Engineering Trust:
Consumer Perceptions of Autonomous & Electric Vehicles

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Product Planning Team
Jeff Mazoway
Autonomy: A Matter of Trust
“Some day in the future when you drive onto a superhighway, you'll reach over to your dashboard and push the button marked "Electronic Drive." Selecting your lane, you'll settle back to enjoy the ride as your car adjusts itself to the prescribed speed. You may prefer to read or carry on a conversation with your passengers-- or even to catch up on your office work. It makes no difference for the next several hundred miles as far as the driving is concerned.

Fantastic? Not at all.”

Science Digest (1958)
Level 3 Partial Autonomy adoption is when the market "tips" into autonomy

- **Autonomous Vehicles “Tipping Point”**
  Transition from human drivers to vehicles driving

- **Our World Today**
  - **0**: HUMAN ONLY
    - The driver (human) controls everything: steering, brakes, throttle, power
  - **1**: MODERN VEHICLE
    - Most functions are still controlled by a driver, but some (like braking) can be done automatically by the car
  - **2**: MODERN PLUS
    - At least 2 functions are automated (like cruise control & lane-centering), but the driver must be ready to take control of the vehicle
  - **3**: PARTIAL AUTONOMY
    - Drivers are still necessary, but are not required to monitor the situation as with previous levels
  - **4**: FULL AUTONOMY (+ HUMAN)
    - Vehicles perform all safety-critical driving functions and monitor roadway conditions for an entire trip, with option for human driving
  - **5**: FULL AUTONOMY (NO HUMAN)
    - No option for human driving - no steering wheel or controls

Source: KBB
Headlines: Impending Autonomy, but Fear

2017 U.S. Tech Choice Study: Consumers Fear Technology Failures with Autonomous Vehicles
BY JOSEPH DOBRIAN, APRIL 19, 2017

Hackers Describe How Hard It Is to Protect Autonomous Cars
April 13, 2017 - Written By Alexander Masham

The Self-Driving Dilemma
Autonomous vehicles could spark a cleaner, cheaper urban mobility revolution—or they could make it tougher to combat sprawl, congestion, and climate change.
ANDREW SMALL | @ASmall_Word | May 4, 2017

The Race for Autonomous Vehicles Picks Up Speed
by PAUL A. EISENSTEIN

Tesla’s Self-Driving System Cleared in Deadly Crash
By NEAL E. BOUDETTE, JAN 19, 2017

Who’s self-driving your car?
The battle for driverless cars revs up
The Economist

The Ethics of Autonomous Cars
“We’re calling (Gen Z) ‘the throwback generation,’”...behavior is completely unexpected, and they are really pushing back from what Millennials were about.”

– Center for Generational Kinetics

Source: 2016 Maritz NVCS
Generation Z – Frugal, Brand-Wary, Determined

“We’re seeing similarities between Gen Z and those that emerged after the Great Depression.”

- **Grown up in era when information was available at all times**
- **Less trusting** of brands – authenticity and transparency valued
- **Occupy Wall Street Movement caused skepticism of big corporations**

- **Aware of Millennials living at home due to high debt**
- **Saving far earlier**
- **Realistic, but more optimistic than other generations**
- **Relate to technology as a tool vs. an obsession**

- **“Survival mode:”** Fight for what they want
- **Feel lucky to get a job vs. Millennial entitlement**
- **Not judgmental and very accepting**

Millennials Most Optimistic – Followed by Gen Z

Autonomous Vehicle Perceptions by Age

- I Would Buy a Self-Driving Vehicle if One Were Available Today
- I Would Not Buy a Self-Driving Vehicle Because of Safety Concerns
- Self-Driving Vehicles Will Lead to Fewer Accidents

Source: 2016 Maritz NVCS
Optimism Increases with Higher Income

Autonomous Vehicle Perceptions by Income

- I Would Buy a Self-Driving Vehicle if One Were Available Today
- I Would Not Buy a Self-Driving Vehicle Because of Safety Concerns
- Self-Driving Vehicles Will Lead to Fewer Accidents

Source: 2016 Maritz NVCS
“With the exception of Gen Y, all other generational groups are becoming more skeptical of self-driving technology, which poses a new challenge to car manufacturers and technology developers...

... we see a pattern where trust drives interest in the technology and right now, the level of trust is declining.”

Source: JD Power 2017 Tech Choice
Challenge to win over SUV/Minivan buyers

I Would Buy a Self-Driving Vehicle if One Were Available Today

- Green Vehicles
- Luxury Vehicles
- “Commodity” Cars
- Performance Cars
- Pick-Ups
- Non-Lux People Movers

% Responding (Top 2 Box)
Brands Tell an Interesting Story

I Would Buy a Self-Driving Vehicle if One Were Available Today

% Responding (Top 2 Box)

 Tesla
 smart
 Volvo
 Land Rover
 Infiniti
 Audi
 Mercedes-Benz
 Alfa Romeo
 Lexus
 Acura
 Volkswagen
 BMW
 Mazda
 Hyundai
 Infiniti
 Kia
 Subaru
 Toyota
 Honda
 Industry
 Cadillac
 Lincoln
 Jaguar
 Nissan
 Chrysler
 MINI
 Genesis
 Dodge
 Chevrolet
 Ford
 Jeep
 Buick
 Porsche
 GMC
 Ram

• Green
• Luxury
• Asian

• Performance
• Light Truck Oriented
• Domestics

Source: 2016 Maritz NVCS
A safer, higher tech possibility – in theory

- Consumers with higher interest in autonomy are more sensitive to safety, attracted to options/technology and may enjoy driving slightly less.

Self-Driving Vehicle Buyer Attitudes

<table>
<thead>
<tr>
<th>% Responding (Top 2 Box)</th>
<th>Industry</th>
<th>Autonomous Interest</th>
</tr>
</thead>
<tbody>
<tr>
<td>I really enjoy driving</td>
<td></td>
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<tr>
<td>When shopping, I actively research safety ratings</td>
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<tr>
<td>I like my vehicle fully equipped with all of the latest options</td>
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<tr>
<td>A vehicle's safety features make it more appealing than its styling</td>
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<tr>
<td>Usually one of the first to buy products with cutting-edge technology</td>
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<tr>
<td>I pay more for features that help me avoid an accident</td>
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</tbody>
</table>

Source: 2016 Maritz NVCS
Safety paradox: largest opportunity and worry

- **Primary autonomy concerns:** Safety/loss of control, hacking, reliability, cost
- **In addition,** up to 10% express an interest in driving themselves

What Concerns You Most About a Self-Driving Vehicle?

Source: 2016 Maritz NVCS
ADAS Transition to Full Autonomy

The Roadmap to accident free driving
From assisted to automated driving

- **Assisted**
  - Emergency Brake

- **Partially Automated**
  - Parking Scenarios
  - Driver distraction
  - ACC Lateral/Longitudinal
  - Traffic Jam Assist
  - Lateral Collision Avoidance

- **Fully Automated**
  - Parking scenarios

- **Highly Automated**
  - Construction Sites
  - Stop&Go, Cruising, 0-130km/h

- **Fully Automated**
  - All driving scenarios

**Technical Enablers**
Functions, Technologies

Source: Continental
## A Matter of Trust – Consumers

<table>
<thead>
<tr>
<th>PRO</th>
<th>CON</th>
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<tbody>
<tr>
<td>“… protects my poor decisions in the car.”</td>
<td>“I don`t want to have the control of a car out of my</td>
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<tr>
<td>“More automation to reduce human stupidity while awesome.”</td>
<td>“I think I am a better driver than a machine.”</td>
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<tr>
<td>“It is an added safety feature to all the distracted</td>
<td>“I want full control of the vehicle. No surprise</td>
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<tr>
<td>“Any function that will help me keep a car–to–car</td>
<td>“Autonomous cars are still new, so some people still</td>
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<tr>
<td>excellent. I think this should be installed on all new Motorists</td>
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<tr>
<td>drive to close to one another.”</td>
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</tr>
<tr>
<td>“I'm personally looking forward to this technology. break every</td>
<td>“I would like to hear a reassurance that the odds of it</td>
</tr>
<tr>
<td>now and then from driving will be</td>
<td>hacked are low...and maybe things they are doing to</td>
</tr>
<tr>
<td>“Assisted driving could lower the number of</td>
<td>doesn't happen.”</td>
</tr>
<tr>
<td>Source: HATCI Consumer Research</td>
<td></td>
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</tbody>
</table>
...many consumers are more likely to trust tech companies—rather than traditional automakers—to develop safe and reliable autonomous vehicle technology.”

— JD Power

“...fewer than half of US consumers surveyed say they trust traditional OEMs to bring fully autonomous vehicles to market, opening the door for new entrants to gain a critical foothold...”

— Deloitte

“...persuading people to actually get in one of these vehicles with no human fallback will take some effort... it may be necessary for the car to tell passengers what it's doing (slowing down, say) and explaining why (because a dog ran into the street).”

— Auto News

“In the near future, cybersecurity literally will be a life-and-death matter...It is critical for the simple fact that it pertains to consumer trust in a brand and confidence in autonomous vehicles.”

— NADA

“The challenge for vehicle manufacturers now is two-fold: fix the technology hiccups & get consumers to experience it for themselves. The answer lies in the ability of manufacturers to build the trust between human emotion & technological reliability.”

— JD Power
Electric Vehicles: Dollar Rules
U.S. EV Market: Tempered Growth

- U.S. EV sales increase 35%–40% in 2016, but penetration remains low (2%–3%)

Total EV Market: Growth Analysis for Top Countries, Global, 2016

- Norway continued to have the highest penetration of 30.2%
- The Netherlands experienced a steep negative 46.6% decline followed by Japan with negative 14.0%.
- In the Netherlands, the decline was due to reduction of incentives.
- In Japan, due to limited choice, there was a wait-and-watch situation for buyers.
- China maintained the lead with over 300,000 unit sales.
- The United States experienced positive growth in 2016 unlike 2015.

Source: Frost & Sullivan
Cognitive Dissonance: Ethics vs. Wallets

- Consideration of EVs mainly centers on the Environment and Financials
- Secondary considerations include Carpool access & keeping up with Technology

Why Americans want electric vehicles...

- 87% are concerned about the environment
- 62% want the long-term savings
- 52% are trying to keep up with technology
- 29% just want to use the carpool lanes!

Source: AAA
EV interest conflicts with regulation plan

- Consideration of alternative fuel options drops through 2016
- Despite compelling new EVs, low fuel price and positive economy support continued purchase of conventional gas vehicles

**Alternative Fuel Consideration**

- Consideration data N/A prior to 2009

<table>
<thead>
<tr>
<th>Year</th>
<th>Avg. Fuel Price</th>
<th>HEV</th>
<th>EV</th>
<th>PHEV</th>
<th>FCEV</th>
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<tbody>
<tr>
<td>2008</td>
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<td>2016</td>
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Source: 2010–2016 Maritz NVCS
Slow growth through 2040

- U.S. EV forecast is only 3% of the market in 2022, rising to 27% by 2040
- While EVs continue to increase through 2040, PHEV begins to decline after 2035

Source: IHS, Bloomberg New Energy Finance
Green Vehicle consumers are largely unique

- EV/PHEV consumers most similar, but PHEV buyers seek to minimize trade-offs
- HEV: Low on Technology, Fun-to-Drive, but prioritize Practicality
- FCEV: High on Technology, Power, Environment, but low on Fuel Economy

Source: 2016 Maritz NVCS
Number of options increase as costs drop

- Number of EVs expected to triple over the next 5 years
- Continued drop in battery prices enables TCO of EVs = ICEs by 2025

Source: AutoPacific, Autosource, Bloomberg New Energy Finance
EV range expectation approaches gas vehicles

- All electric range (AER) expectations have risen significantly since 2011
- 54% of EV intenders surveyed in 2016 expect 300+ miles AER

Source: AutoPacific Competitive Battleground; AutoPacific FADS; AutoSource
Tiering: A relatable EV purchase model

- AER expectations have risen beyond the minimum for many consumers
- Opportunity to implement modular/tiered strategy to meet wider consumer needs
  - Tesla has already implemented this strategy, with battery options ranging from 75kWh to 100kWh on Model S and X

### iPhone Tiered Model

<table>
<thead>
<tr>
<th>Model</th>
<th>Screen Size</th>
<th>32GB</th>
<th>128GB</th>
<th>256GB</th>
</tr>
</thead>
<tbody>
<tr>
<td>SE</td>
<td>4” Diagonal</td>
<td>$399.00</td>
<td>$499.00</td>
<td>Not Available</td>
</tr>
<tr>
<td>7s</td>
<td>4.7” Diagonal</td>
<td>$649.00</td>
<td>$749.00</td>
<td>$849.00</td>
</tr>
<tr>
<td>7s Plus</td>
<td>5.5” Diagonal</td>
<td>$769.00</td>
<td>$869.00</td>
<td>$969.00</td>
</tr>
</tbody>
</table>

### Other Tiered Products

- Communications (Data Usage)
  - at&t 
  - verizon 
  - T-Mobile 

- Entertainment (Content/Speed)
  - U-verse 
  - NETFLIX 
  - comcast 
  - IMAX THEATRE 

- Computer (Processor/Memory)
  - ASUS 
  - Microsoft 
  - DELL 
  - Apple
Gratuitous Plug...with a relevant message

- 1st Green Vehicle with 3 P/T types: EV, HEV, PHEV
- Addresses consumer demand for efficiency plus practicality and styling
- Innovative EV leasing plan:
  - 36-month lease ranging from $275-$365 + tax
  - $2,500 down payment covered by CA $2,500 incentive
  - Unlimited miles
  - Charging reimbursement
  - Scheduled maintenance for 50K miles

- 1st non-luxury dedicated SUV Green Vehicle
- 2nd best-selling Dedicated Green Vehicle for 2017
- 4th best-selling Green Vehicle overall for 2017
- HEV & PHEV versions (PHEV available 2nd half 2017)
- SUV style & image with Green Vehicle efficiency

OEMs require innovative marketing to offset Green Vehicle affordability
Consumers now demand Green Vehicle efficiency with conventional vehicle style & practicality
Key Take-Aways

Autonomous Vehicles

• ADAS enables transition to full autonomy
• Implementation, customization and ease of use build trust
• Trust (in accuracy, performance, safety) is the key to mass adoption
• Skepticism grows, with Gen Z preliminarily more pragmatic than Millennials

Electric Vehicles

• Consumer interest grows, but financials & AER still hinder adoption
• OEMs adopt innovative marketing to encourage sales
• Battery tiering and Tech company partnerships are powerful enablers
• New models minimize sacrifices for efficiency
• EV/Gas “singularity” projected at 2025
Questions?