TOMNET and D-STOP USDOT Tier 1 University Transportation Centers present

The ABCs (Attitudes – Behaviors – Choices) of Future Mobility

Future Vehicle Ownership Patterns in an Era of AVs

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University of Texas At Austin
June 12, 2020
**TOMNET D-STOP Transformative Technologies in Transportation Survey (T4 Survey)**

- Phoenix, Atlanta, Austin, and Tampa metro areas
- Summer and Fall 2019
- Random address-based sample with online instrument
- Comprehensive attitudinal survey on MaaS and AV
- Weighted to better represent Census distributions

<table>
<thead>
<tr>
<th></th>
<th>Phoenix, AZ</th>
<th>Atlanta, GA</th>
<th>Austin, TX</th>
<th>Tampa, FL</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sample Size</strong></td>
<td>1,027</td>
<td>944</td>
<td>1,127</td>
<td>260</td>
<td>3,358</td>
</tr>
<tr>
<td><strong>%</strong></td>
<td>30.6%</td>
<td>28.1%</td>
<td>33.6%</td>
<td>7.8%</td>
<td>100%</td>
</tr>
</tbody>
</table>
Survey Instrument

- Attitudes and Preferences
- Vehicles You Have and Where You Live
- Current Travel Patterns
- Mobility on Demand and Shared Mobility Services
- Autonomous Vehicles
- Background Information
Introduction

Predictions of AV Market Penetration

- Are people buying AVs?
  - *When? Now or Later?*
- Why are they waiting to buy?
- Will they give up their ability to drive to purchase an AV?
  - *What impacts this decision?*
  - *Travel time? Travel cost? Vehicle cost?*
- Will they trust and use AV ridesharing?

Companies plan to produce self-driving vehicles this year or very soon, so what is going to happen?

<table>
<thead>
<tr>
<th>Company</th>
<th>Autonomous Vehicle Majority Market Penetration Prediction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ford</td>
<td>True Self-Driving by 2021</td>
</tr>
<tr>
<td>GM</td>
<td>Self-Driving Beyond 2020</td>
</tr>
<tr>
<td>Honda</td>
<td>Self-Driving on the Highway by 2020</td>
</tr>
<tr>
<td>Toyota</td>
<td>Self-Driving on the Highway by 2020</td>
</tr>
<tr>
<td>Renault-Nissan</td>
<td>2020 for Autonomous Cars in Urban Conditions, 2025 for Truly Driverless Cars</td>
</tr>
<tr>
<td>Volvo</td>
<td>Self-Driving on the Highway by 2021</td>
</tr>
<tr>
<td>Hyundai</td>
<td>Highway 2020, Urban Driving 2030</td>
</tr>
<tr>
<td>Daimler and BMW</td>
<td>Nearly Fully Autonomous by Early 2020's</td>
</tr>
<tr>
<td>Fiat-Chrysler</td>
<td>CEO expects there to be some self driving on the road by 2021</td>
</tr>
<tr>
<td>Tesla</td>
<td>Beginning of 2020</td>
</tr>
<tr>
<td>Level</td>
<td>Automation Type</td>
</tr>
<tr>
<td>-------</td>
<td>----------------</td>
</tr>
<tr>
<td>0</td>
<td>NO AUTOMATION</td>
</tr>
<tr>
<td>1</td>
<td>DRIVER ASSISTANCE</td>
</tr>
<tr>
<td>2</td>
<td>PARTIAL AUTOMATION</td>
</tr>
<tr>
<td>3</td>
<td>CONDITIONAL AUTOMATION</td>
</tr>
<tr>
<td>4</td>
<td>HIGH AUTOMATION</td>
</tr>
<tr>
<td>5</td>
<td>FULL AUTOMATION</td>
</tr>
</tbody>
</table>

Source: [https://medium.com/@BabakShah/levels-of-automation-for-self-driving-cars-d410a4f679b7](https://medium.com/@BabakShah/levels-of-automation-for-self-driving-cars-d410a4f679b7)
WHAT?

Regular Vehicle

Autonomous Vehicle

Rely on AV Ride-hailing Services only
Survey Question: What will you purchase?

Stated Preference Question

Each respondent was presented 2 Scenarios

What would you do when faced with your next car purchase decision in each of the following scenarios?

Respondents ranked 1 as most preferred, 3 as least preferred

<table>
<thead>
<tr>
<th>Options</th>
<th>Option A: Buy a regular vehicle</th>
<th>Option B: Buy an AV</th>
<th>Option C: Don’t buy a vehicle and use AV ride-hailing/rental services</th>
</tr>
</thead>
<tbody>
<tr>
<td>Costs</td>
<td>$\text{XXX}$/month + $\text{YYY}$/mile</td>
<td>$\text{XXX}$/month + $\text{YYY}$/mile</td>
<td>$\text{XXX}$/month + $\text{YYY}$/mile</td>
</tr>
<tr>
<td>Average wait time: 0 minutes</td>
<td></td>
<td></td>
<td>Average wait time: 2 minutes</td>
</tr>
</tbody>
</table>

Rank

_____  _____  _____

Values highlighted vary for each respondent based on random block design.
## Survey Question: What will you purchase?

<table>
<thead>
<tr>
<th>Options</th>
<th>Option A: Buy a regular vehicle</th>
<th>Option B: Buy an AV</th>
<th>Option C: Don’t buy a vehicle and use AV ride-hailing/rental services</th>
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</thead>
<tbody>
<tr>
<td>Costs</td>
<td>$XXX/month + $Y.YY/mile</td>
<td>$XXX/month + $Y.YY/mile</td>
<td>$0/month + $Y.YY/mile</td>
</tr>
<tr>
<td>Average wait time</td>
<td>0 minutes</td>
<td>0 minutes</td>
<td>Z minutes</td>
</tr>
<tr>
<td>Rank</td>
<td>200, 300 or 500</td>
<td>Within the range 150 to 625</td>
<td>3, 6 or 9</td>
</tr>
</tbody>
</table>
What will you purchase?

**Austin**
- Regular Vehicle: 46%
- Autonomous Vehicle: 41%
- AV Ridehailing Services: 13%

**Phoenix**
- Regular Vehicle: 60%
- Autonomous Vehicle: 28%
- AV Ridehailing Services: 12%

**Tampa**
- Regular Vehicle: 62%
- Autonomous Vehicle: 24%
- AV Ridehailing Services: 14%

**Atlanta**
- Regular Vehicle: 55%
- Autonomous Vehicle: 33%
- AV Ridehailing Services: 12%
What will you purchase?

All Cities

- Regular Vehicle: 54%
- Autonomous Vehicle: 34%
- AV Ridehailing Services: 12%
What will you purchase?

First Choice
- Regular Vehicle
- Autonomous Vehicle
- Autonomous Ride-hailing

Second Choice
- Autonomous Vehicle
- Regular Vehicle
- Autonomous Vehicle
## What will you purchase? Demographic Data

### Age

<table>
<thead>
<tr>
<th>Age</th>
<th>Regular Vehicle</th>
<th>Autonomous Vehicle</th>
<th>AV Ridehailing Services</th>
</tr>
</thead>
<tbody>
<tr>
<td>29 and younger</td>
<td>43%</td>
<td>43%</td>
<td>14%</td>
</tr>
<tr>
<td>30 to 64</td>
<td>54%</td>
<td>34%</td>
<td>12%</td>
</tr>
<tr>
<td>65 and older</td>
<td>64%</td>
<td>24%</td>
<td>12%</td>
</tr>
</tbody>
</table>

### Educational Background

<table>
<thead>
<tr>
<th>Educational Background</th>
<th>Regular Vehicle</th>
<th>Autonomous Vehicle</th>
<th>AV Ridehailing Services</th>
</tr>
</thead>
<tbody>
<tr>
<td>Completed graduate degree(s)</td>
<td>52%</td>
<td>36%</td>
<td>12%</td>
</tr>
<tr>
<td>Bachelor's degree(s) or some graduate school</td>
<td>54%</td>
<td>34%</td>
<td>12%</td>
</tr>
<tr>
<td>Some college or technical school</td>
<td>57%</td>
<td>30%</td>
<td>13%</td>
</tr>
<tr>
<td>Completed high school or GED</td>
<td>58%</td>
<td>27%</td>
<td>15%</td>
</tr>
<tr>
<td>Some grade/high school</td>
<td>34%</td>
<td>48%</td>
<td>18%</td>
</tr>
</tbody>
</table>
What will you purchase? *Demographic Data*

**Male**
- Regular Vehicle: 51%
- Autonomous Vehicle: 37%
- AV Ridehailing Services: 12%

**Female**
- Regular Vehicle: 57%
- Autonomous Vehicle: 31%
- AV Ridehailing Services: 12%
What will you purchase? *Attitudinal Data*

**Happy Commuter**
- Regular Vehicle: 57%
- Autonomous Vehicle: 30%
- AV Ridehailing Services: 13%

**Anti-Tech**
- Regular Vehicle: 63%
- Autonomous Vehicle: 25%
- AV Ridehailing Services: 12%

**Pro-Environment**
- Regular Vehicle: 49%
- Autonomous Vehicle: 36%
- AV Ridehailing Services: 15%
What will you purchase? 

Willingness to Pay

<table>
<thead>
<tr>
<th>Anti-Tech</th>
<th>Solo Unitasker</th>
<th>Contemporary Efficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>RV costs more</td>
<td>RV costs more</td>
<td>RV costs more</td>
</tr>
<tr>
<td>70%</td>
<td>58%</td>
<td>56%</td>
</tr>
<tr>
<td>Same cost</td>
<td>Same cost</td>
<td>Same cost</td>
</tr>
<tr>
<td>72%</td>
<td>61%</td>
<td>62%</td>
</tr>
<tr>
<td>AV costs more</td>
<td>AV costs more</td>
<td>AV costs more</td>
</tr>
<tr>
<td>76%</td>
<td>68%</td>
<td>65%</td>
</tr>
</tbody>
</table>

Cost per month

Choose Regular Vehicle

Choose Autonomous Vehicle
Survey Question: When will you purchase?

When do you expect to buy an AV?

- I will be one of the first people to buy an AV.
- I will eventually buy an AV, but only after these vehicles are in common use.
- I will never buy an AV.
When will you purchase?

**Austin**
- I will never buy an AV. 27%
- I will be one of the first people to buy an AV. 5%
- I will eventually buy an AV, but only after these vehicles are in common use. 68%

**Phoenix**
- I will be one of the first people to buy an AV. 2%
- I will never buy an AV. 54%
- I will eventually buy an AV, but only after these vehicles are in common use. 44%

**Tampa**
- I will never buy an AV. 43%
- I will be one of the first people to buy an AV. 2%
- I will eventually buy an AV, but only after these vehicles are in common use. 55%

**Atlanta**
- I will be one of the first people to buy an AV. 3%
- I will never buy an AV. 36%
- I will eventually buy an AV, but only after these vehicles are in common use. 61%
I will be one of the first people to buy an AV. 3%

I will never buy an AV. 36%

I will eventually buy an AV, but only after these vehicles are in common use. 61%
When will you purchase?

**Demographic Data**

**Male**
- I will be one of the first people to buy an AV. 6%
- I will eventually buy an AV, but only after these vehicles are in common use 63%
- I will never buy an AV. 31%

**Female**
- I will be one of the first people to buy an AV. 2%
- I will eventually buy an AV, but only after these vehicles are in common use 59%
- I will never buy an AV. 39%
When will you purchase?

**Demographic Data**

### Age

- **29 and younger**: 5% will be one of the first to buy, 71% will eventually buy, 24% will never buy.
- **30 to 64**: 4% will be first, 62% will eventually, 34% will never.
- **65 and older**: 2% will be first, 49% will eventually, 49% will never.

### Educational Background

- **Completed graduate degree(s)**: 4% will be first, 64% will eventually, 32% will never.
- **Bachelor's degree(s) or some graduate school**: 3% will be first, 63% will eventually, 34% will never.
- **Some college or technical school**: 3% will be first, 56% will eventually, 41% will never.
- **Completed high school or GED**: 3% will be first, 52% will eventually, 45% will never.
- **Some grade/high school**: 4% will be first, 76% will eventually, 20% will never.

- **I will be one of the first people to buy an AV.**
- **I will eventually buy an AV, but only after these vehicles are in common use.**
- **I will never buy an AV.**
When will you purchase? **Attitudinal Data**

**Happy Commuter**
- I will be one of the first people to buy an AV. 3%
- I will never buy an AV. 40%
- I will eventually buy an AV, but only after these vehicles are in common use 57%

**Anti-Tech**
- I will never buy an AV. 47%
- I will eventually buy an AV, but only after these vehicles are in common use 52%
- I will be one of the first people to buy an AV. 1%

**Pro-Environment**
- I will be one of the first people to buy an AV. 6%
- I will eventually buy an AV, but only after these vehicles are in common use 61%
- I will never buy an AV. 33%
- I will eventually buy an AV, but only after these vehicles are in common use 57%

Thank you!

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A special thanks to Felipe Dias!