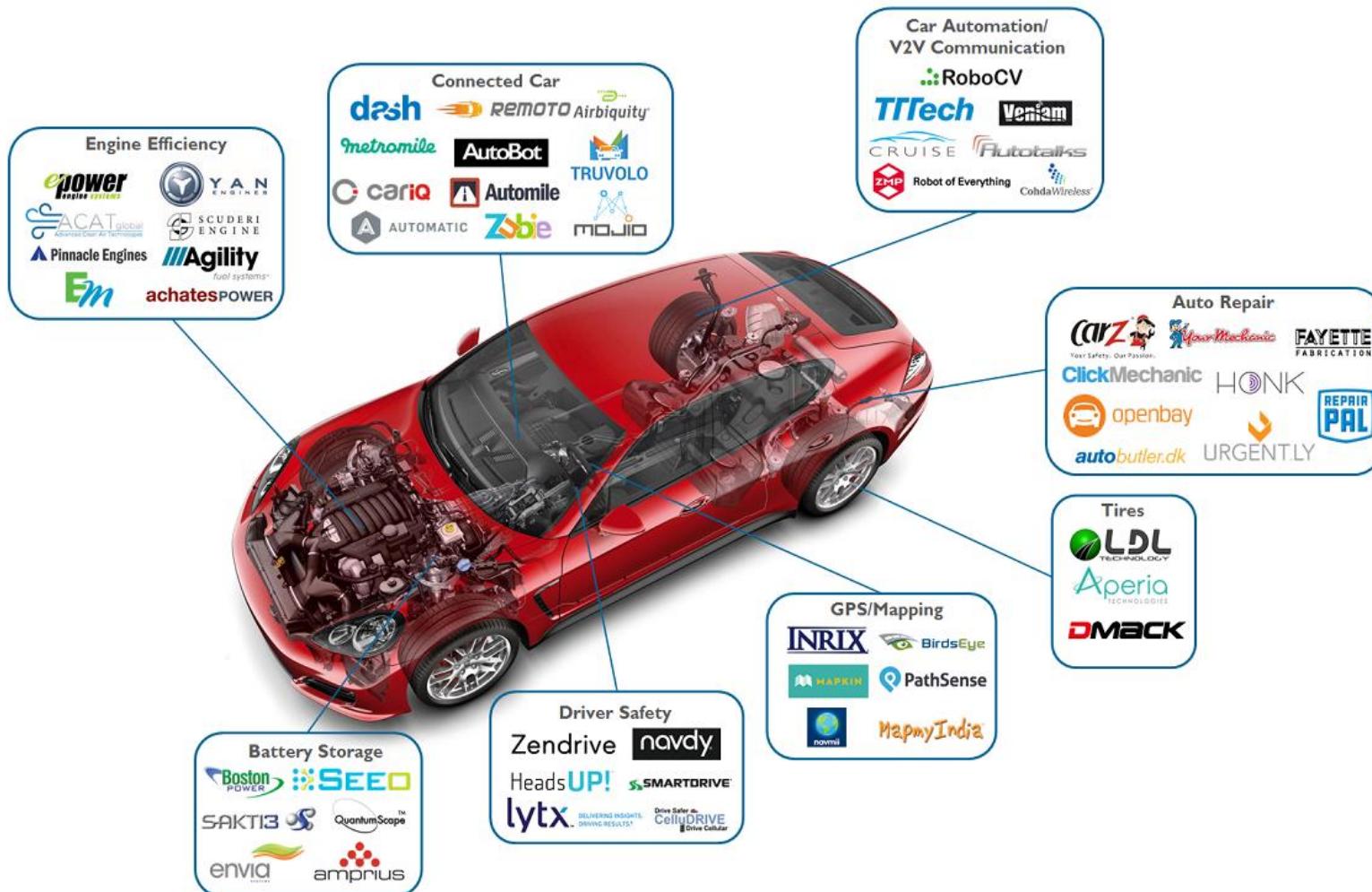
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Drivers of change: Silicon Valley rediscovers the car...



Source: CB Insights

... and Detroit discovers Silicon Valley.



This is because in some ways software is “eating the car”*

- ❖ The cost of electronics and software in autos was <20% of the total cost a decade ago. Today it is as much as 35%.
- ❖ “More importantly, electronics systems now contribute more than 90% of innovations and new features.” (Broy)
- ❖ Lines of code in Hubble Telescope: 2 million; Chrome 9; Android 12; LHC 50; typical new car 100 mm (McCandless)
- ❖ New cars use 30-80 ECUs with more than 150 mm object code instructions, for well over 1 gigabyte of software in a premium car. “Value creation in cars today is primarily determined by embedded software” (Ebert)

* With apologies to Mark Andreessen

Sources: Manfred Broy (TU Munich), David McCandless (UK journalist), Christof Ebert (Vector Consulting); Ford

And while we are used to change in the automotive industry...

Materials	Parts	Mfg	Dist	Repair	Recycle
Aluminum displaces cast iron and makes inroads against steel	Smallest suppliers have exited	Toyota Production System “changes the world”	Dealership system globally dominant but mutates	Aftermarket “peels off” work from dealers and their OEMs: increased complexity was to drive business to dealers, does not	Increasingly professional, consolidated, globalized:
Plastics gain share in interiors	Remaining suppliers consolidate vertically: horizontal mega-suppliers break up	BTO doesn’t advance as much as predicted.	Internet takes over car shopping, not yet transactions	DIY erodes...but does not die.	<ul style="list-style-type: none"> - Auctions - Salvage - Recycling - Used car remarketing
Carbon fiber is making a move	OEMs reduce vertical integration (except Tesla)	Modular assembly conquers seats, IPs, FEMs, then stalls	Chinese fail to export.	ADAS may start to erode insurance business.	CarMax transforms used-car sales, but only in the USA.
Magnesium content is growing, from a low base	OEMs fail to consolidate: scale is not everything.	OEMs fail to consolidate: scale is not everything.	Public dealer chains stall out: economies seem regional rather than national.	Rapid growth in BRICs now cooling	Recycling rate in cars crosses 90%.
Lithium becomes a key material	Electrification of the car reshapes the supply base.				
	Globalization grows dramatically and then plateaus				

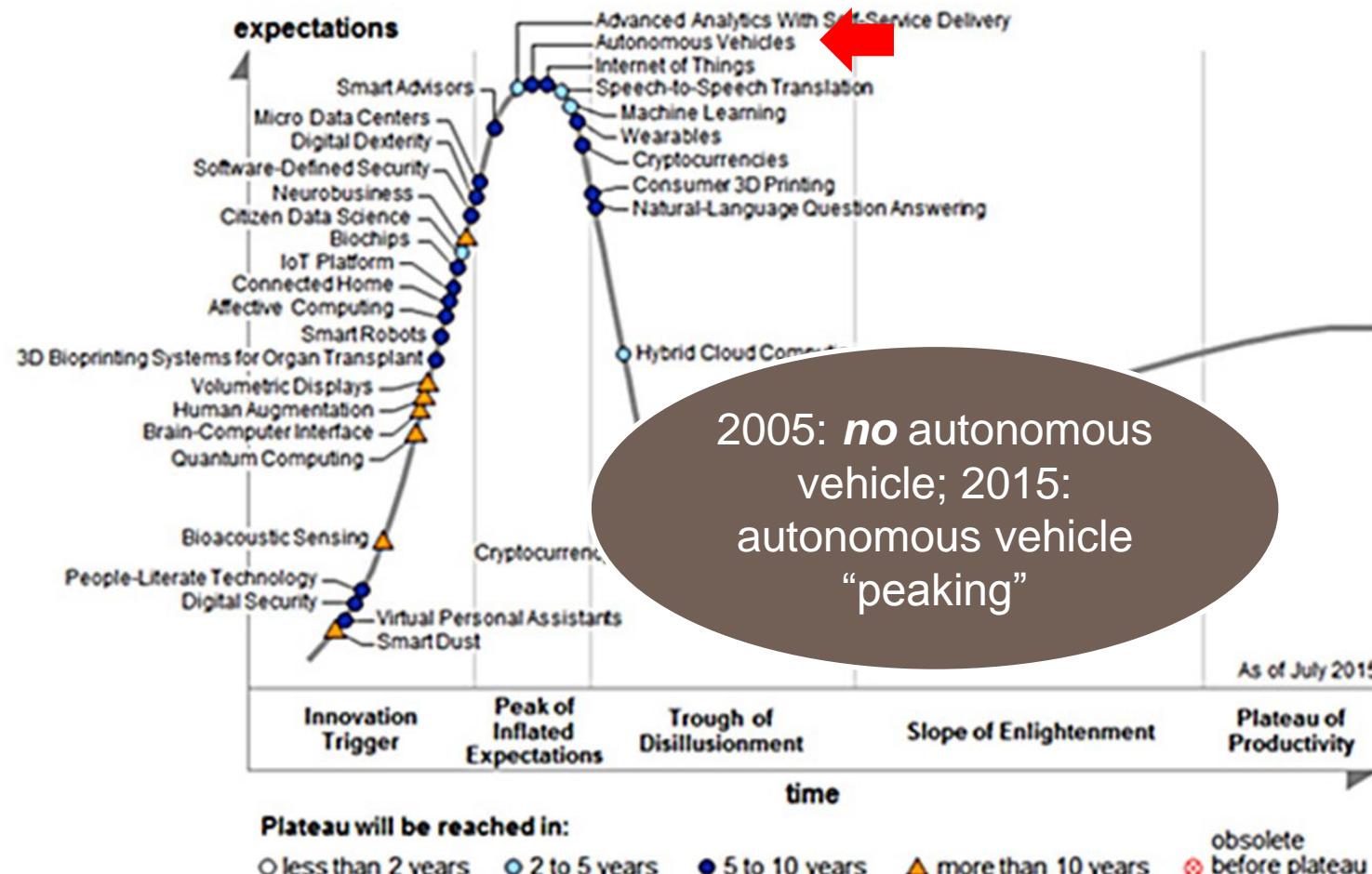
... today change acts on the (overlooked) USAGE link in the chain

Materials	Parts	Mfg	Dist	Usage	Repair	Recycle
What: Steel Iron Aluminum Plastics	What: T 1 assemblies T 2 components T 3 parts	What: Design and manufactures of light duty vehicles	What: Distribution marketing retailing of cars	What: Activities in and around the car except repair	What: - Maintenance - Repair - Collision	What: Handling the car after first owner: remarket, recycle
Who: Several hundred firms	Who: Tens of thousands	Who: Two dozen majors	Who: >100,000 dealers	Formerly just insurance and rental. Now a new wave of IT-enabled “usage monetizers:”	Who: >1,000,000 firms	Who: >10,000? Firms
Globalization: High	Globalization: Moderate	Globalization: High	Globalization: Low	<ul style="list-style-type: none"> • Zipcar... • Uber.... • “CarDOS” • Apps • Autonomy • UBI <p>Identity, location, profitability all wildly varying</p>	Globalization: Low	Globalization: Low but growing
Profitability: Moderate	Profitability: Moderate	Profitability: Low	Profitability: High	<ul style="list-style-type: none"> • Zipcar... • Uber.... • “CarDOS” • Apps • Autonomy • UBI <p>Identity, location, profitability all wildly varying</p>	Profitability: High	Profitability: High

No more “Buy and Bye!”

Worse, it has seemingly come “out of nowhere”

GARTNER TECHNOLOGY HYPE CYCLE



Peak Hype?

A patent application published by the US Patent and Trademark Office (USPTO) on Sept 8, 2016...suggests that Walmart has at least considered the possibility of a **self-driving shopping cart**. The application depicts a Roomba-esque motorized device attached to the underside of a shopping cart. Customers use their smartphone or other mobile device to summon the internet-connected device. From there, the cart is controlled by a centralized computer, and navigates the store using its sensors.

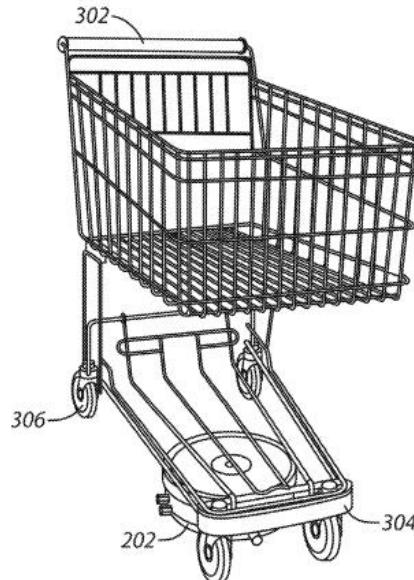


FIG. 3A

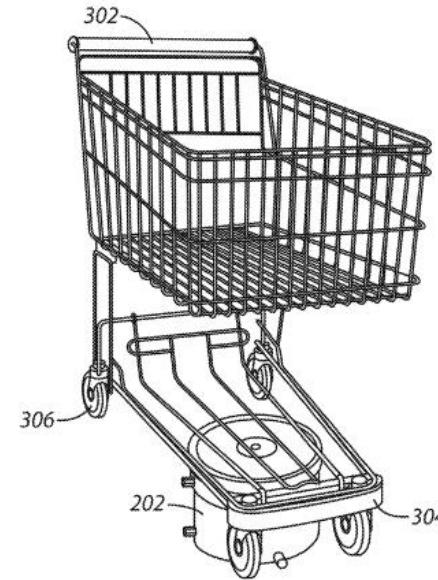


FIG. 3B

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- Nature of change, **three-part change framework**

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Framework: boil it all down to connectivity, mobility, autonomy

NEW AUTOMOTIVE TECH “GRAND UNIFIED THEORY”

Apple CarPlay

Android Auto

OTA Updates

Internet of Things

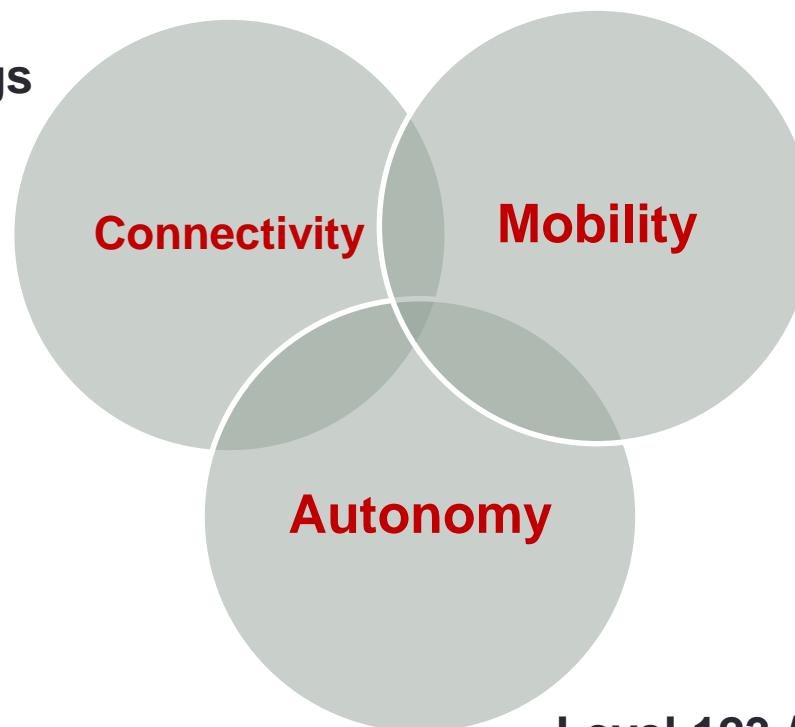
V2V V2I etc.

Music

UBI

Phone & text

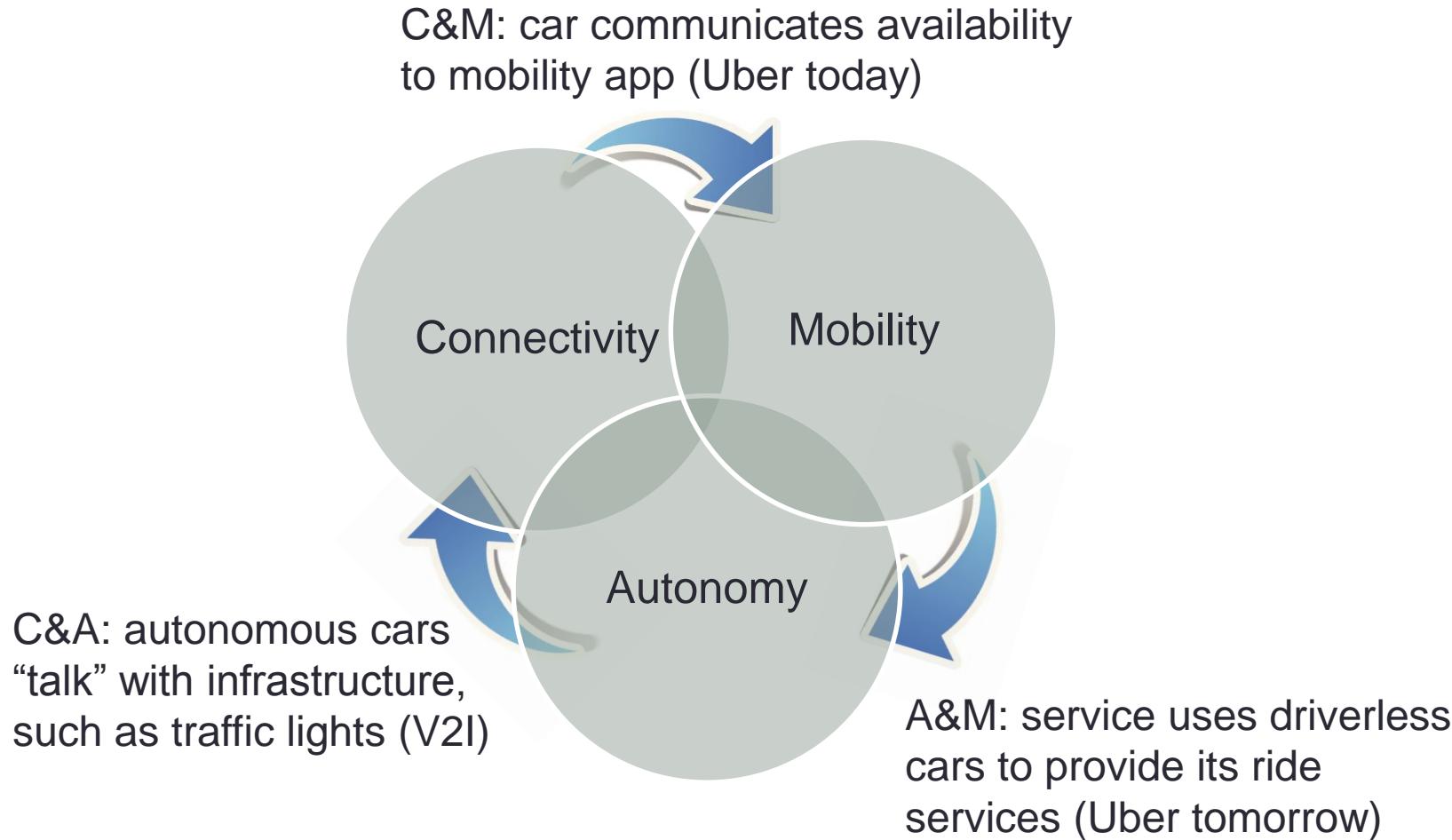
Wifi hotspot.....



Carshare (ZipCar)
MS/TNC (Uber, Lyft)
Pooling (UberPool)
Taxi apps
Delivery (Instacart,
Doordash, Postmates)

Level 123 / ADAS
Level 45 partial/full autonomy
Driverless cars

The three fields potentially reinforce each other.



Connectivity – the theme is *complexity*: what to connect?

INVENTORY OF CONNECTED-CAR APPLICATIONS

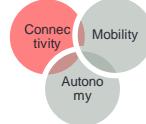


Table 1: National ITS Architecture Products & Services

Traffic Management Market Sector — ITS examples:	Public Transportation Market Sector — ITS examples:	Emergency Management Market Sector — ITS examples:
1. Freeway & Arterial management systems 2. Active Traffic Management Systems 3. Traffic Decision Support & Demand Management Systems 4. Traffic Management Roadside Hardware / Software 5. Traffic Incident Management Equipment / Systems 6. Roadway Weather Information Systems (RWIS) 7. Traffic Detectors / Surveillance Equipment 8. Traffic Probes 9. Signaling and Control Devices 10. Intersection Cabinet Safety Devices / Components 11. Battery Backup / Uninterruptible Power Supply systems 12. Roadway Closure Equipment / Systems 13. Dynamic Message Signs (DMS) 14. Electronic Toll Collection Equipment / Systems 15. Electrical Lighting & Management Systems 16. Drawbridge Management Systems 17. Emissions Monitoring Systems 18. Speed Monitoring Systems 19. Variable Speed Limit Systems 20. HOV Lane Management Systems 21. Mainline Traffic Flow Management Systems 22. Reversible Lane Management Systems 23. Metering Systems 24. Regional Intelligent Transportation Systems 25. Parking Facility Management Systems 26. Asset Management Systems	1. ITS Archived Data / Business Intelligence Systems 2. Voice / Data Communications Systems 3. Computer-Assisted Dispatch (CAD) Systems 4. Automatic Vehicle Location (AVL) System for Buses 5. Automated Train Location System (ATLS) for Rail Transit 6. Transit Signal Priority (TSP) Systems 7. Connection Protection / Notification Systems 8. Positive Train Control 9. Automated Vehicle Monitoring (AVM) 10. Automatic Passenger Counting (APC) System 11. Transit Travel Information (TTI) Systems 12. A...	1. Early Warning System Alert & Advisory Systems 2. Emergency Call-Taking & Dispatch Services 3. Emergency Routing Equipment Systems 4. Emergency Signal Preemption 5. Transportation Infrastructure Protection Systems 6. Roadway Service Patrols 7. Mayday & Alarms Support Systems/Equipment 8. Wide-Area Alert Systems 9. Disaster Response & Recovery Equipment / Systems 10. Disaster Traveler Information Systems / Software 11. Evacuation & Reentry Management Systems / Software 12. A...
Cross-Cutting & Other Market Sectors — ITS examples:	ITS Applications — ITS examples:	ITS Applications — ITS examples:
1. Communications 2. Systems Integration 3. Systems Engineering	1. Dynamic Route Guidance 2. Dynamic In-Vehicle Guidance 3. Dynamic Route Guidance 4. Dynamic In-Vehicle Signing 5. Static In-Vehicle Signing 6. Yellow Pages and Reservations Services	1. Dynamic Route Guidance 2. Dynamic In-Vehicle Guidance 3. Dynamic Route Guidance 4. Dynamic In-Vehicle Signing 5. Static In-Vehicle Signing 6. Yellow Pages and Reservations Services
Archived Data Management Sector — ITS examples:		
1. ITS Data Collection & Management 2. ITS Data Warehouses		

Observations:

1. It's a crowded field, hard to see a "killer app"
2. Many of these are "answers looking for questions" (check the fridge from your VW van?)

We need to focus, not chase everything.

Mobility – the theme is *value*: how much is this worth?

INVENTORY OF MOBILITY APPLICATIONS



Observations:

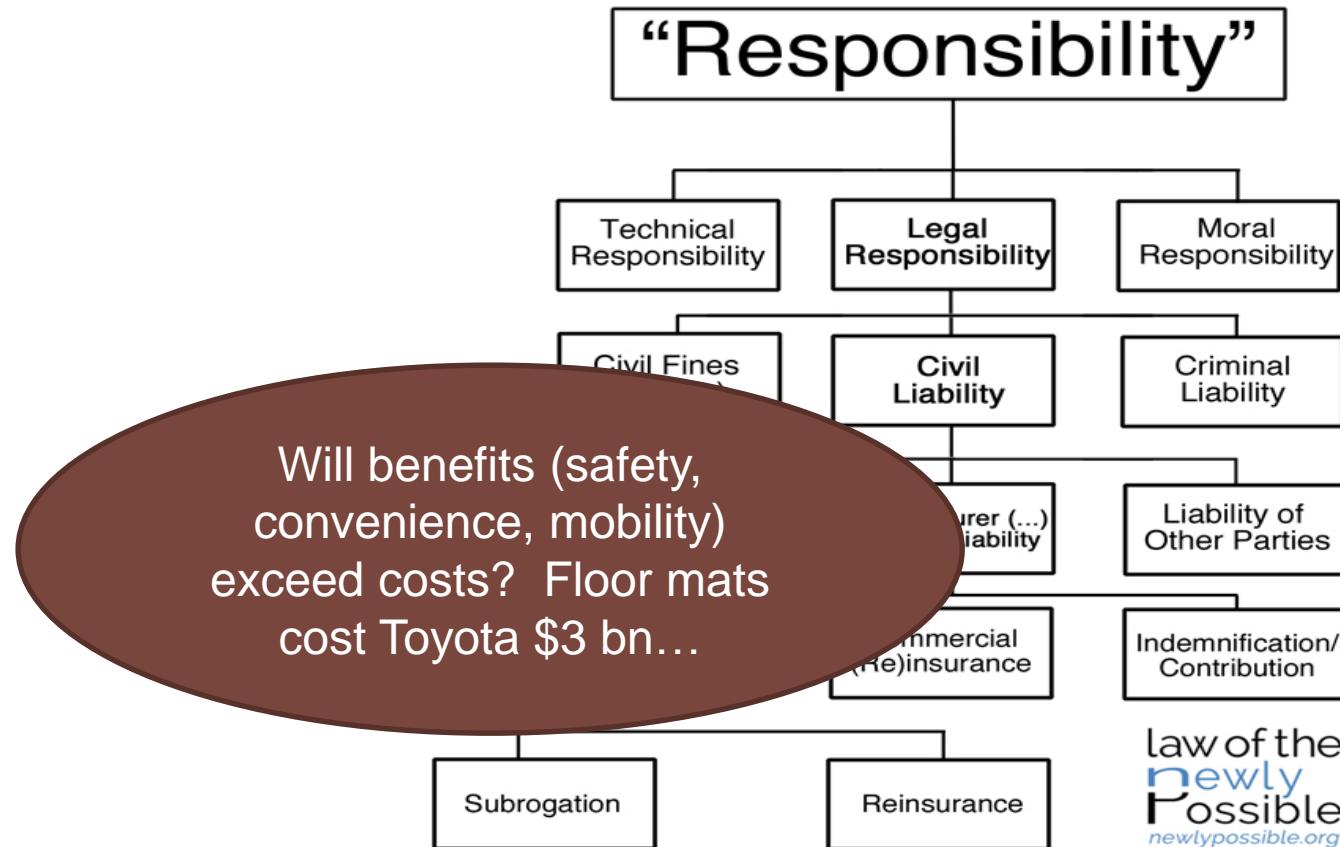
1. Uber in 9 months in 2015 lost \$1.7 bn on \$1.2 bn in revenue, Lyft losing \$250 mm/year, Sidecar gone...
2. Are models more based on **value** or regulatory **avoidance**, or even **exploitation**?





Full autonomy – the theme is *risk*: what can go wrong?

INVENTORY OF VEHICLE RESPONSIBILITIES



Risks of fully-autonomous (L4/5) vehicles

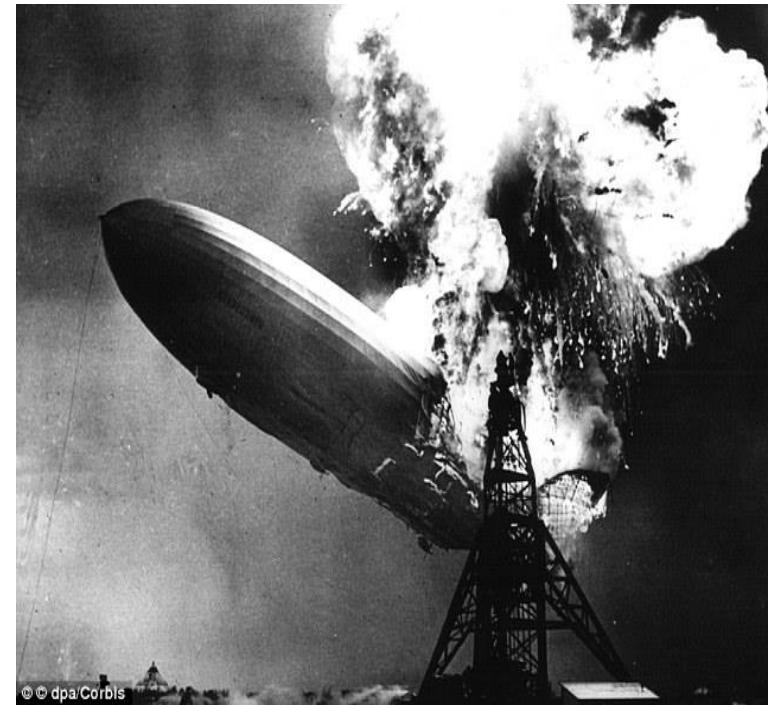
THE RISK OF A “HINDENBURG MOMENT”



“FrankenCar Kills Family of Four!”

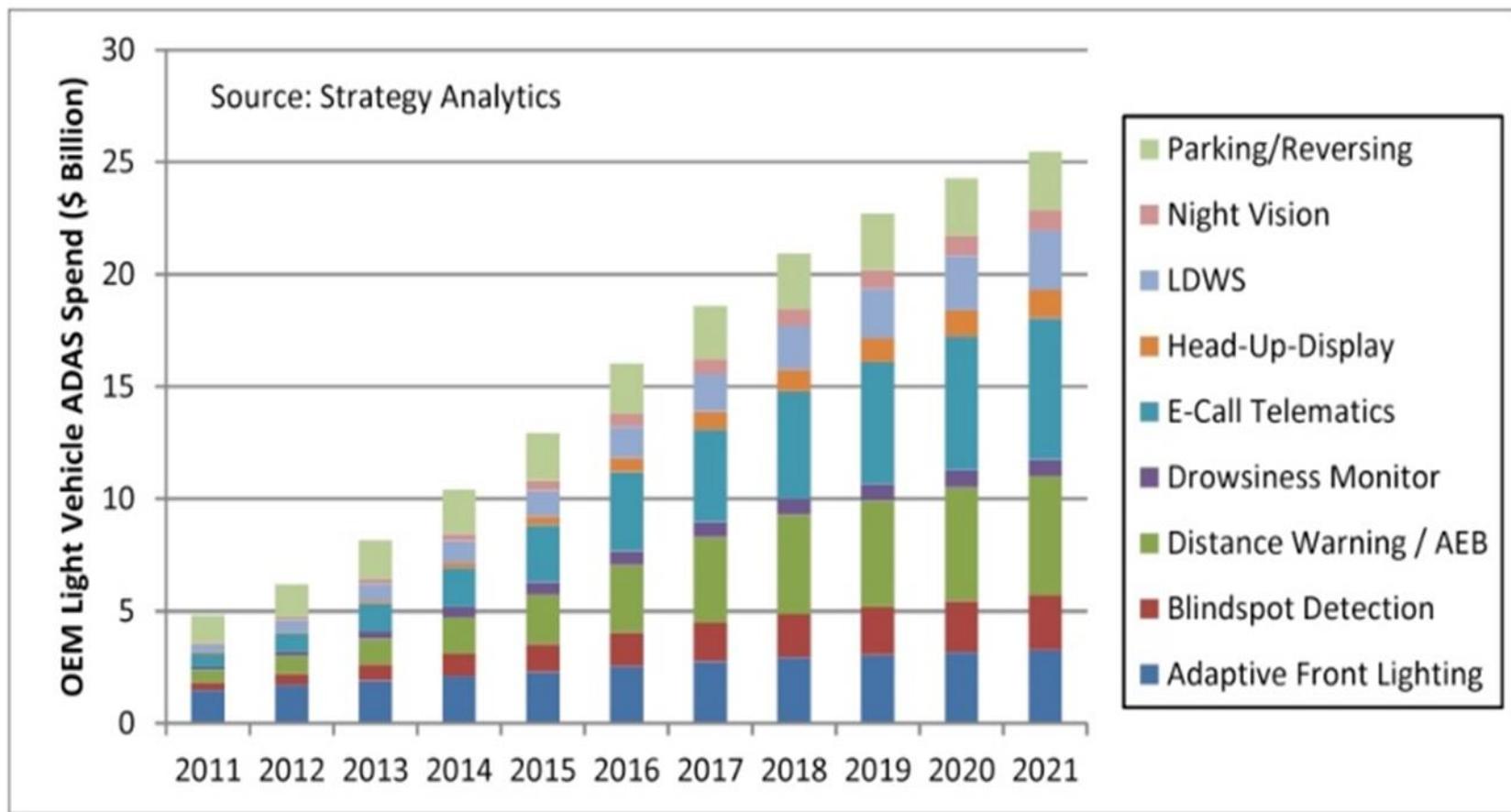
Palo Alto, January 8, 2025

Police today reported that an Acme Motors autonomous vehicle collided with a large truck on Route 101, killing all four members of the Jones family on board. Local city council member Brad Field commented “We’ve got to get these deadly robocars off our roads! And Acme must pay for what they have done...”



However, in *partial* (L123) autonomy, the growth is clear

ADAS SPEND FORECAST



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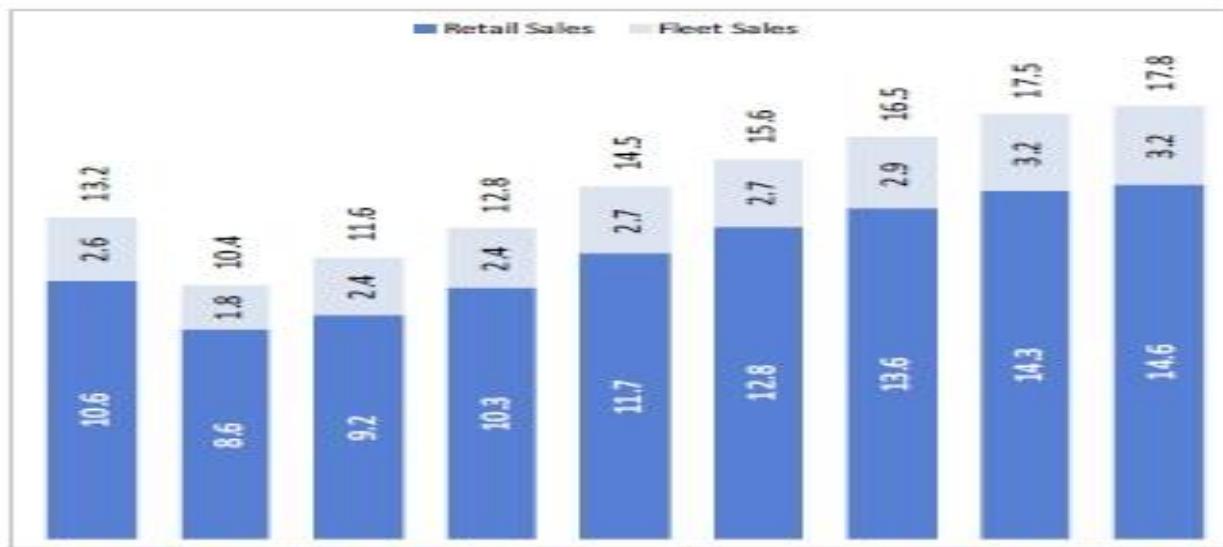
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Impact to date: no effect on USA sales yet

USA ANNUAL SALES 2008-2015, 2016 FORECAST



SAAR (MM)	2008	2009	2010	2011	2012	2013	2014	2015 F'cst	2016 F'cst
Total	13.21	10.42	11.57	12.76	14.47	15.57	16.49	17.46	17.77
Retail Sales (MM)	10.60	8.63	9.18	10.32	11.73	12.84	13.56	14.29	14.57
Total Sales	13.21	10.42	11.57	12.76	14.47	15.57	16.49	17.46	17.77

Source: J D Power

And other “disrupted” fields seem relatively unscathed

- ❖ Despite AirBnB, American hotel occupancy rate (65%) is the highest it has been since records started being kept (27 years)
- ❖ Despite Uber, taxi license applications in San Francisco have been rising steadily
- ❖ Despite Amazon, the number of independent bookstores in the USA is up 25% since 2009

Source: press reports

Uber versus taxis: meeting in the middle?

The image is a composite of three parts. On the left, a man and a woman are smiling at each other. In the center, there's a screenshot of a mobile application interface with the text "Get going in a tap." Below it, a testimonial reads: "With Flywheel, you can call a cab and pay for it with just a few simple taps on your smartphone." At the bottom left, there's a red button with a smartphone icon and the text "Available on the App Store". On the right, a dark-colored taxi with a "TAXI" sign on top is shown from a side-front angle, parked on a city street at night.

ABOUT PRESS FAQ DRIVERS

Get going in a tap.

With Flywheel, you can call a cab and pay for it with just a few simple taps on your smartphone.

Available on the App Store

In San Francisco: 80% of taxi fleets have signed up with Flywheel “hailing app;” 50% of taxi license applicants are former Uber/Lyft drivers; regulations are starting to converge

Source: press reports

But perhaps the impact is not revenue *lost*, but revenue *never had*
AUTO INDUSTRY HAS LOST THE LAST THREE ROUNDS OF CONSUMER TECHNOLOGY “WARS”



In-car communication: lost to phones



In-car navigation: lost to PNDs and then phones



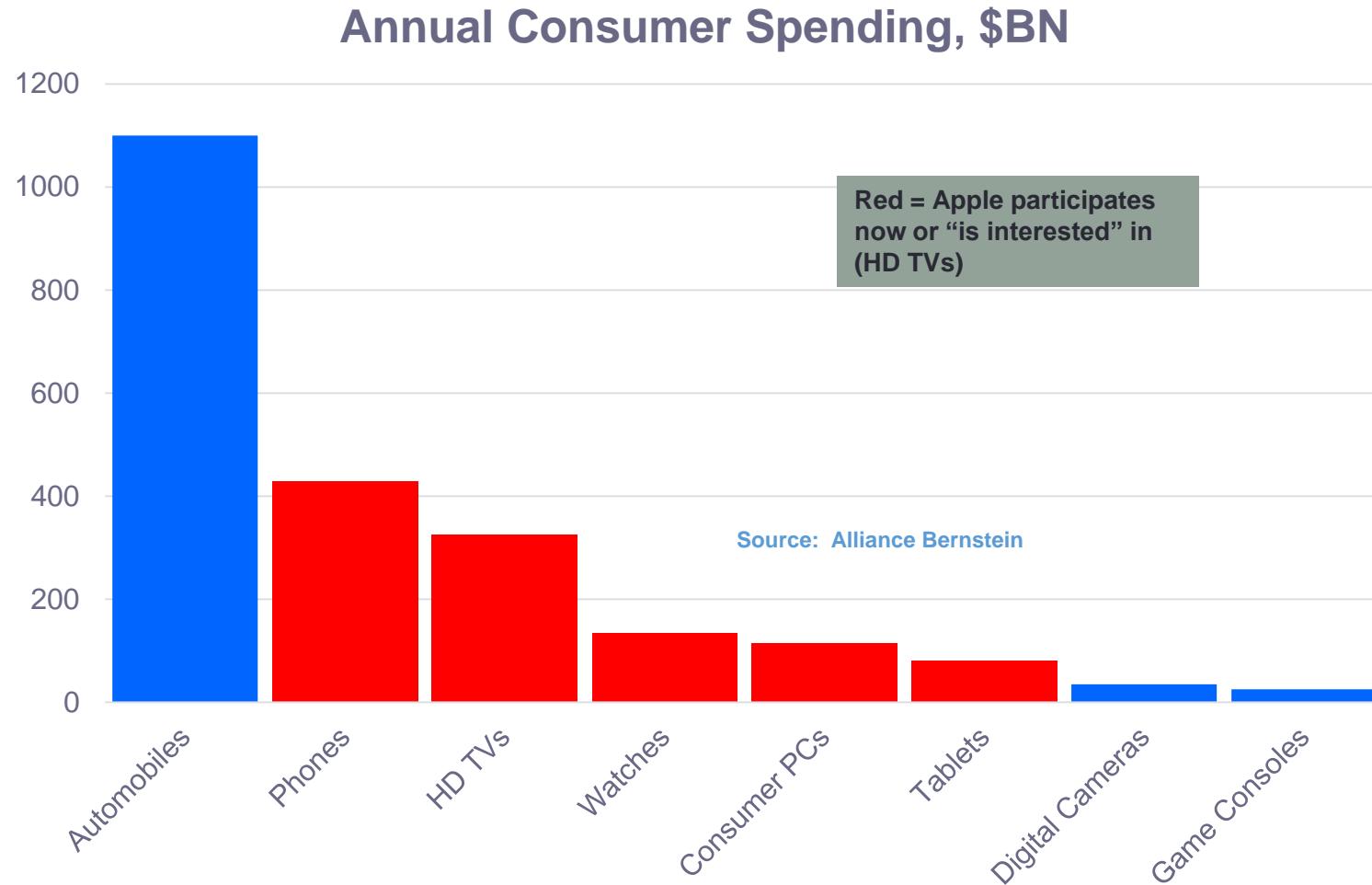
in-car music (and video?): lost to phones

Total market size: billion\$

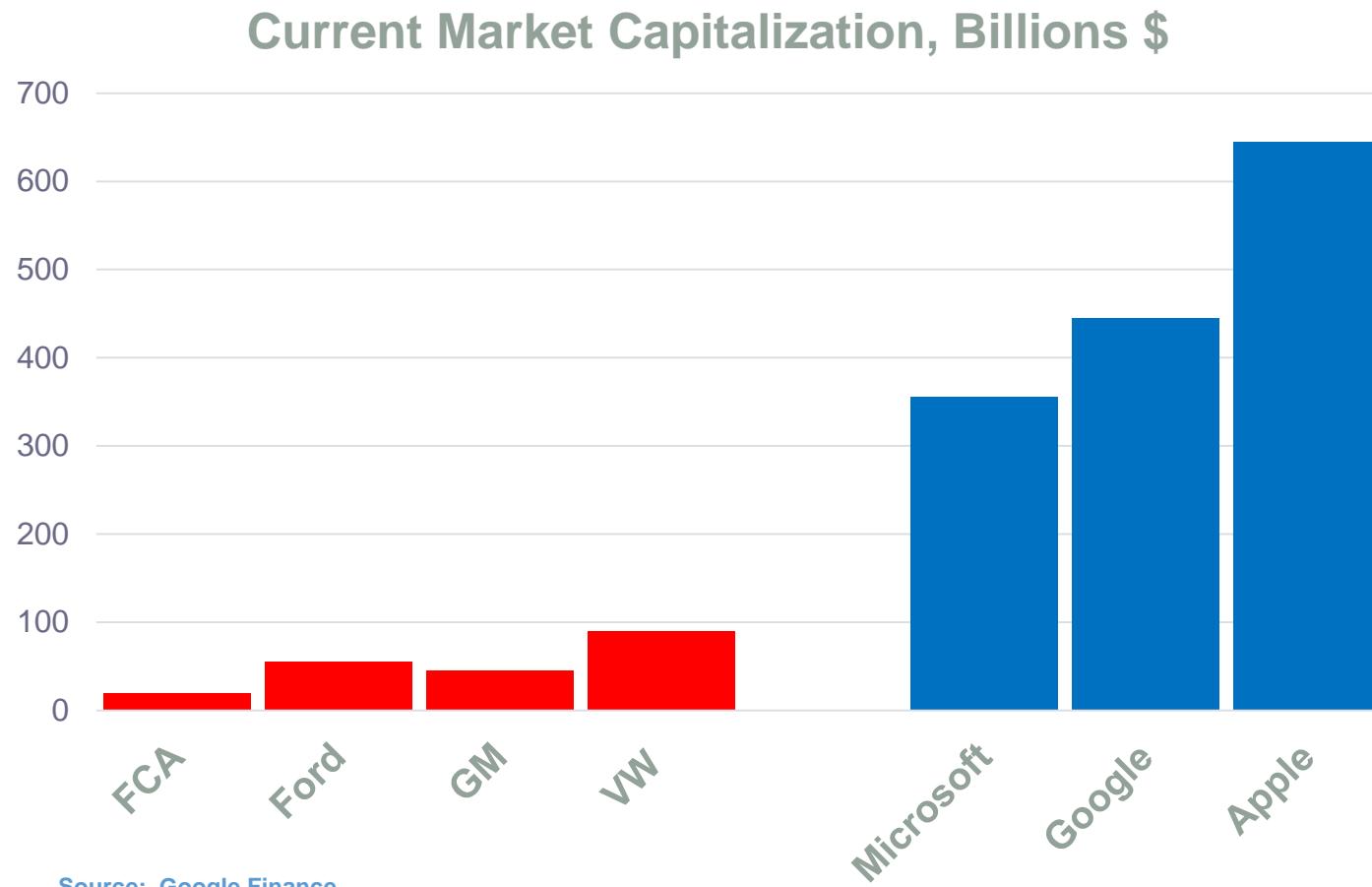
Are OEMs so aggressive now just to show that *this time* they will not lose again?

While outside players may develop supply and *create demand*...

EXAMPLE OF APPLE: ONLY CARS COULD “MOVE THE NEEDLE” FOR THEM?



... and they have the money to fund their efforts.



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Implications for Dealers: General

1. You've got time... plan, but don't panic
2. Don't confuse "intent" and "impact," or PR and action
3. Turn this to your advantage ... as you always have

Plan, but don't panic

EXAMPLE: AUTONOMOUS VEHICLE PENETRATION

If we assume:

1. By 2020 there are sold 500,000 fully-autonomous (Level 45) vehicles annually (far beyond any forecast)...
2. Every year after 2020 that number goes up by 0.5 million (beyond any non-speculative forecast)...
3. Every year we scrap about 10 million cars...
4. Level 45 cars do not reach half the fleet until mid-century.

And *this* assumes that regulators approve, the legal system adapts, customers pay, and technology works.

Autonomous Vehicle Penetration: hot off the press!

FROM FORD'S INVESTOR DAY, SEPTEMBER 14, 2016

Under a moderate adoption scenario, AVs could account for 20% of new vehicle sales by 2030. About 80% of these AV sales will be to fleet owners and 20% for personal ownership. Ford expects to enter high volume production (>100,000 units per year) with the launch of their AV in 2021. Initial roll-out will be in large geo-fenced urban markets (e.g. Manhattan plus its boroughs) similar to the initial deployment plans for the nuTonomy AVs in Singapore. Retail sales might begin in 2025. Ford still believes mediated perception and LiDAR are necessary for safe operation of AVs. [UBS]

MEDIATED PERCEPTION parses an entire scene in multiple images to make a driving decision (massive complexity, high computing load); the BEHAVIOR REFLEX directly maps an overall image onto a selection of scenarios (lower complexity, lower computing load, but probably too abstract for the “real world”); and DIRECT PERCEPTION uses (typically) Convolutional Neural Networks to learn the environment, allowing a simpler processor to make decisions quickly and easily. MP is the dominant current approach, BR has lost ground, and DP is gaining it.

Don't confuse “intent” and “impact,” or PR and action

EXAMPLE: VOLVO DRIVEME

- Set to launch in 2017.
- Volvo announces, perfectly correctly, this is a real-world AV pilot, on real roads that real people take to work every day.
- But the test will be limited:
 - to Gothenberg in Sweden only;
 - to only one hundred cars;
 - to driving only on a pre-determined 50 miles of roads;
 - which are multi-lane controlled-access highways with no pedestrians.
- So while Volvo is not misleading anyone, the press can assert that “Volvo has autonomous cars now,” whereas unless you are one of 100 drivers on a specific 50 miles of highway, you’re not going to be getting yours any time soon.

Turn this to your advantage, as you have before: examples

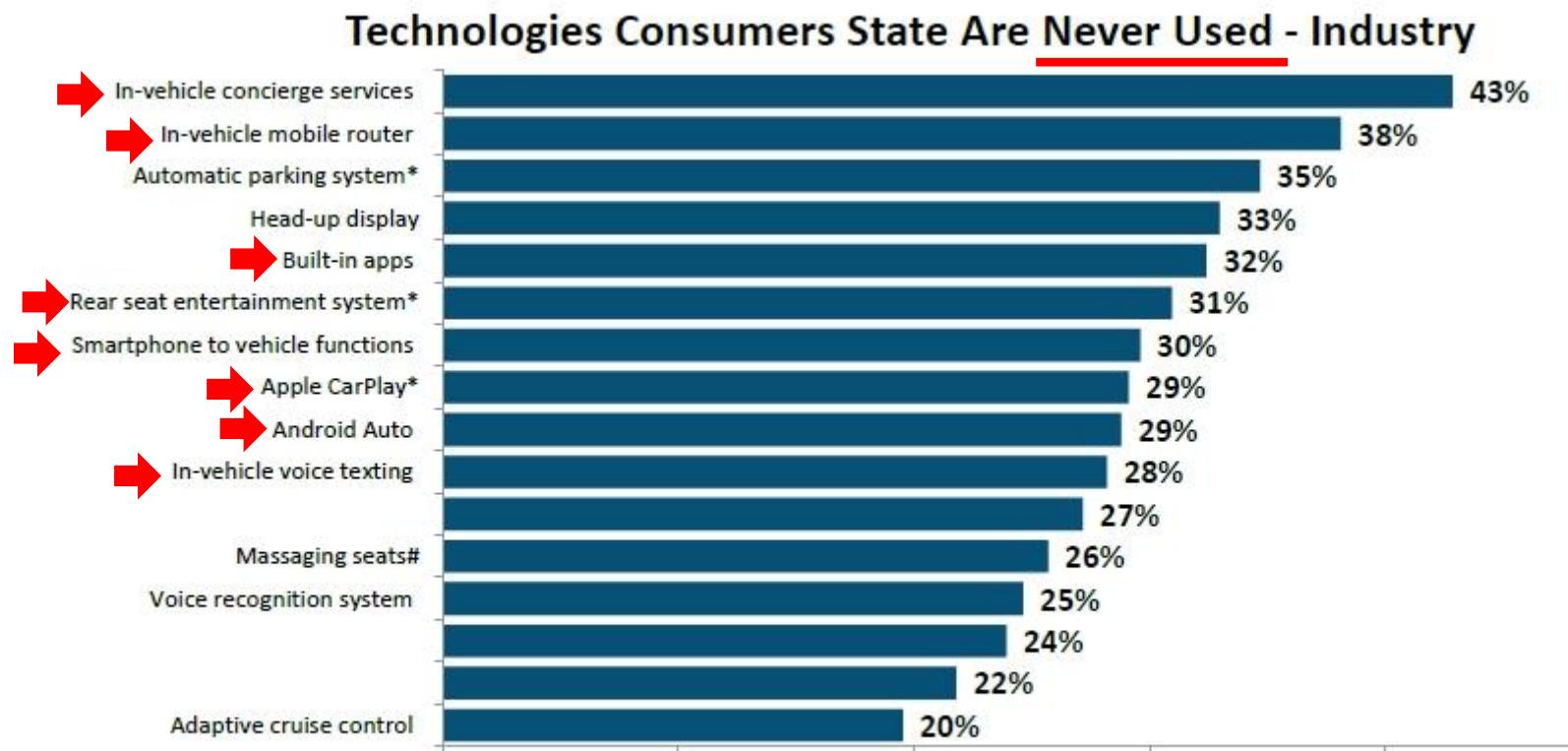
- Past threat #1: “Attack of the public chains” – Huizenga-era AutoNation, with end-to-end integration (e.g. rental fleets as in-house supply of used cars). Unable to improve on traditional dealer model, all six revert to it. Dealers adapt best practices (e.g. F&I menu selling). Combined market share of the Public 6 in 2004: 8.1%; in 2014: 8.6%.
- Past threat #2: “Rise of the disintermediators” – Original AutoByTel, CarsDirect, et al. Becomes clear the model is flawed, costly. ABTL IPOs at over \$200 in 1999, currently trading at \$17. Dealers learn to use the internet themselves, these firms become service providers.
- Past threat #3: “Invasion of the OEMs” – FRN and GMRH. Ford Retail Network gone by 2001, and GMRH cancels before it launches. Dealers simply out-compete company stores.

Implications for dealers: Specific

- Connectivity:
 - PRO: more options and features to sell, telematics in theory will boost service retention, connected cars may bring in younger customers...
 - CON: value often unclear, more training required, more time to devote to customer education, potential blowback when things don't work
- Mobility:
 - PRO: not much... maybe higher per-car service as cars are run harder
 - CON: individual retail sales shift to no-margin fleet sales (to Uber, Maven) ... If Uber pushes to “permanent rental” SAAR collapses
- Autonomy:
 - ADAS: more options, safety benefits may pull demand ahead
 - (FULL) AUTONOMY: years away; will raise prices (+/-); will raise SAAR (e.g. from transit, *from the elderly*); will drive up VMT, service

CONNECTIVITY: Many of these features are just lost on customers

JD POWER CUSTOMER VALUE IN AUTO TECHNOLOGY SURVEY, 2015

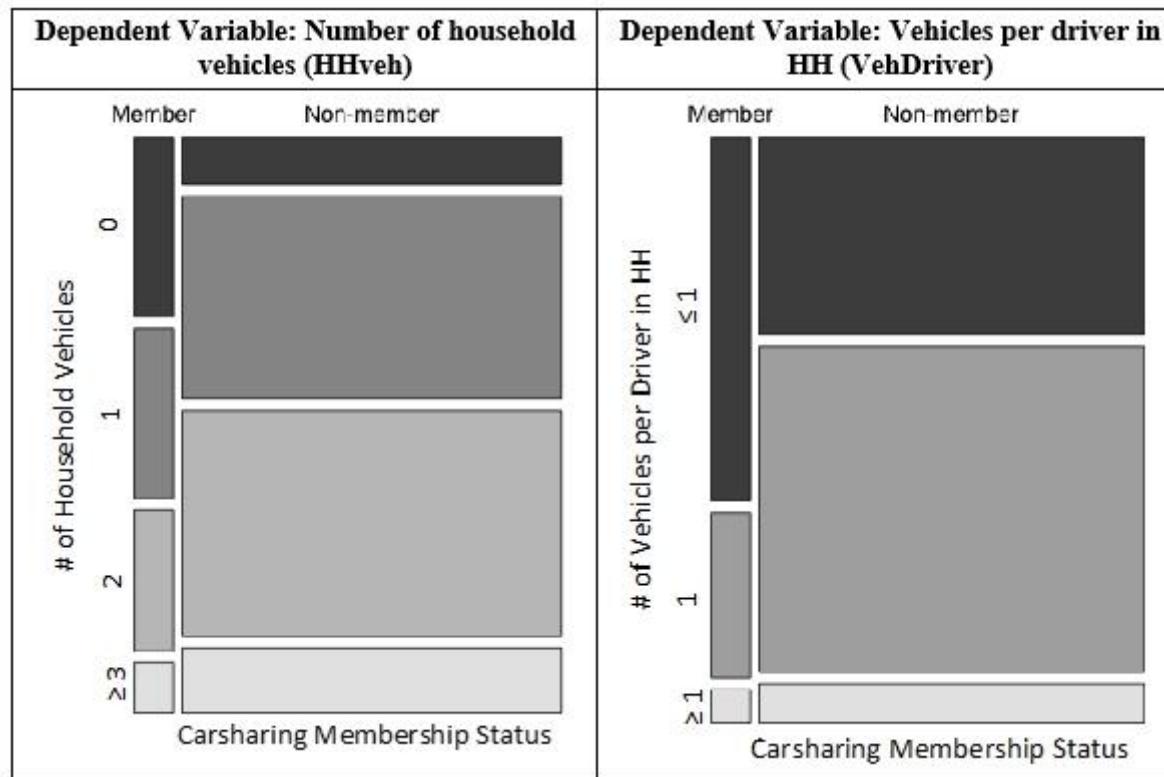


Note: * indicates small sample size (29 < n < 100)

indicates insufficient sample size (n < 30)

MOBILITY: It is clear that rideshare depresses vehicle ownership....

CARSHARE IMPACT ON CAR OWNERSHIP STUDY



Source: "The effect of carsharing on vehicle holdings and travel behavior: A propensity score and causal mediation analysis of the San Francisco Bay Area,"
 G S Mishra, R R Clewlow, P L Mokhtarian, K F Widaman (2015)

MOBILITY: ...but how far will rideshare spread?

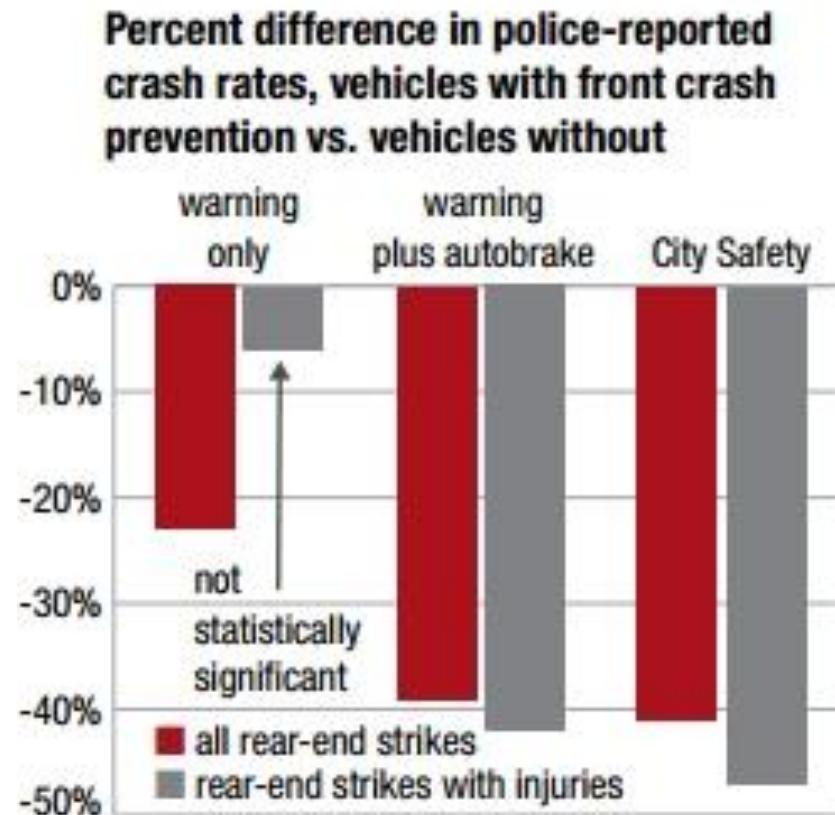
SUBURBS'S SHARE OF USA POPULATION HAS GROWN STEADILY FOR THE LAST 20 YEARS

Bob Brackett of Sanford Bernstein: "...carpooling in the US has plunged over the last 35 years, from 19.7% of all commuters in 1980 to 9.4% in 2013. If Americans are so prepared to share cars with other human beings, why are fewer of them doing so now than a generation ago? ...

Yes, cars are “inefficient”—used only 5% of the time, for example. But so is art. And so is jewelry, and I’ve yet to convince my wife to rent it. So are golf clubs but we still buy them. Toothbrushes are used less than 1% of the day, and an app called Gumbuddy could find neighbors willing to share for a modest fee. I’d argue that automobiles in the American tradition fall closer to a personal and emotional item.”

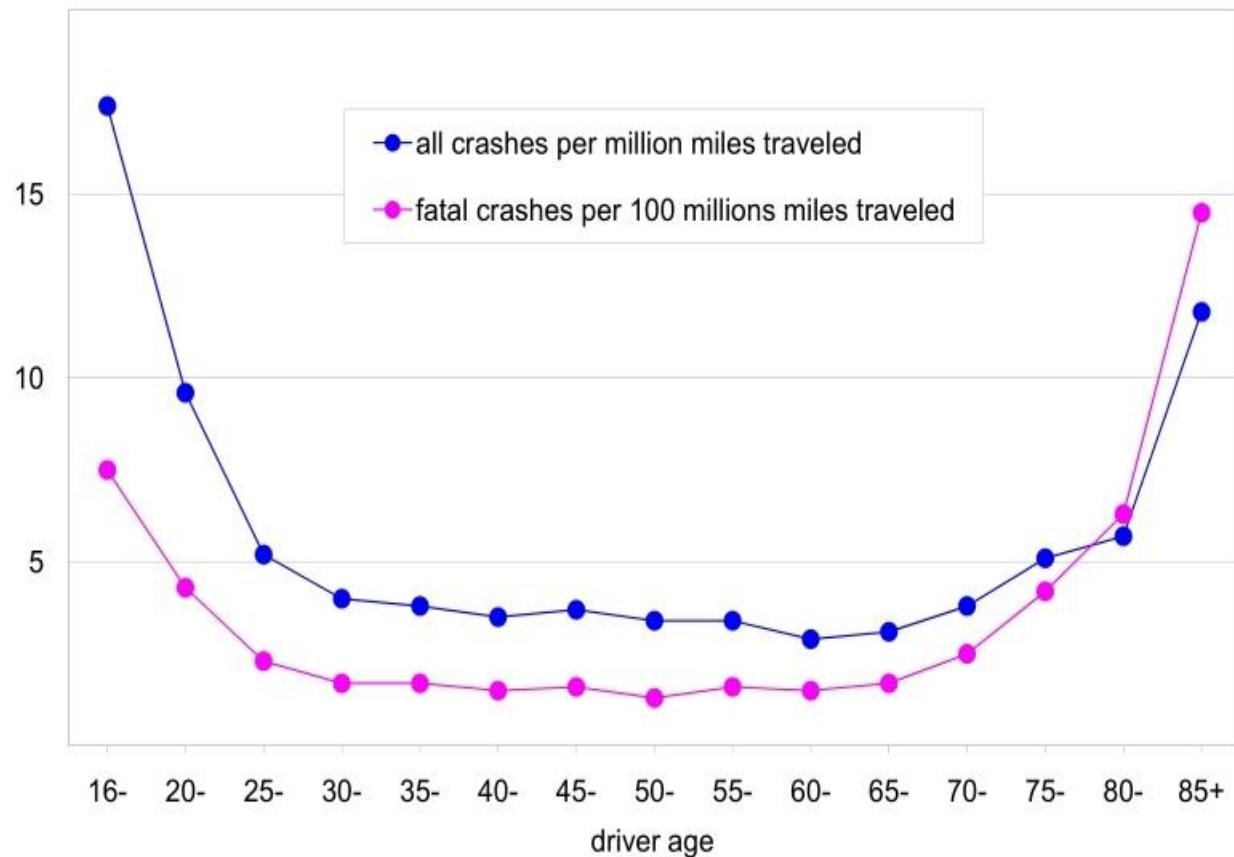
(from Quartz, “Investors have placed a one-way bet on Uber” by Steve LeVine, August 5, 2016)

AUTONOMY: ADAS may pull demand forward, due to safety benefits.... ADAS IS STARTING TO HAVE REAL IMPACT ON COLLISIONS



Source: IIHS January 2016; City Safety is Volvo's system

AUTONOMY: The “killer app” may be mobility for the elderly. L45 (QUASI) FULL AUTONOMY COULD BE A BOON FOR THE DISABLED OR ELDERLY



Source: IIHS, Federal Interagency Forum on Aging-Related Statistics

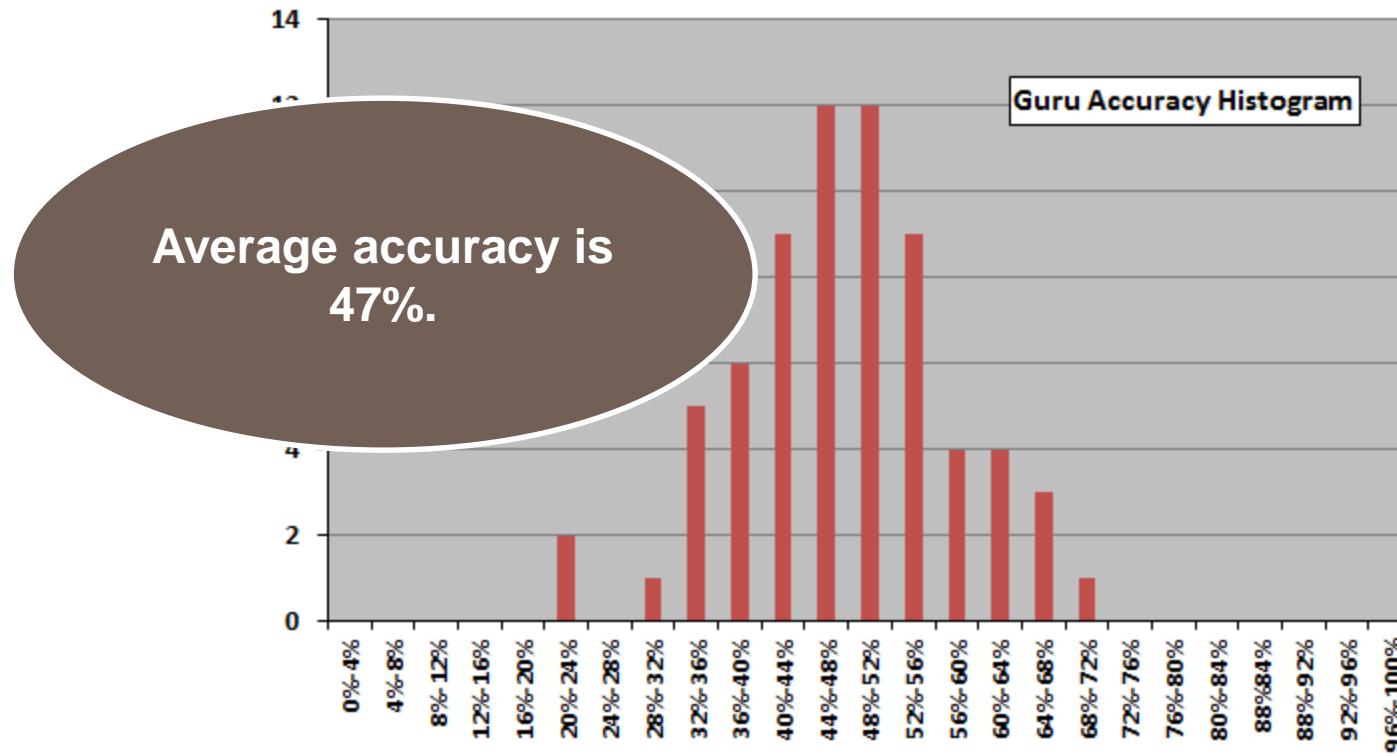
CLOSING COMMENT 1: Study the new entrants

- ❖ Uber: what is its end game? It can't just be taxis.*
 - Low barriers to entry dictate desperate race to scale, thus aggressiveness
 - Incumbents are starting to fight back more effectively
 - Unsuitable for delivery (how many pizza slices do we need?), but may be a privatizer of mass transit?
- ❖ Tesla: very *instructive* but not (yet?) *disruptive*: what can we learn from them?
 - May focus on battery supply, using the car company as “proof of concept,” becomes a supplier
 - If this indeed occurs, Musk may sell car company and keep the battery company
- ❖ Apple: someone will have to build this car, but will it be an OEM or Foxconn?**
 - How does a company known for great UX make an engaging autonomous car?
 - Most likely to aim at high end (>\$50,000) where margins allow enriched experience
 - Unlikely to grow premium car market the way iPhone grew premium phone market (\$200►\$600 ≠ \$20,000►\$60,000)
- ❖ Google: can the leap to level 5 work?
 - “You can’t train for a marathon by walking a lot.” But level 5 failure mode is “Hindenburg moment?”
 - “Killer app” may be low-speed local-area mobility enablement for elderly/disabled... not safety
 - Is “Project Chauffeur” really just about selling the software?

* Taxi miles in the US are <1% of total VMT ** See author for Alliance Bernstein report

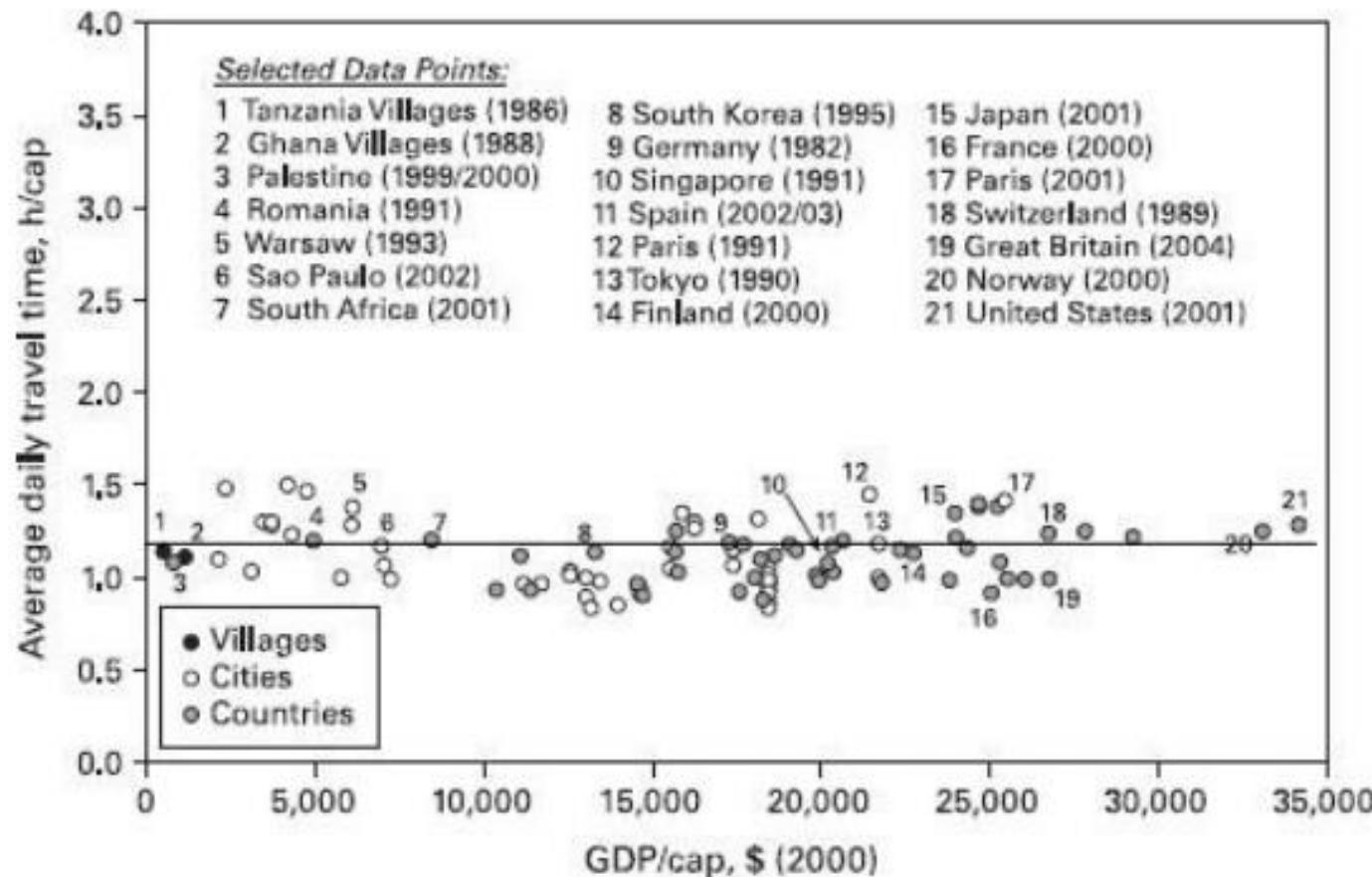
CLOSING COMMENT 2: Beware of experts (such as me)

6,582 FORECASTS FOR THE US STOCKMARKET 2005-2012, AS OFFERED BY 68 EXPERTS, WITH ACCURACY PEGGED TO THE S&P 500



Source: CXO Advisory

CLOSING COMMENT 3: Take comfort in the eternal urge to move



Average daily travel time in hours per person as a function of GDP per capita. Source: updated dataset of Schäfer, A., D.G. Victor, 2000. The Future Mobility of the World Population, *Transportation Research A*, 34(3): 171-205.

END