Who’s on First: Early Adopters of Self-Driving Vehicles

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Context

• Self-driving cars being tested on public roads
• Higher levels of vehicle automation; no human driver
• Future societal benefits and costs uncertain
• Impacts depend on when and how adopted and used
• Desired outcome is informed decision making by transportation agencies
TTI’s prior research

Early adopters of technology, in general, would be likely to use self-driving vehicles (Zmud et al. 2016, Sener et al. 2017)

- Austin 2015
- Dallas 2016
- Waco 2016
- Houston 2016
Tested two hypotheses

1. Current ride-hailing users are more likely to use self-driving vehicles than non-users
2. Among ride-hailing users, acceptance and likely usage increases with ride-hailing experience
“Intent to use” reflects technology acceptance, which is precursor to technology adoption.

Ride-hailing users were more likely to use self-driving vehicles than non-users by a margin of almost 2 to 1.
Intent to use self-driving vehicles by user type

The longer people have used ride-hailing services, the more likely they will use self-driving vehicles.

![Bar chart showing the intent to use self-driving vehicles by user type.](chart.png)

- **Non-user** (N=1218):
  - Likely to Use: 40%
  - Not Likely to Use: 60%

- **New user** (N=689):
  - Likely to Use: 60%
  - Not Likely to Use: 40%

- **Long-term user** (N=1368):
  - Likely to Use: 80%
  - Not Likely to Use: 20%
Intent to use self-driving vehicles by user type and adoption level

Relationship between technology adoption, intent to use, and user type is significant.
Methodology

• Online survey 3,275 persons in four cities
  – Boston, Las Vegas, Phoenix, San Francisco/Silicon Valley

• Key survey question:
  – Imagine that self-driving vehicles were on the market now for you to purchase and/or use today. Using a scale from 1 (not at all likely) to 4 (extremely likely), please indicate your likelihood to do the following:
    • Purchase a self-driving vehicle
    • Use self-driving vehicles in the form of car-sharing services like Zipcar or Car2go
    • Use self-driving vehicles in the form of ride-sharing services like Uber or Lyft.
Generally, shared mobility services were preferred to privately owned vehicles.

Type of self-driving car preferred by user type

- **Non-user**
  - Privately owned vehicle: 20%
  - Car-sharing service: 30%
  - Ride-sharing service: 50%

- **New user**
  - Privately owned vehicle: 30%
  - Car-sharing service: 40%
  - Ride-sharing service: 50%

- **Long-term user**
  - Privately owned vehicle: 40%
  - Car-sharing service: 50%
  - Ride-sharing service: 60%
Intent to use by various application types

- At least one type: 59%
- None of the types: 40%

- Ride-sharing service: 52%
- Car-sharing service: 41%
- Privately owned vehicle: 35%
- All types: 20%

- Only ride-sharing service: 10%
- Only privately owned vehicle: 5%
- Only car-sharing service: 2%
Congestion effects: Intent to use by pooled or non-pooled versions

People generally preferred non-pooled rather than pooled autonomous fleets.
**Top ranked reasons for intending to use as...**

<table>
<thead>
<tr>
<th>Rank</th>
<th>Privately Owned</th>
<th>Car-Sharing Fleets</th>
<th>Ride-Hailing Fleets</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Relieves <strong>stress</strong> of driving</td>
<td><strong>Costs</strong> lower than owning</td>
<td><strong>Convenience</strong></td>
</tr>
<tr>
<td>2</td>
<td><strong>Trust</strong> technology tested</td>
<td><strong>Test</strong> before owning</td>
<td><strong>Costs</strong> lower than owning</td>
</tr>
<tr>
<td>3</td>
<td><strong>Productive</strong> while driving</td>
<td>Relieves <strong>stress</strong> of driving</td>
<td><strong>Test</strong> before owning</td>
</tr>
<tr>
<td>4</td>
<td><strong>Safer</strong> than human drivers</td>
<td><strong>Trust</strong> technology tested</td>
<td><strong>Productive</strong> while driving</td>
</tr>
<tr>
<td>5</td>
<td>Lower insurance <strong>costs</strong></td>
<td><strong>Productive</strong> while driving</td>
<td><strong>Relieves</strong> stress of driving</td>
</tr>
</tbody>
</table>
Top ranked reasons for **NOT** intending to use as...

<table>
<thead>
<tr>
<th>Rank</th>
<th>Privately Owned</th>
<th>Car-Sharing Fleets</th>
<th>Ride-Hailing Fleets</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><strong>Safety</strong> of reaction time</td>
<td>Lack of <strong>information</strong></td>
<td><strong>Privacy</strong></td>
</tr>
<tr>
<td>2</td>
<td><strong>Cost</strong> (purchase)</td>
<td><strong>Trust</strong></td>
<td>Vehicle <strong>hacked</strong></td>
</tr>
<tr>
<td>3</td>
<td><strong>No need</strong> to own car</td>
<td>Lack of <strong>control</strong></td>
<td><strong>Safety</strong> of reaction time</td>
</tr>
<tr>
<td>4</td>
<td><strong>Like to drive</strong></td>
<td><strong>Safety</strong> of reaction time</td>
<td><strong>Trust</strong></td>
</tr>
<tr>
<td>5</td>
<td><strong>Cost</strong> (maintenance/repair)</td>
<td><strong>Safety</strong> of shared vehicle</td>
<td>Lack of <strong>information</strong></td>
</tr>
</tbody>
</table>
Three reasons findings are important

1. The size of the ride-hailing market in a city is a good estimate of the likely size of the early future self-driving market

2. Characteristics of ride-hailing users define characteristics of early users of self-driving vehicle

3. Travel patterns of ride-hailing users inform early application areas
What do we know about “when”? 

- Automakers currently marketing private vehicles at Level 2 automation. With fleet turnover rates, it would take decades to obtain saturation of Level 4 or 5 vehicles.
- LIDAR sensors are still too expensive to be used in mass produced and marketed vehicles.
- To engender trust among the public and policy makers, early options will likely be geographically-constrained to ensure safe operation. Fits business model of mobility service fleets.
- Consumers will be slow to purchase level 4/5 vehicles when operation is constrained.
Implications for decision makers

• Indications that self-driving vehicles will first be available to consumers as mobility service fleets
• Good news for transportation decision makers
• Public sector agencies can engage with and steer the deployment of automated mobility service fleets to a greater degree than drive-anywhere private vehicles
• Gives public agencies times to work out “rules of the road” for the privately owned vehicles.
Thank you. Questions?


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The Pikes Peak Area Council of Governments Presents
The Next Big Thing: Transportation Technology & Planning Our Future System

SCHEDULE OF EVENTS

1:00 - COFFEE SERVED
1:10 - OPENING REMARKS
1:20 - HOW FAR AWAY ARE AUTONOMOUS VEHICLES?
1:50 - WHAT'S NEXT FOR ROADX: PLANS FOR 2019
2:20 - REFRESHMENTS
2:35 - CAN AUTONOMOUS SHUTTLES PROVIDE A REAL RETURN ON INVESTMENT?
3:05 - THE ROLE OF UNMANNED AIRCRAFT IN TRANSPORTATION'S FUTURE
3:35 - PANEL DISCUSSION
4:05 - NETWORKING