Project Overview and Results from the Initial Phoenix Pilot Survey

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Introduction

• Transformative changes in transportation

• People’s attitudes towards and perceptions of these technologies and services need to be measured and understood

• Transportation models should account for attitudes and perceptions, adoption pathways, and adaptation mechanisms
Study Purpose

Collect a rich set of data across multiple jurisdictions that includes information about people’s travel behavior, and attitudes towards and perceptions of advanced transportation technologies and mobility options such as AVs, MaaS, Micromobility, and Shared Modes.
TOMNET D-STOP Transformative Technologies in Transportation Survey (T^4 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>Sample Size</td>
<td>1,027</td>
<td>944</td>
<td>1,127</td>
<td>260</td>
<td>3,358</td>
</tr>
<tr>
<td>%</td>
<td>30.6%</td>
<td>28.1%</td>
<td>33.6%</td>
<td>7.8%</td>
<td>100%</td>
</tr>
</tbody>
</table>
Comprehensive 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
Age Distribution - Weighted

- Phoenix (N=1027)
- Atlanta (N=945)
- Tampa (N=261)
- Austin (N=1126)
- Total (N=3359)

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Phoenix</th>
<th>Atlanta</th>
<th>Tampa</th>
<th>Austin</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>18-30 years</td>
<td>26%</td>
<td>19%</td>
<td>15%</td>
<td>17%</td>
<td>25%</td>
</tr>
<tr>
<td>31-40 years</td>
<td>19%</td>
<td>19%</td>
<td>16%</td>
<td>19%</td>
<td>18%</td>
</tr>
<tr>
<td>41-50 years</td>
<td>19%</td>
<td>14%</td>
<td>18%</td>
<td>13%</td>
<td>16%</td>
</tr>
<tr>
<td>51-60 years</td>
<td>14%</td>
<td>10%</td>
<td>9%</td>
<td>9%</td>
<td>7%</td>
</tr>
<tr>
<td>61-70 years</td>
<td>14%</td>
<td>10%</td>
<td>9%</td>
<td>13%</td>
<td>10%</td>
</tr>
<tr>
<td>71+ years</td>
<td>14%</td>
<td>13%</td>
<td>7%</td>
<td>14%</td>
<td>13%</td>
</tr>
</tbody>
</table>

Legend:
- 18-30 years
- 31-40 years
- 41-50 years
- 51-60 years
- 61-70 years
- 71+ years
Highest Education Attained - Weighted

- Some grade/high school
- Some college or technical school
- Bachelor's degree(s) or some graduate school
- Completed high school or GED
- Completed graduate degree(s)
Employment/Student Status - Weighted

- A worker (part-time or full-time)
- Both a worker and a student
- A student (part-time or full-time)
- Neither a worker nor a student

<table>
<thead>
<tr>
<th>Location</th>
<th>A worker</th>
<th>Both a worker and a student</th>
<th>A student</th>
<th>Neither a worker nor a student</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phoenix (N=1026)</td>
<td>52% 8% 6% 33%</td>
<td>28% 9% 8% 20%</td>
<td>4% 10% 10% 12%</td>
<td>4% 20% 14% 19%</td>
</tr>
<tr>
<td>Atlanta (N=944)</td>
<td>54% 9% 8% 33%</td>
<td>28% 9% 8% 20%</td>
<td>4% 10% 10% 12%</td>
<td>4% 20% 14% 19%</td>
</tr>
<tr>
<td>Tampa (N=261)</td>
<td>62% 7% 2% 33%</td>
<td>28% 9% 8% 20%</td>
<td>4% 10% 10% 12%</td>
<td>4% 20% 14% 19%</td>
</tr>
<tr>
<td>Austin (N=1128)</td>
<td>55% 12% 14% 19%</td>
<td>28% 9% 8% 20%</td>
<td>4% 10% 10% 12%</td>
<td>4% 20% 14% 19%</td>
</tr>
<tr>
<td>Total (N=3359)</td>
<td>55% 10% 9% 27%</td>
<td>28% 9% 8% 20%</td>
<td>4% 10% 10% 12%</td>
<td>4% 20% 14% 19%</td>
</tr>
</tbody>
</table>
Household Income - Weighted

- Missing
- Less than $25,000
- $25,000 to $49,999
- $50,000 to $74,999
- $75,000 to $99,999
- $100,000 to $149,999
- $150,000 to $249,999
- $250,000 or more

Phoenix (N=1028)
- Missing: 7%
- Less than $25,000: 14%
- $25,000 to $49,999: 18%
- $50,000 to $74,999: 18%
- $75,000 to $99,999: 18%
- $100,000 to $149,999: 11%
- $150,000 to $249,999: 6%
- $250,000 or more: 2%

Atlanta (N=944)
- Missing: 3%
- Less than $25,000: 17%
- $25,000 to $49,999: 17%
- $50,000 to $74,999: 13%
- $75,000 to $99,999: 10%
- $100,000 to $149,999: 13%
- $150,000 to $249,999: 6%
- $250,000 or more: 5%

Tampa (N=262)
- Missing: 0%
- Less than $25,000: 13%
- $25,000 to $49,999: 15%
- $50,000 to $74,999: 16%
- $75,000 to $99,999: 19%
- $100,000 to $149,999: 15%
- $150,000 to $249,999: 4%
- $250,000 or more: 5%

Austin (N=1128)
- Missing: 0%
- Less than $25,000: 15%
- $25,000 to $49,999: 18%
- $50,000 to $74,999: 17%
- $75,000 to $99,999: 18%
- $100,000 to $149,999: 13%
- $150,000 to $249,999: 3%
- $250,000 or more: 4%

Total (N=3362)
- Missing: 0%
- Less than $25,000: 15%
- $25,000 to $49,999: 18%
- $50,000 to $74,999: 15%
- $75,000 to $99,999: 15%
- $100,000 to $149,999: 15%
- $150,000 to $249,999: 5%
- $250,000 or more: 4%
### Household Size - Weighted

<table>
<thead>
<tr>
<th>Location</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4 or more</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phoenix (N=1028)</td>
<td>21%</td>
<td>22%</td>
<td>25%</td>
<td>41%</td>
</tr>
<tr>
<td>Atlanta (N=945)</td>
<td>25%</td>
<td>32%</td>
<td>14%</td>
<td>16%</td>
</tr>
<tr>
<td>Tampa (N=260)</td>
<td>18%</td>
<td>29%</td>
<td>25%</td>
<td>29%</td>
</tr>
<tr>
<td>Austin (N=1127)</td>
<td>26%</td>
<td>25%</td>
<td>19%</td>
<td>26%</td>
</tr>
<tr>
<td>Total (N=3360)</td>
<td>24%</td>
<td>16%</td>
<td>25%</td>
<td>25%</td>
</tr>
</tbody>
</table>

- **Phoenix (N=1028)**: 21% one person, 22% two persons, 25% three persons, 41% four or more persons.
- **Atlanta (N=945)**: 25% one person, 32% two persons, 14% three persons, 16% four or more persons.
- **Tampa (N=260)**: 18% one person, 29% two persons, 25% three persons, 29% four or more persons.
- **Austin (N=1127)**: 26% one person, 25% two persons, 19% three persons, 26% four or more persons.
- **Total (N=3360)**: 24% one person, 16% two persons, 25% three persons, 25% four or more persons.
Pilot Survey Deployment

• Question: How should the survey be administered?
  • Is single mode OK?
• Test survey questionnaire
• Structure and Format
  • Phoenix Metropolitan area only
  • Fall 2018
  • Random address-based sample
  • Rewards: $10 for each of the first 100 respondents

SAMPLE SIZE: 262 responses
Objectives of Pilot Survey

• Study the impact of the recruitment/administration method on representativeness of the sample and quality of responses.

• Identify differences in attitudes between ONLINE respondents and PAPER-MAIL respondents.

• If we adopt a pure online survey methodology, are we missing key sub-populations in terms of their attitudes?

• Not as concerned about socio-economic differences because we can potentially correct for those through post-weighting procedures.
Pilot Survey Data Collection

Mail recruitment
- 2,500 invitations
- 126 responses
- Provided with a postage-paid business reply envelope in the mail invitation

Paper survey booklet

Email recruitment
- 3,500 invitations
- 49 responses
- 87 responses

Online survey
- Powered by Qualtrics, anonymous personalized link, protected by access code, for those invited by mail

3,500 invitations
- 49 responses
- 87 responses
Comparison Between Recruitment/Survey Methods

Demographic and Socio-economic characteristics
Age Distribution

- **Mail - Paper (N=126)**
  - Missing: 6%
  - 18-29 years: 13%
  - 30-39 years: 10%
  - 40-49 years: 12%
  - 50-59 years: 14%
  - 60-69 years: 22%
  - 70+ years: 29%

- **Mail - Online (N=49)**
  - Missing: 3%
  - 18-29 years: 27%
  - 30-39 years: 14%
  - 40-49 years: 24%
  - 50-59 years: 16%
  - 60-69 years: 18%
  - 70+ years: 17%

- **Email - Online (N=87)**
  - Missing: 1%
  - 18-29 years: 13%
  - 30-39 years: 16%
  - 40-49 years: 14%
  - 50-59 years: 14%
  - 60-69 years: 14%
  - 70+ years: 22%

- **Maricopa County 18 years and above (N=3.3 million)**
  - Missing: 1%
  - 18-29 years: 14%
  - 30-39 years: 14%
  - 40-49 years: 18%
  - 50-59 years: 18%
  - 60-69 years: 17%
  - 70+ years: 22%
Gender Distribution

- **Mail - Paper (N=126)**
  - Male: 36%
  - Female: 63%
  - Other/Gender not reported: 1%

- **Mail - Online (N=49)**
  - Male: 41%
  - Female: 59%
  - Other/Gender not reported: 2%

- **Email - Online (N=87)**
  - Male: 46%
  - Female: 52%
  - Other/Gender not reported: 2%

- **Maricopa County 18 years and above (N=3.3 million)**
  - Male: 49%
  - Female: 51%
Highest Education Attained

- Some grade school or completed high school:
  - Mail - Paper (N=126): 18%
  - Mail - Online (N=49): 4%
  - Email - Online (N=87): 13%
  - Maricopa County 18 years and above (N=3.3 million): 37%

- Bachelor's degree(s) or some graduate school:
  - Mail - Paper (N=126): 31%
  - Mail - Online (N=49): 31%
  - Email - Online (N=87): 28%

- Some college/technical school:
  - Mail - Paper (N=126): 26%
  - Mail - Online (N=49): 31%
  - Email - Online (N=87): 28%

- Completed graduate degree(s):
  - Mail - Paper (N=126): 25%
  - Mail - Online (N=49): 35%
  - Email - Online (N=87): 32%
  - Maricopa County 18 years and above (N=3.3 million): 10%
Household Income

- **Mail - Paper (N=126)**
  - Missing: 4%
  - Less than $25,000: 16%
  - $25,000 to $49,999: 21%
  - $50,000 to $74,999: 17%
  - $75,000 to $99,999: 16%
  - $100,000 to $149,999: 12%
  - $150,000 or more: 14%

- **Mail - Online (N=49)**
  - Missing: 6%
  - Less than $25,000: 20%
  - $25,000 to $49,999: 24%
  - $50,000 to $74,999: 16%
  - $75,000 to $99,999: 16%
  - $100,000 to $149,999: 16%
  - $150,000 or more: 14%

- **Email - Online (N=87)**
  - Missing: 6%
  - Less than $25,000: 18%
  - $25,000 to $49,999: 14%
  - $50,000 to $74,999: 18%
  - $75,000 to $99,999: 16%
  - $100,000 to $149,999: 16%
  - $150,000 or more: 13%

- **Maricopa County households (N=1.5 million)**
  - Missing: 11%
  - Less than $25,000: 14%
  - $25,000 to $49,999: 13%
  - $50,000 to $74,999: 19%
  - $75,000 to $99,999: 23%
  - $100,000 to $149,999: 20%
  - $150,000 or more: 14%
Household Vehicle Ownership

- Mail - Paper (N=126):
  - No vehicles available: 5%
  - 1 vehicle available: 28%
  - 2 vehicles available: 39%
  - 3 vehicles available: 12%
  - 4 or more vehicles available: 17%

- Mail - Online (N=49):
  - No vehicles available: 2%
  - 1 vehicle available: 20%
  - 2 vehicles available: 49%
  - 3 vehicles available: 16%
  - 4 or more vehicles available: 12%

- Email - Online (N=87):
  - No vehicles available: 3%
  - 1 vehicle available: 28%
  - 2 vehicles available: 34%
  - 3 vehicles available: 23%
  - 4 or more vehicles available: 13%

- Maricopa County households (N=1.5 million):
  - No vehicles available: 6%
  - 1 vehicle available: 37%
  - 2 vehicles available: 39%
  - 3 vehicles available: 13%
  - 4 or more vehicles available: 5%
Survey Method

• Regardless of survey administration method, respondent sample will be biased

• As expected, Paper-Mail respondents are (dis)proportionately **women, older, less educated, and lower income** than the rest of the sample

• But going with one survey recruitment/administration method may be fine from a **demographics** perspective – we can **weight**
Comparison Between Recruitment/Survey Methods

General Attitudes
I am committed to using less polluting means of transportation as much as possible.
I am committed to using less polluting means of transportation as much as possible. >60 year-old Subsample

Mail - Paper (N=69)
- Strongly disagree: 6%
- Disagree: 29%
- Neutral: 39%
- Agree: 23%
- Strongly agree: 3%

Mail - Online (N=16)
- Strongly disagree: 6%
- Disagree: 25%
- Neutral: 63%
- Agree: 6%
- Strongly agree: 4%

Email - Online (N=26)
- Strongly disagree: 12%
- Disagree: 27%
- Neutral: 42%
- Agree: 15%
- Strongly agree: 4%
Learning how to use new technologies is often frustrating for me.

Mail - Paper (N=126): 15% Strongly disagree, 34% Disagree, 25% Neutral, 21% Agree, 4% Strongly agree

Mail - Online (N=49): 6% Strongly disagree, 18% Disagree, 47% Neutral, 8% Agree, 2% Strongly agree

Email - Online (N=87): 2% Strongly disagree, 17% Disagree, 13% Neutral, 13% Agree, 52% Strongly agree
Learning how to use new technologies is often frustrating for me. >60 year-old Subsample

<table>
<thead>
<tr>
<th>Method</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mail - Paper (N=70)</td>
<td>17%</td>
<td>43%</td>
<td>30%</td>
<td>9%</td>
<td>1%</td>
</tr>
<tr>
<td>Mail - Online (N=16)</td>
<td>6%</td>
<td>25%</td>
<td>19%</td>
<td>44%</td>
<td>4%</td>
</tr>
<tr>
<td>Email - Online (N=26)</td>
<td>4%</td>
<td>19%</td>
<td>23%</td>
<td>38%</td>
<td>15%</td>
</tr>
</tbody>
</table>
I prefer to shop in a store in person rather than online.

<table>
<thead>
<tr>
<th></th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mail - Paper</td>
<td>1%</td>
<td>12%</td>
<td>27%</td>
<td>21%</td>
<td>39%</td>
</tr>
<tr>
<td>Mail - Online</td>
<td>4%</td>
<td>20%</td>
<td>35%</td>
<td>33%</td>
<td>8%</td>
</tr>
<tr>
<td>Email - Online</td>
<td>5%</td>
<td>21%</td>
<td>32%</td>
<td>29%</td>
<td>14%</td>
</tr>
</tbody>
</table>
I prefer to shop in a store in person rather than online.

>60 year-old Subsample

**Make a selection:**

- **Strongly disagree**
- **Disagree**
- **Neutral**
- **Agree**
- **Strongly agree**

<table>
<thead>
<tr>
<th>Email Method</th>
<th>N</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mail - Paper</td>
<td>70</td>
<td>9%</td>
<td>26%</td>
<td>43%</td>
<td>23%</td>
<td>2%</td>
</tr>
<tr>
<td>Mail - Online</td>
<td>16</td>
<td>4%</td>
<td>25%</td>
<td>50%</td>
<td>19%</td>
<td>1%</td>
</tr>
<tr>
<td>Email - Online</td>
<td>26</td>
<td>4%</td>
<td>25%</td>
<td>50%</td>
<td>23%</td>
<td>6%</td>
</tr>
</tbody>
</table>
Trends in Attitudes

People responding using different survey modes differ with respect to their attitudes and lifestyle preferences, even after controlling for a key demographic variable.
Comparison Between Recruitment/Survey Methods

Emerging Mobility Options
Familiarity and Frequency of Use of Ridehailing Services

<table>
<thead>
<tr>
<th></th>
<th>Mail - Paper (N=119)</th>
<th>Mail - Online (N=49)</th>
<th>Email - Online (N=87)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not familiar with it</td>
<td>5%</td>
<td>6%</td>
<td>1%</td>
</tr>
<tr>
<td>Familiar, but not a current user</td>
<td>8%</td>
<td>18%</td>
<td>13%</td>
</tr>
<tr>
<td>Use it less than once a month</td>
<td>18%</td>
<td>29%</td>
<td>24%</td>
</tr>
<tr>
<td>Use it monthly</td>
<td>55%</td>
<td>41%</td>
<td>48%</td>
</tr>
<tr>
<td>Use it weekly</td>
<td>13%</td>
<td>6%</td>
<td>14%</td>
</tr>
</tbody>
</table>

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
Familiarity and Frequency of Use of Private Ridehailing Services  

>60 year-old Subsample

- **Not familiar with it**
- **Familiar, but not a current user**
- **Use it less than once a month**
- **Use it monthly**
- **Use it weekly**

<table>
<thead>
<tr>
<th>Method</th>
<th>Not familiar</th>
<th>Familiar, but not a current user</th>
<th>Use it less than once a month</th>
<th>Use it monthly</th>
<th>Use it weekly</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mail - Paper (N=67)</td>
<td>3%</td>
<td>6%</td>
<td>16%</td>
<td>58%</td>
<td>16%</td>
</tr>
<tr>
<td>Mail - Online (N=16)</td>
<td>6%</td>
<td>19%</td>
<td>63%</td>
<td>13%</td>
<td>4%</td>
</tr>
<tr>
<td>Email - Online (N=26)</td>
<td>4%</td>
<td>15%</td>
<td>54%</td>
<td>27%</td>
<td>5%</td>
</tr>
</tbody>
</table>
I would ride in an AV alone or with others I know.

<table>
<thead>
<tr>
<th>Survey Type</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mail - Paper (N=116)</td>
<td>6%</td>
<td>32%</td>
<td>20%</td>
<td>28%</td>
<td>15%</td>
</tr>
<tr>
<td>Mail - Online (N=47)</td>
<td>13%</td>
<td>40%</td>
<td>13%</td>
<td>19%</td>
<td>11%</td>
</tr>
<tr>
<td>Email - Online (N=83)</td>
<td>13%</td>
<td>18%</td>
<td>17%</td>
<td>11%</td>
<td>13%</td>
</tr>
</tbody>
</table>
I would ride in an AV alone or with others I know.

>60 year-old Subsample

<table>
<thead>
<tr>
<th>Method</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mail - Paper</td>
<td>4%</td>
<td>28%</td>
<td>18%</td>
<td>29%</td>
<td>21%</td>
</tr>
<tr>
<td>Mail - Online</td>
<td>6%</td>
<td>44%</td>
<td>6%</td>
<td>25%</td>
<td>19%</td>
</tr>
<tr>
<td>Email - Online</td>
<td>4%</td>
<td>35%</td>
<td>12%</td>
<td>15%</td>
<td>4%</td>
</tr>
</tbody>
</table>

Mail - Paper (N=68)
Mail - Online (N=16)
Email - Online (N=26)
I would send an AV to pick up groceries/laundry/food orders by itself.

### Mail - Paper (N=117)
- Strongly disagree: 3%
- Disagree: 17%
- Neutral: 24%
- Agree: 26%
- Strongly agree: 29%

### Mail - Online (N=48)
- Strongly disagree: 13%
- Disagree: 27%
- Neutral: 21%
- Agree: 29%
- Strongly agree: 23%

### Email - Online (N=83)
- Strongly disagree: 7%
- Disagree: 35%
- Neutral: 23%
- Agree: 27%
- Strongly agree: 8%
I would send an AV to pick up groceries/laundry/food orders by itself. >60 year-old Subsample

Mail - Paper (N=68):
- Strongly disagree: 19%
- Disagree: 21%
- Neutral: 40%
- Agree: 21%
- Strongly agree: 6%

Mail - Online (N=16):
- Strongly disagree: 19%
- Disagree: 25%
- Neutral: 31%
- Agree: 35%
- Strongly agree: 35%

Email - Online (N=26):
- Strongly disagree: 12%
- Disagree: 35%
- Neutral: 35%
- Agree: 19%
- Strongly agree: 19%
I would send an AV to pick up groceries/laundry/food orders by itself. **College Educated Subsample**

Mail - Paper (N=70):
- Strongly disagree: 13%
- Disagree: 26%
- Neutral: 24%
- Agree: 34%
- Strongly agree: 0%

Mail - Online (N=30):
- Strongly disagree: 13%
- Disagree: 30%
- Neutral: 13%
- Agree: 33%
- Strongly agree: 10%

Email - Online (N=47):
- Strongly disagree: 9%
- Disagree: 30%
- Neutral: 30%
- Agree: 28%
- Strongly agree: 10%
Conclusions

• Those who answer survey using different modes have different characteristics and attitudes

• Differences in demographics can be handled through weighting

• Differences in attitudes across survey modes appear to persist even after controlling for a key demographic (age)
  • But will differences fade once *all demographics are controlled, thus rendering choice of survey method/mode largely irrelevant*?
  • Ongoing research to quantify/model residual influence of survey mode

• In the end, we adopted **Mail – Online** and **Email – Online** for full deployment in the interest of efficiency and resource constraints
Thank you!

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