EXAMINING FUTURE AUTOMATED VEHICLE USAGE
A FOCUS ON THE ROLE OF RIDE HAILING

by

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INTRODUCTION

Self-driving cars are being tested on public roads and may be generally available for consumers within the next few years. A self-driving vehicle is one in which there is no human driver and refers to the higher levels of vehicle automation (see Table 1). A completely self-driving vehicle does not require a steering wheel, accelerator, or brake pedal. All driving functionality is handled through onboard computers, software, maps, and radar and light detection and ranging (LIDAR) sensors. Self-driving cars can be further distinguished as being connected or not, indicating whether they can communicate with other vehicles and/or infrastructure.

Table 1. Levels of Self-Driving Capability

Level	Description
Level 0	No automation.
Level 1	Automated technologies assist driving.
Level 2	Automated technologies control steering, acceleration, or braking.
Level 3	Automated technologies control driving but human is expected to take over at any moment.
Level 4	Vehicle is self-driving in some situations but not all.
Level 5	Vehicle is completely self-driving in every situation.

The technology is coming, but what will it mean for society? Will self-driving cars eliminate traffic fatalities? Will they substantially reduce personal car ownership? Will they increase congestion? Will they reshape urban and suburban development? Today, the future benefits and costs of self-driving vehicles are uncertain. More information is needed to fully assess how self-driving vehicles will impact drivers, the economy, equity, the environment, and the overarching concern—safety. The first known death of a pedestrian struck by a self-driving car on a public road happened in March 2018 (Wren 2018). What impact will this fatality have on public acceptance and adoption?

The likely impacts of self-driving vehicles depend on how and when these vehicles will be adopted and used. Early adopters may shed light on future adoption patterns. An early adopter is a person who starts using a technology as soon as it becomes available. A 2016 study conducted by the Texas A&M Transportation Institute (TTI) determined that early adopters of technology, in general, are expected to be early adopters of self-driving vehicles (Zmud et al. 2016). Another study found that ride-hailing users are significantly more likely than non-ride-hailing users to prefer using ride-hailing services such as taxis, Uber, or Lyft as self-driving vehicles (Kelley Blue Book and Cox Automotive 2016). Considering current ride-hailing users as potential early adopters of mobility alternatives, research among current ride-hailing users could inform acceptance and likely use of self-driving vehicles. In addition, research has indicated that experience, defined as practical contact, with new transportation options tends to promote acceptance. In a survey of public opinion data on road pricing and toll roads, Zmud and Arce (2008) found that the public learns from experience. When the opportunity to use a tolled facility already exists, public support is higher than when it is simply a possibility for the future. Therefore, the

strength of the relationship between ride-hailing usage and acceptance/likely usage of self-driving vehicle is expected to increase with experience in using a ride-hailing service.

This premise was extended in the current study, which examined the likelihood that early adopters of mobility technology like ride hailing would also be early adopters of self-driving vehicles. In this respect, this study primarily focused on examining the following two questions:

- Are current ride-hailing users more likely to use self-driving vehicles than non-users?
- Among ride-hailing users, is acceptance/likely usage increase with ride-hailing experience?

METHODOLOGY

Benefiting from the earlier studies of self-driving vehicles, this study included a two-step process. First, researchers conducted an online survey to examine the main hypotheses of the study. Upon the completion of the online survey, a small number of follow-up qualitative interviews were conducted by telephone to probe about surprising or seemingly inconsistent responses. The Institutional Review Board of Texas A&M University approved the research protocol.

Online Survey

The survey took place from December 2017 to January 2018 and used questions that were consistent with TTI surveys conducted in 2015 and 2016 (that also helped to vet the questions in the current survey).

Survey Design

Researchers designed the online survey to collect information for two distinct segments of the population:

- Ride-hailing users.
- Non-ride-hailing users.

Two separate survey instruments were developed to use separate sample frames to recruit participants for each population segment. The survey instrument was designed first for ride-hailing users, and then modifications were made for the non-ride-hailing user survey instrument. Once the instruments were finalized and approved, they were programmed into Qualtrics. Prior to fielding the survey, project team members were also given extensive opportunity to test the online survey. This proved invaluable in not only identifying areas within the survey that needed further attention but also allowing project team members to have a full user experience. The final survey instrument for ride hailing is given in Appendix A, and the final survey instrument for non-ride hailing is given in Appendix B.

The final online survey was administered in English to individuals aged 18 or over who resided in one of the following four cities: Boston, Las Vegas, Phoenix, and San Francisco/Silicon Valley. Geographic quotas were implemented to obtain an equal distribution of surveys across the four cities. The four cities were selected because tests of self-driving vehicles are taking place on their public roads, increasing the likely awareness of self-driving vehicles. A video depicting the technology was also embedded in the online survey to raise knowledge levels and increase answer reliability.

Survey Implementation

The ride-hailing survey sampled current ride-hailing users through Lyft's database. The non-ride-hailing survey sampled non-ride-hailing users from the ResearchNow online panel. A non-ride-hailing user was defined as someone who had never used ride-hailing services. Lyft and ResearchNow provided small incentives to ride-hailing users and non-ride-hailing users, respectively, upon completion of the survey.

The initial recruitment for the ride-hailing users started on December 13, 2017. Lyft sent the initial recruitment email to approximately 106,000 Lyft users. The survey closed December 15, 2017. During the field period, researchers received a few emails from respondents reporting issues accessing the survey. In most cases, it was determined that these recruits were using older versions of web browsers or email clients, and these issues were resolved quickly. Over the field period, more than 8,000 unique Lyft users logged in to the survey. Of these individuals, 2,504 (31 percent) met the main eligibility criteria for responding to the questions. Among these, 2,057 responded to the main question of interest for the study (i.e., intent to use self-driving vehicles and ride-sharing experience), and 2,003 responded to every question asked of them. The median survey length (for full survey completion) was 10.6 minutes.

The non-ride-hailing portion of the survey was fielded from December 14, 2017, to January 13, 2018. While 3,588 individuals logged into the survey, 1,384 (39 percent) met the main eligibility criteria for responding to the questions. Among these, 1,218 responded to the main question of interest, and 1,206 responded to every question asked of them. The median survey length (for full survey completion) was 9.2 minutes. Figure 1 presents a summary of survey completion time for non-ride-hailing users.

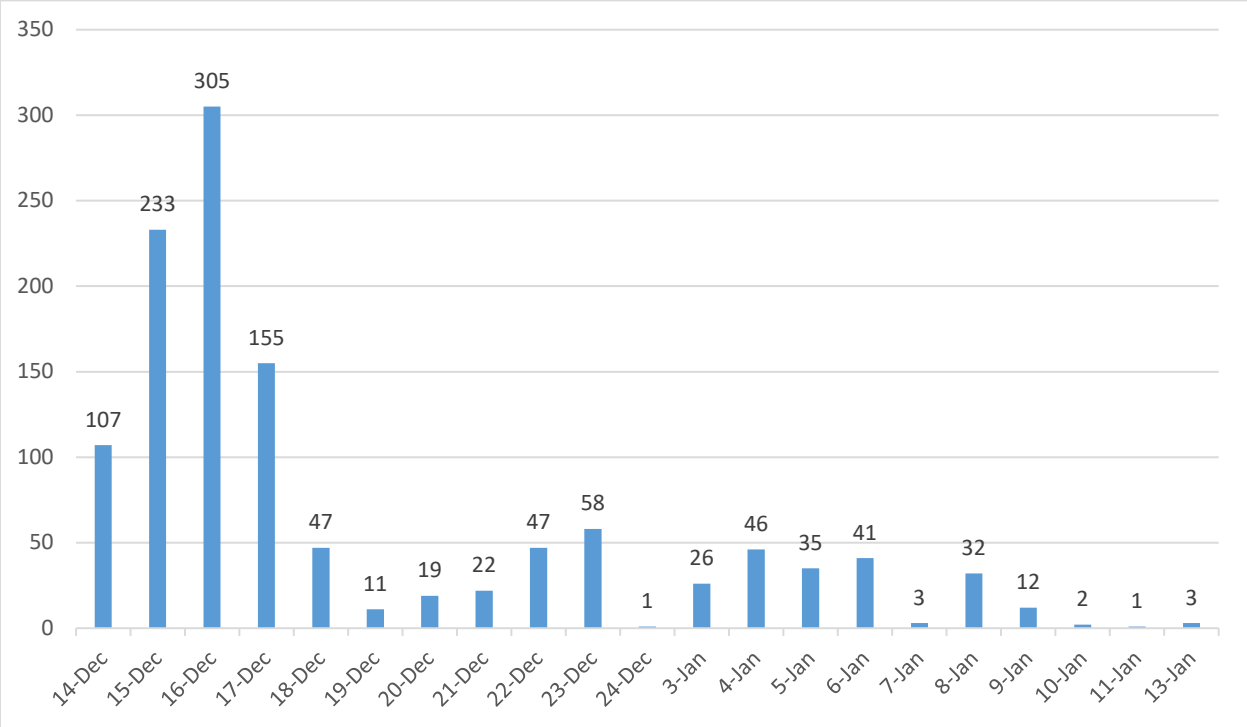


Figure 1. Non-Ride-Hailing User Survey Completion Time

Follow-Up Interviews

At the end of the online survey, respondents were asked if they would be willing to participate in a qualitative telephone interview on future travel behaviors, with an additional incentive. Those interested in a follow-up interview were asked to provide contact information in the online survey but were notified that they may or may not be selected for the interview.

In total, almost half of the respondents indicated willingness to participate in a follow-up interview. Based on the responses to the online survey, researchers identified six distinct groups to probe on surprising or seemingly inconsistent responses:

- Group 1: respondents who reside in Phoenix and indicate unwillingness to use the ride-hailing pooling option of self-driving.
- Group 2: respondents who are unlikely to use a self-driving vehicle of any type (i.e., privately owned vehicle, car-sharing service or ride-hailing service).
- Group 3: respondents who are likely to use a self-driving vehicle but only as a privately owned vehicle.
- Group 4: respondents who are likely to use a self-driving vehicle but only as a ride-hailing service.
- Group 5: respondents who have a car-sharing membership but are not likely to use a self-driving vehicle in the form of car sharing (instead likely to use only ride hailing or a privately owned vehicle).
- Group 6: respondents who have a very high income (>250,000) and are likely to use a self-driving vehicle as pooled ride hailing.

Initially, researchers desired to complete 25 interviews (four to five per group). To reach this number, 25 randomly selected people were identified for contact. Several calls were made at different times and days to schedule an interview. If researchers could not reach the respondents after several attempts, another random selection was made until the desired number of participants was contacted and scheduled for an interview. For some groups, the initial sample was very limited, so the same people were tried again. The interview scheduling process ended once researchers scheduled 25 interviews. Among the scheduled interviews, 15 were conducted. The remaining 10 interviews were unable to be completed since respondents either did not pick up the phone at the scheduled times or declined to conduct the interview. Table 2 presents a summary of the interview scheduling process.

Table 2. Follow-Up Telephone Interview Scheduling

Group ID	Number of Respondents Who Met the Criteria	Number of Respondents Selected to Be Called	Number of Total Calls	Number of Interviews Scheduled	Number of Interviews Conducted
1	109	30	39	5	2
2	268	20	34	6	4
3	25	24	38	5	2
4	111	29	58	5	4
5	5	5	19	2	1
6	6	6	25	2	2
Total	**524**	**114**	**213**	**25**	**15**

The interviews were conducted from February 26, 2018, to March 8, 2018. Questions concerned the following areas:

- Reasons for intent or no intent to use self-driving vehicles through various platforms (i.e. types).
- Interest in and reasons for using self-driving vehicles through a fleet of low-speed, fully automated, shared vehicles that can serve multiple persons at one time (like carpooling or micro-transit).
- Perceptions on the safety of self-driving vehicles and trust in a specific self-driving technology.
- Financial or cost considerations and data privacy concerns of self-driving vehicles by different types.
- In the case of self-driving vehicle use, impact on number of vehicles owned by the household and frequency of travel.

Upon completion of interviews, a $10 electronic gift card was sent to the respondents (one respondent declined the gift card). Upon approval from Lyft, unused gift cards were donated to non-profit/charity, including Habitat for Humanity, National Park Foundation and World of Children.

Analysis

Upon the completion of data collection, researchers conducted checks to ensure that the final analytical dataset was logical and free of error. Once the analytical datasets and data preparation were completed, researchers conducted several bivariate and univariate descriptive analyses to characterize the data profile with a focus on intent to use self-driving vehicles.

Next, self-driving acceptance (or intent to use) choice models were developed to explore the factors influencing the acceptance and likely usage of self-driving vehicles among both ride-hailing users and non-ride-hailing users. Different variable specifications and functional forms of variables were examined during model development. The final models' specifications were based on statistical fit and significance as well as intuitive considerations. The final models included a few variables that were not highly statistically significant; these variables were kept in the models for their potential to provide guidance in future studies. All other variables were statistically significant at the standard 0.05 level of significance. The final model results indicate a good model fit and a statistically significant chi-square statistic ($p < 0.05$).

Note that the sample used for analyses was not based on survey completion, maximizing the utility of the dataset by making use of partial cases whenever appropriate. That is, respondents might not have answered all questions (except the qualifying criteria of age and study area). However, given the focus of the study, respondents who did not respond to the questions that were used to define their intent to use self-driving vehicles and their level of ride-hailing experience were removed from the analysis sample, as described in the previous section.

Appendix A and Appendix B present the frequencies of survey completion for ride-hailing users and non-ride-hailing users, respectively.

RESULTS

This section presents the results of the analyses on intent to use self-driving vehicles. Whenever applicable, the similarities and differences that emerged across different types of self-driving vehicles in this decision-making process are discussed.

Intent to use reflects technology acceptance, which is a necessary precursor to technology adoption. Survey respondents were asked questions about their intent to use self-driving vehicles. Specifically, the survey read:

> "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 a self-driving vehicle in the form of car-sharing services like Zipcar or car2go.
> - Use a self-driving vehicle in the form of ride-sharing[1] services like Uber or Lyft."

Given the focus of the study, the analyses aimed to draw a picture of the role of ride-hailing experience, while discussing the intent to use across the survey sample of four cities. Based on 3,275 usable surveys, the distribution of survey responses by city and ride-hailing experience are provided in Table 3.

Table 3. Distribution of Online Survey Responses by City and Ride-Hailing Experience

User Type	Boston	Phoenix	Las Vegas	San Francisco/ Silicon Valley	Total
Non-ride-hailing user	316 (9.6%)	301 (9.2%)	299 (9.1%)	302 (9.3%)	1,218 (37.2%)
Ride-hailing user	526 (16.1%)	512 (15.6%)	494 (15.1%)	525 (16.0%)	2,057 (62.8%)
Total	842 (25.7%)	813 (24.8%)	793 (24.2%)	827 (25.3%)	3,275 (100%)

Intent to Use Self-Driving Vehicles

Figure 2 presents the survey results about intent to use. Overall, almost 60 percent of survey respondents stated an intent to use some form of self-driving vehicle (ranging from 56 to 64 percent across the four cities). Intent to use in this survey was higher than in TTI's 2015 survey in Austin, Texas (in which 50 percent indicated an intent to use), and in TTI's 2016 surveys in Dallas, Houston, and Waco (in which intent to use ranged from 53 to 56 percent) (Sener et al. 2017). The greater familiarity that people have with this technology today is an important factor for the increased acceptance.

Observability and trial ability are characteristics of innovations that influence their adoption. The chances of adoption are greater if consumers can observe a new technology or if they can test it. San Francisco/Silicon Valley residents have the longest history of using ride-hailing services and of

[1] The terms *ride hailing* and *ridesharing* are used interchangeably in this report.

observing self-driving vehicles. As seen in Figure 2, this is reflected in the highest percentage of respondents who expressed intent to use in the region (64 percent).

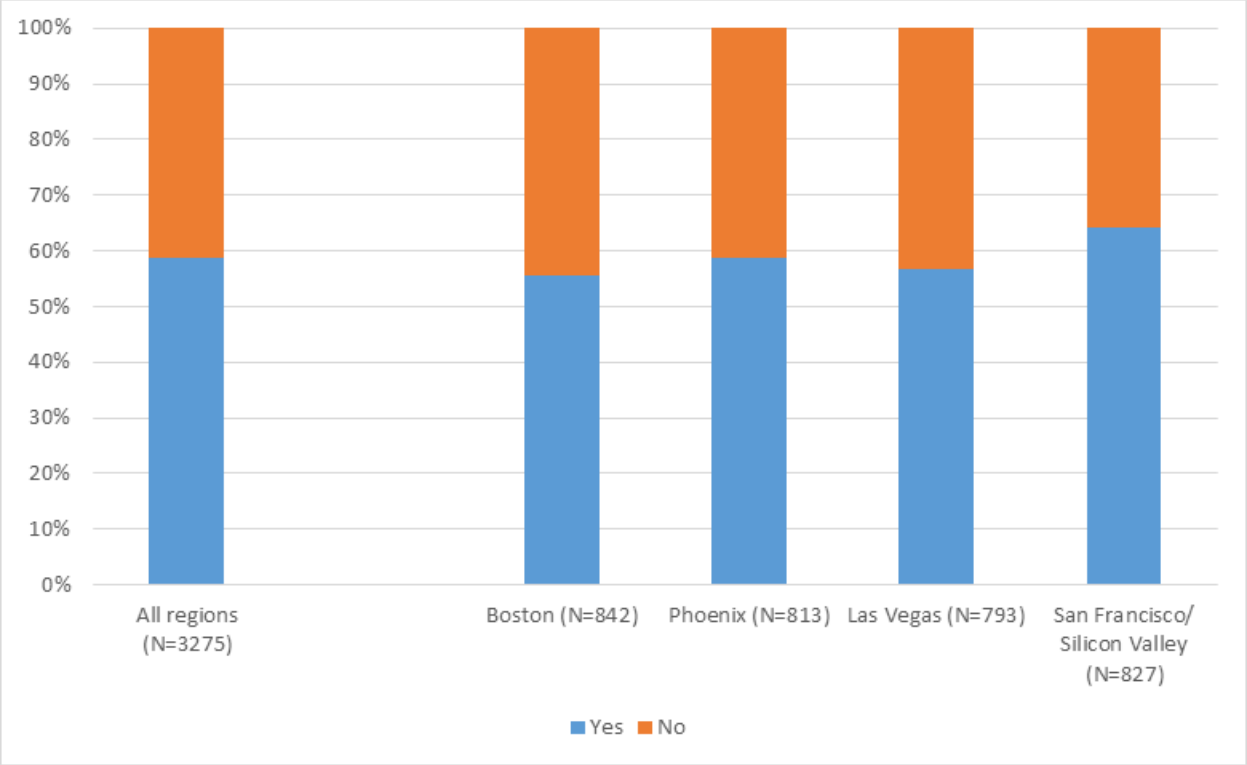


Figure 2. Intent to Use a Self-Driving Vehicle by City

Intent to Use Self-Driving Vehicles and Ride-Hailing Services

For the purpose of this analysis, respondents were grouped into three categories:

- Non-ride-hailing user (non-user).
- New or short-term ride-hailing user (new user).
- Long-term ride-hailing user (long-term user).

As mentioned previously, a non-ride-hailing user is someone who has never used ride-hailing services. A ride-hailing user is defined based on the criteria of frequency and duration of ride-hailing use:

- The frequency variable was extracted from the following survey question: "How often do you currently use ride-sharing services (e.g., Lyft and Uber)?"
- The duration variable was extracted from the following survey question: "How long have you been using ride-sharing services (e.g., Lyft and Uber)?"

Table 4 provides the eligibility criteria for being a new or short-term ride-hailing user versus a long-term ride-hailing user based on these two survey questions.

Table 4. Definition of Ride-Hailing User Type

New User versus Long-Term User of Ride-Hailing Service?		Duration of Ride-Hailing Service Use			
		Less than 3 Months	4–11 Months	1–3 Years	3+ Years
Frequency of ride-hailing service use	Rarely	New or short-term user	New or short-term user	New or short-term user	New or short-term user
	Occasionally	New or short-term user	New or short-term user	New or short-term user	Long-term user
	Frequently	New or short-term user	New or short-term user	Long-term user	Long-term user
	Very frequently	New or short-term user	New or short-term user	Long-term user	Long-term user

Figure 3 presents intent to use a self-driving vehicle by user type for the overall sample. In response to our first question, intent to use was found to be higher across ride-hailing users compared to non-users. The results also suggested that the longer people have used ride-hailing services, the more likely they are to intend to use self-driving vehicles. Specifically, acceptance was about 42% among non-users, 63% among new users, and 71% among long-term users of ride-hailing services. The higher likelihood among ride-hailing users (compared to non-users) and among long-term users (compared to new users) was observed for each city (see Figure 4). The effects were found to be more prominent in Phoenix in terms of the difference between non-users and users, and in Las Vegas in terms of the difference between new users and long-term users.

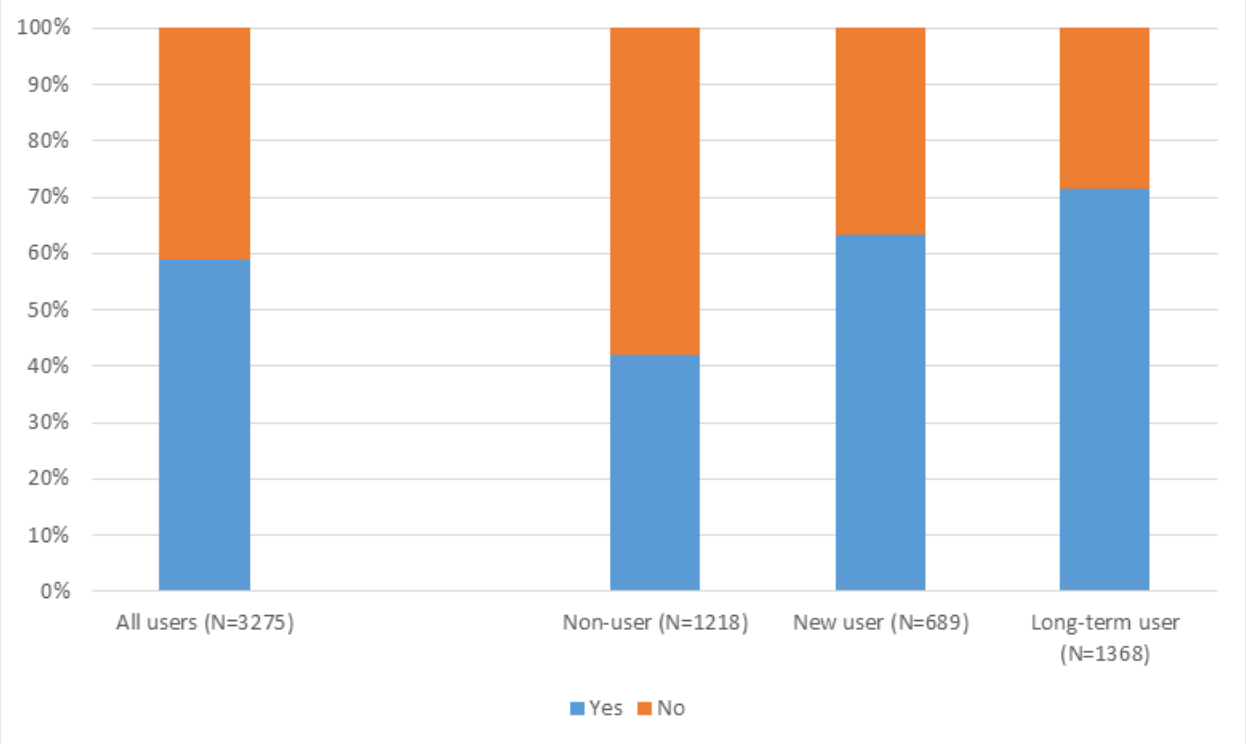


Figure 3. Intent to Use a Self-Driving Vehicle by User Type

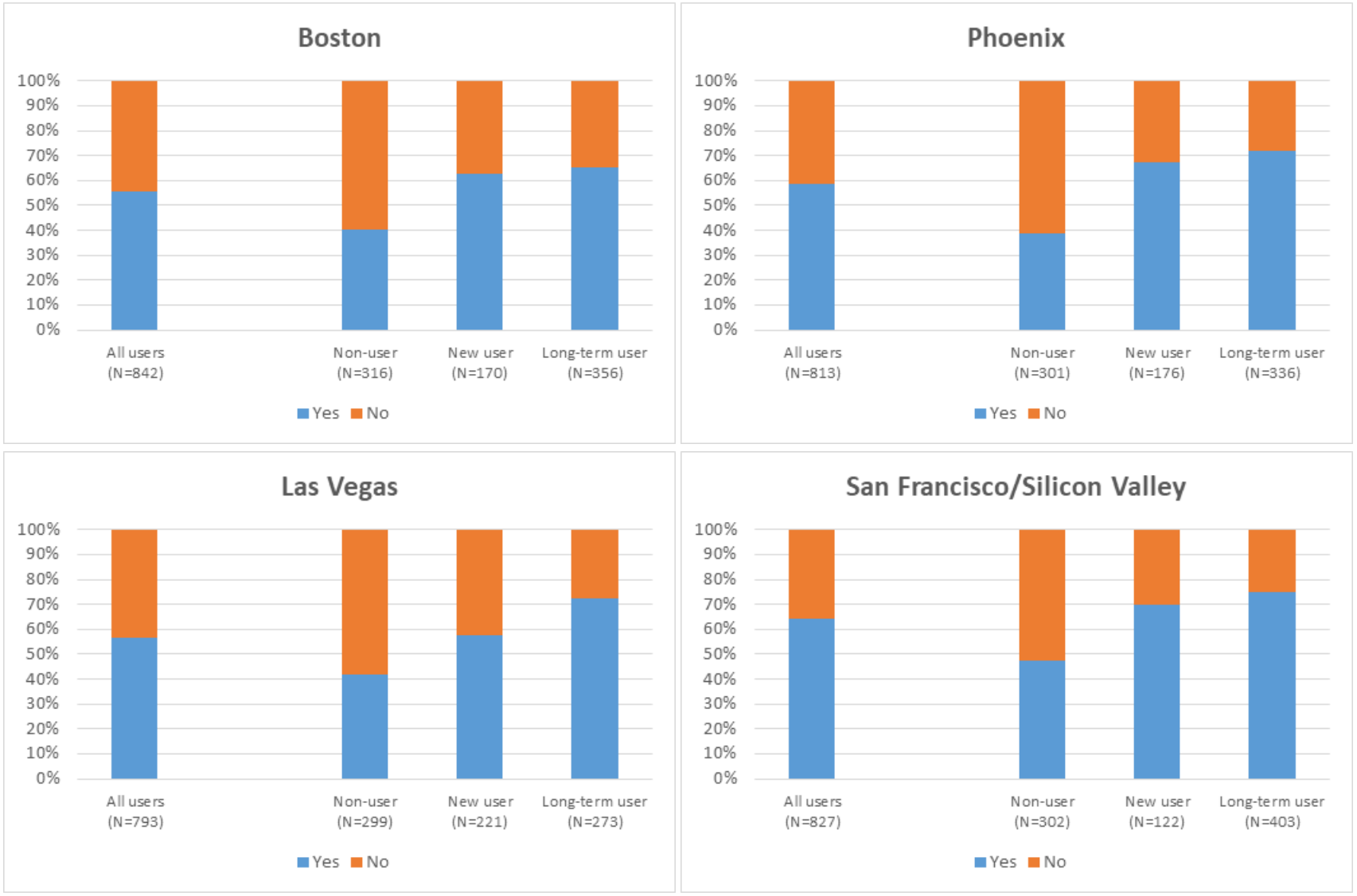


Figure 4. Intent to Use a Self-Driving Vehicle by User Type and by City

In the survey, respondents were asked about how they would classify themselves when it comes to adopting new technology. Figure 5 presents the distribution of user types at each level of technology adoption based on the likelihood of intent to use a self-driving vehicle. The results highlight the increased intent to use a self-driving vehicle with increased levels of ride-hailing user experience and technology adoption.

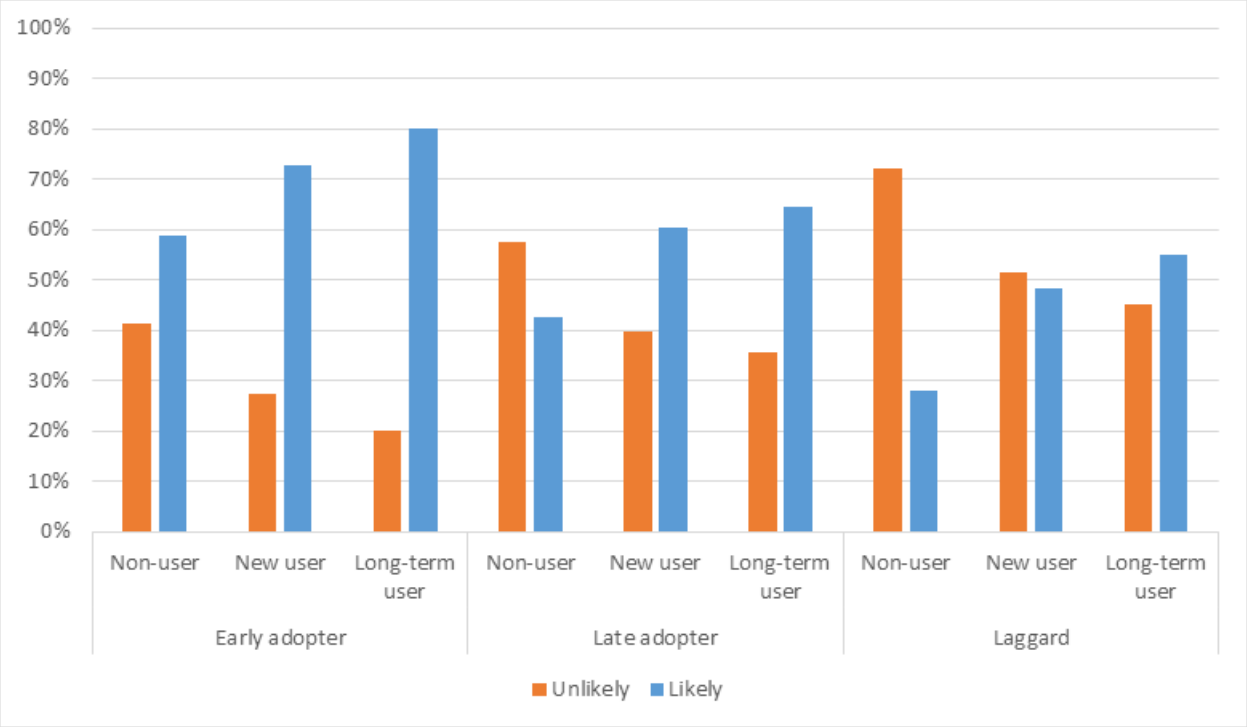


Figure 5. Intent to Use a Self-Driving Vehicle by User Type at Different Technology Adoption Levels

Intent to Use Different Types of Self-Driving Vehicles

The survey not only recognized the significance of early adoption of mobility technology but also considered that different types of self-driving vehicles matter to people in their future adoption behaviors. This study considered the use of self-driving vehicle technology via three platforms (i.e. types): as a privately owned vehicle, as a car-sharing service, and as a ride-hailing service.

Figure 6 presents the histograms of the intent to use a self-driving vehicle based on different application types, including:

- Likely to use at least one type of self-driving vehicles
- Not likely to use any type of self-driving vehicle

- Likely to use self-driving vehicles as a privately owned vehicle (regardless of other uses)
- Likely to use self-driving vehicles as a car-sharing service (regardless of other uses)
- Likely to use self-driving vehicles as a ride-hailing service (regardless of other uses)
- Likely to use all types of self-driving vehicles

- Likely to use self-driving vehicles only as a privately owned vehicle
- Likely to use self-driving vehicles only as a car-sharing service
- Likely to use self-driving vehicles only as a ride-hailing service

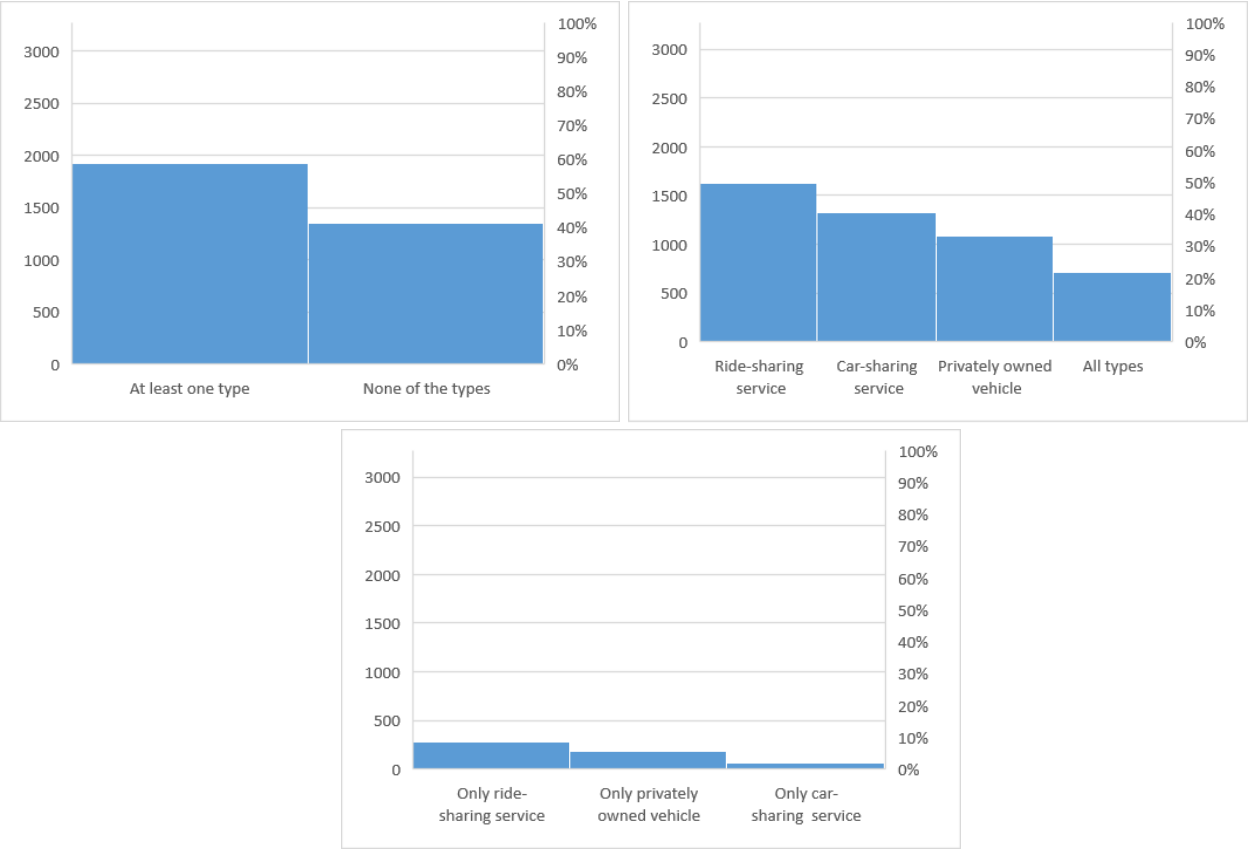


Figure 6. Intent to Use a Self-Driving Vehicle by Various Application Types

In summary:

As mentioned previously, the majority of respondents indicated their intent to use a self-driving vehicle regardless of the type. The follow-up interview findings indicated that the reasons for not intending to use a self-driving vehicle were similar across different types. In other words, the type of self-driving vehicle did not make a significant difference in the respondent's decision-making process of not intending to use self-driving technology.

Most of the respondents are likely to use more than one type of self-driving vehicle instead of only one type.

- Generally, shared mobility services were preferred to privately owned vehicles, with the majority of the respondents residing in urban areas and being current users of ride-hailing services.
- Intent to use a self-driving vehicle as a ride-hailing service had the highest share compared to the other types.

Car sharing refers to a model of car rental where vehicles are rented out for short periods of time (usually on a per-hour basis) and often intended for short trips in urban areas. In the research, car sharing was less familiar to respondents than ride hailing. Among those who were familiar with both, car sharing was perceived as less convenient and more expensive, and thus a less attractive option.

Figure 7 presents the intent to use different types of self-driving vehicles across user types. Current non-users of ride-hailing services could be expected to lean toward a preference for use of a self-driving vehicle as their own private vehicle (due to their current preference of not using a ride-hailing service). However, they expressed almost equal preference for use of a self-driving vehicle as ride-hailing service and a privately owned vehicle.

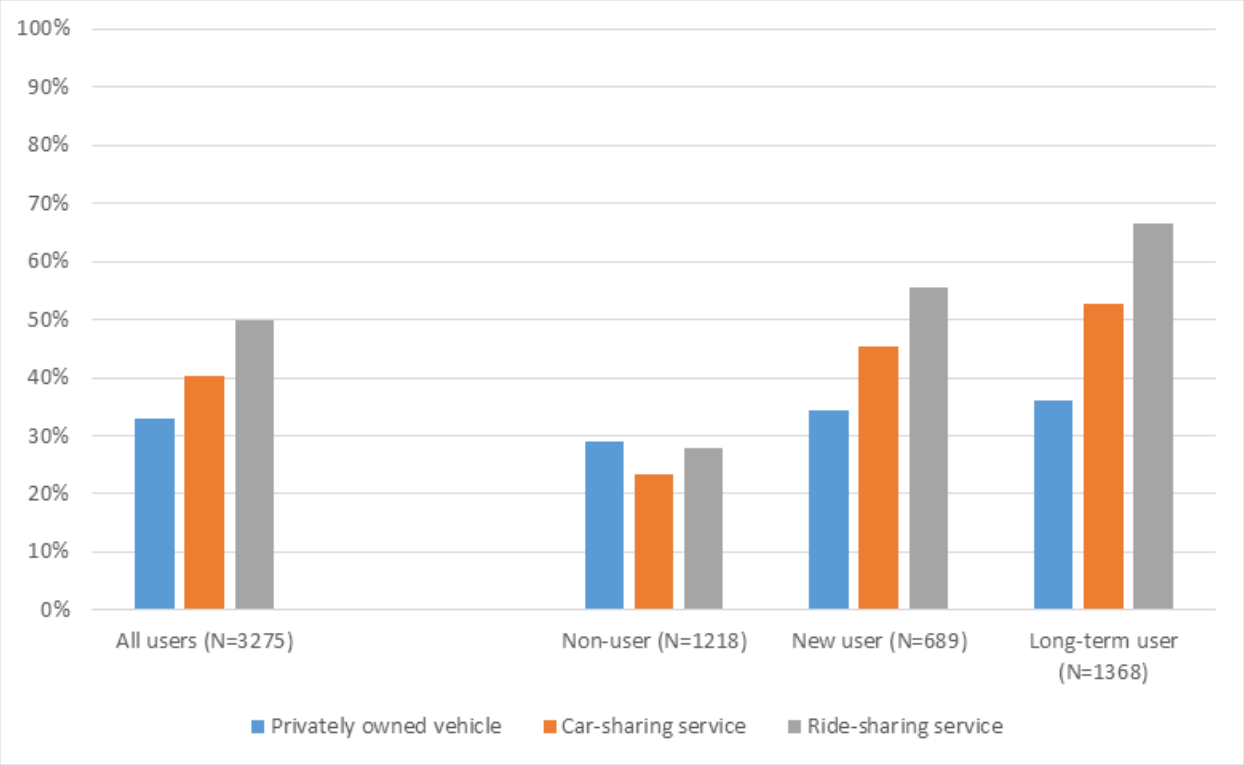


Figure 7. Intent to Use Different Types of Self-Driving Vehicles by User Type

Figure 8 extends the statistics presented in Figure 7 to each city. The results indicate similar trends. As might be expected, respondents residing in San Francisco/Silicon Valley expressed the strongest preference for using a self-driving vehicle through a ride-hailing service rather than as a privately owned vehicle.

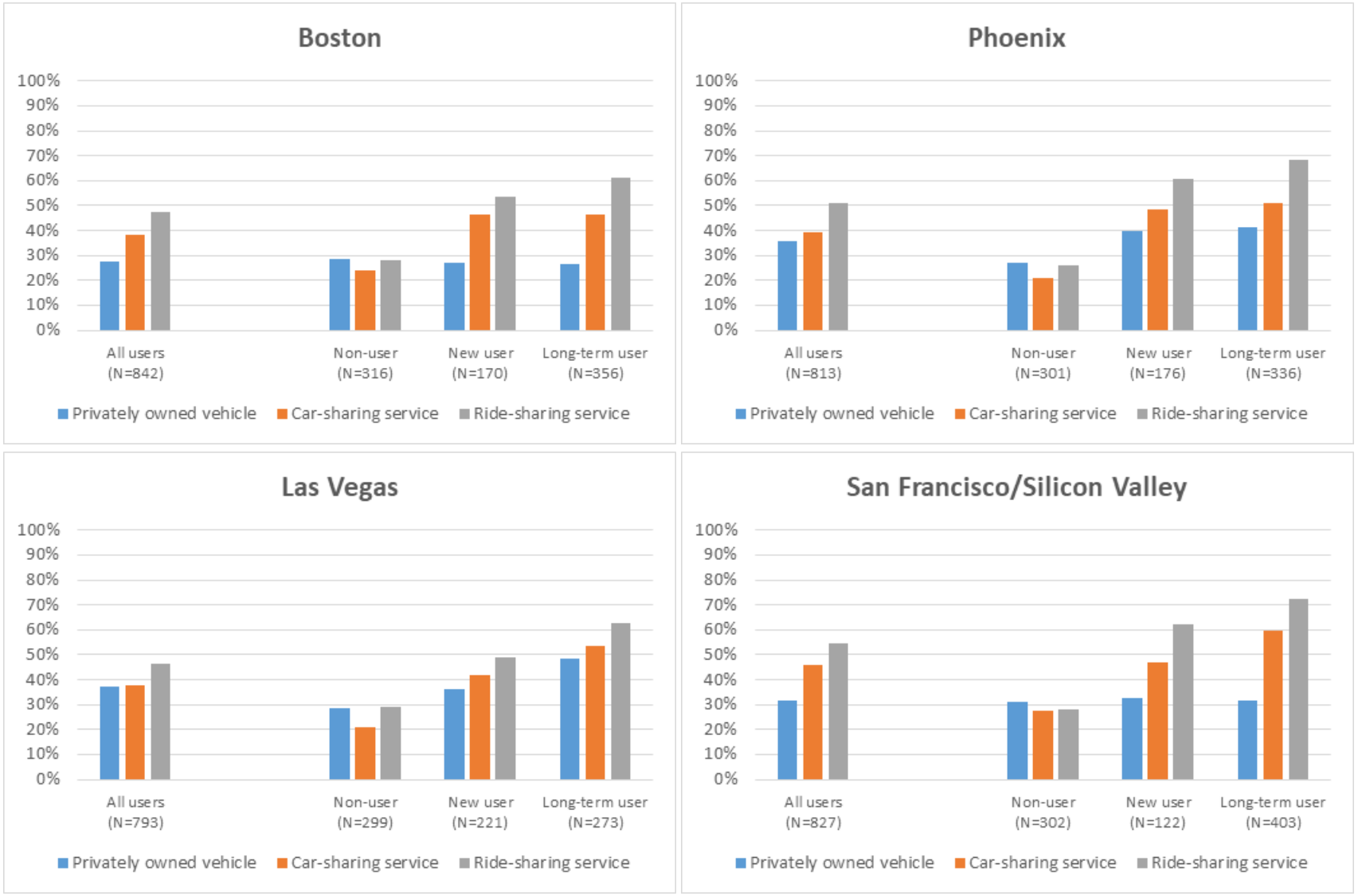


Figure 8. Intent to Use Different Types of Self-Driving Vehicles by User Type and by City

The strong preference of early adopters for use of the vehicles as a mobility service (rather than privately owned) corroborates the viewpoint that self-driving vehicles will first be available to consumers as mobility service fleets (The Economist 2018). Four reasons are typically identified:

1. Today, LIDAR sensors are still too expensive to be used in mass-produced self-driving cars. The cost of this technology is considered less of a barrier for fleet vehicles, because they will be generating revenue throughout the day to cover the expense, whereas the typically privately owned vehicle is used for a small fraction of a day.
2. In addition, automakers are currently marketing vehicles at Level 2 automation. With people keeping their vehicles on average for about 7 years, and with an average age of vehicles on the road of 11 years, it would take decades to obtain saturation of Level 4 or 5 vehicles.
3. Early stage deployments will need to be near perfect in operations to engender trust among the public and policy makers. Testing on controlled roadways so that these technologies are as foolproof as possible is important before their introduction on public roadways. Following this, early self-driving options will likely be geographically-constrained to ensure safe operation. This fits the business model of highly automated mobility fleets, which could quickly begin operating as urban circulator (closed-loop) systems as a prelude to less route-constrained, on-demand mobility services.
4. Level 5 vehicles entail *drive anytime, drive anywhere* operations. However, the fact that many road operators have not implemented or anticipated required rules of the road for highly automated vehicles means they will likely be constrained at early stages of implementation. An owner of a private vehicle may not want to pay a high purchase price for a vehicle that is geographically constrained in its sphere of operations.

Figure 9 provides additional insights about respondents, who were likely to either use all types or use none of them. The longer individuals used ride-hailing services, the higher their intent to use all types of self-driving vehicles. Consistently, non-users had the highest share of using none of the self-driving vehicle types. As expected, not intending to use any of the self-driving vehicle types decreased with increased ride-hailing experience.

As presented in Figure 6, though at a lower level, some respondents intended to use a self-driving vehicle of only one specific type. Among the ones who intended to purchase a self-driving vehicle (but were not interested in using it through a mobility service), non-users had the highest share. In contrast, long-term users had the highest percentage among respondents who were willing to use these vehicles in the form of a car-sharing service or ride-hailing service (see Figure 10).

The remaining figures in this section present the demographic distributions of respondents who were:

- Likely to use all types of self-driving vehicles.
- Not likely to use any type of self-driving vehicle.
- Likely to use self-driving vehicles only as a privately owned vehicle.
- Likely to use self-driving vehicles only as a car-sharing service.
- Likely to use self-driving vehicles only as a ride-hailing service.

Figure 11, Figure 12, Figure 13, and Figure 14 provide the age, gender, household income, and auto ownership distributions of respondents, respectively, for different types of self-driving vehicles. Figure

15 disaggregates the household income distribution by age categories, and Figure 16 disaggregates auto ownership distribution by different household size categories.

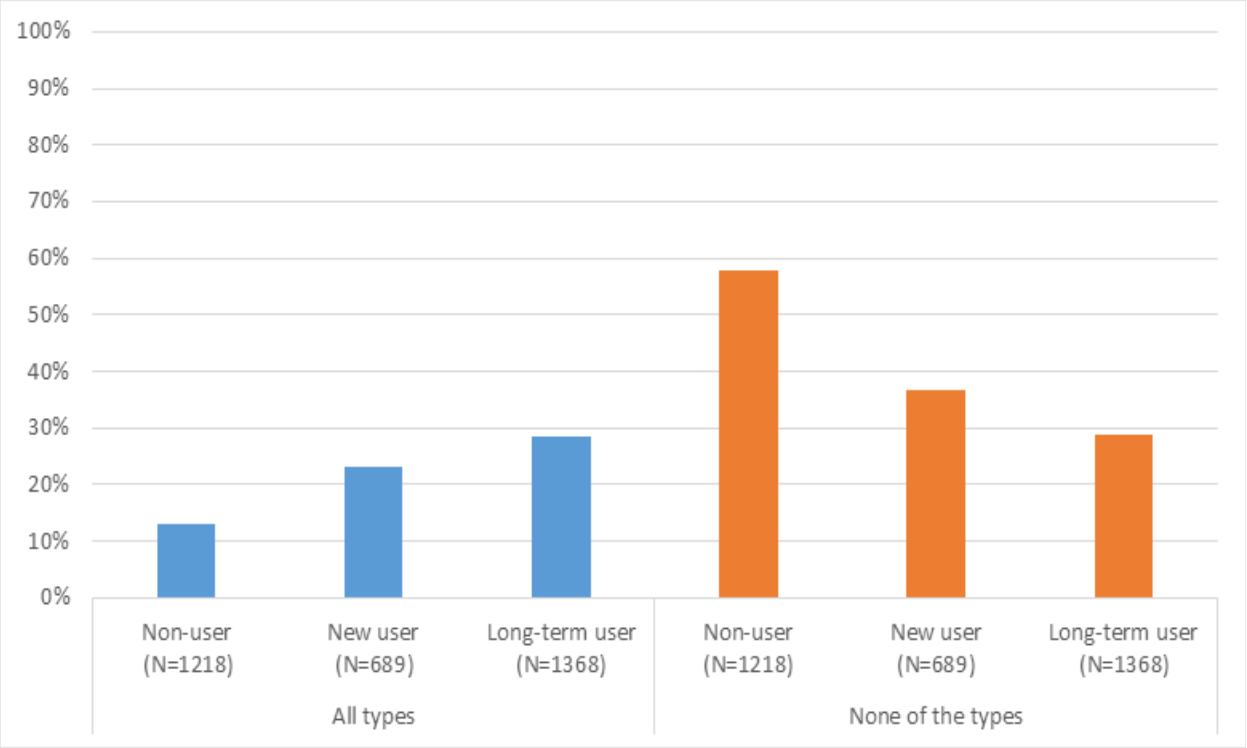


Figure 9. Intent to Use Self-Driving Vehicles: All or None

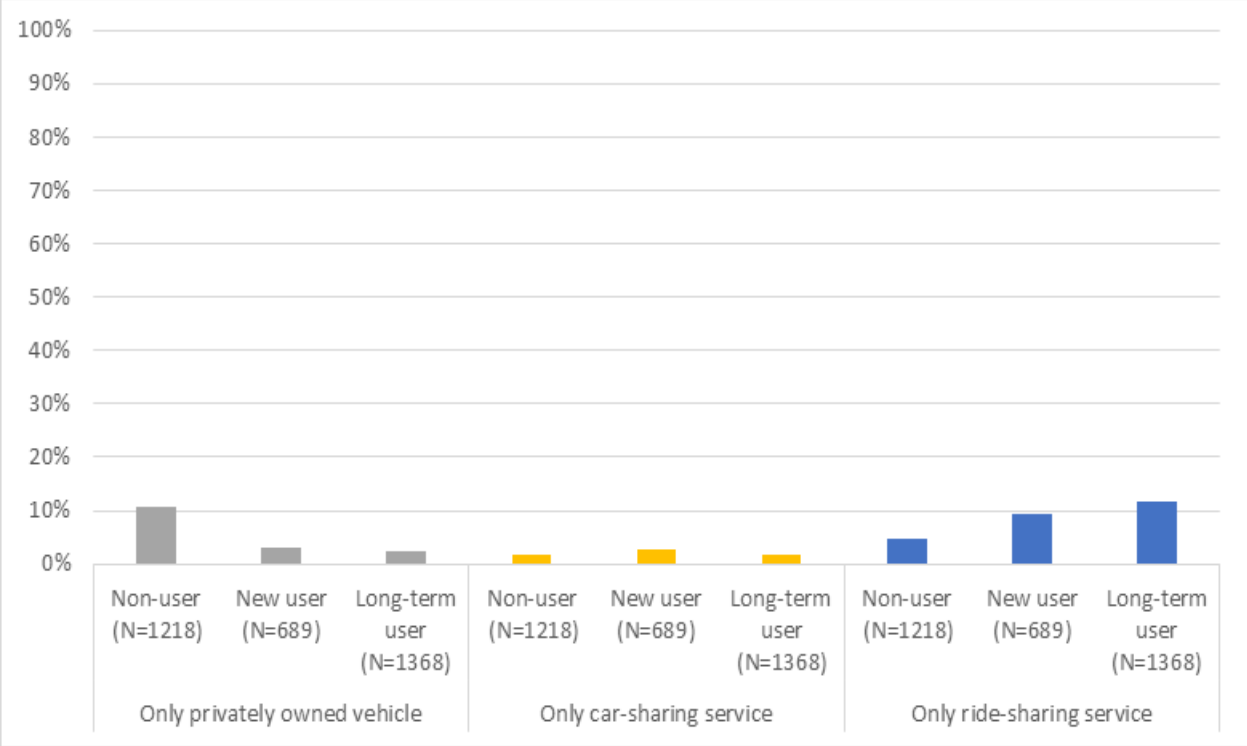


Figure 10. Intent to Use Self-Driving Vehicles: Only One Type

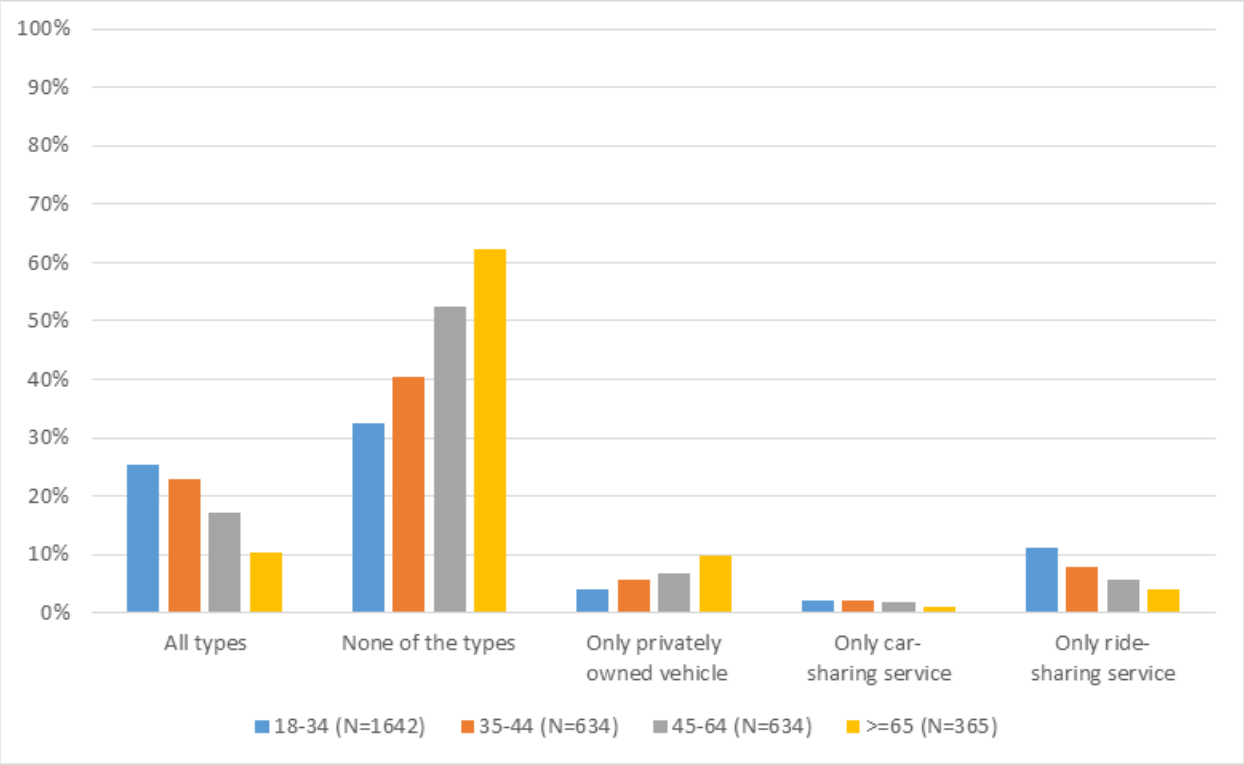


Figure 11. Intent to Use Different Types of Self-Driving Vehicles by Age

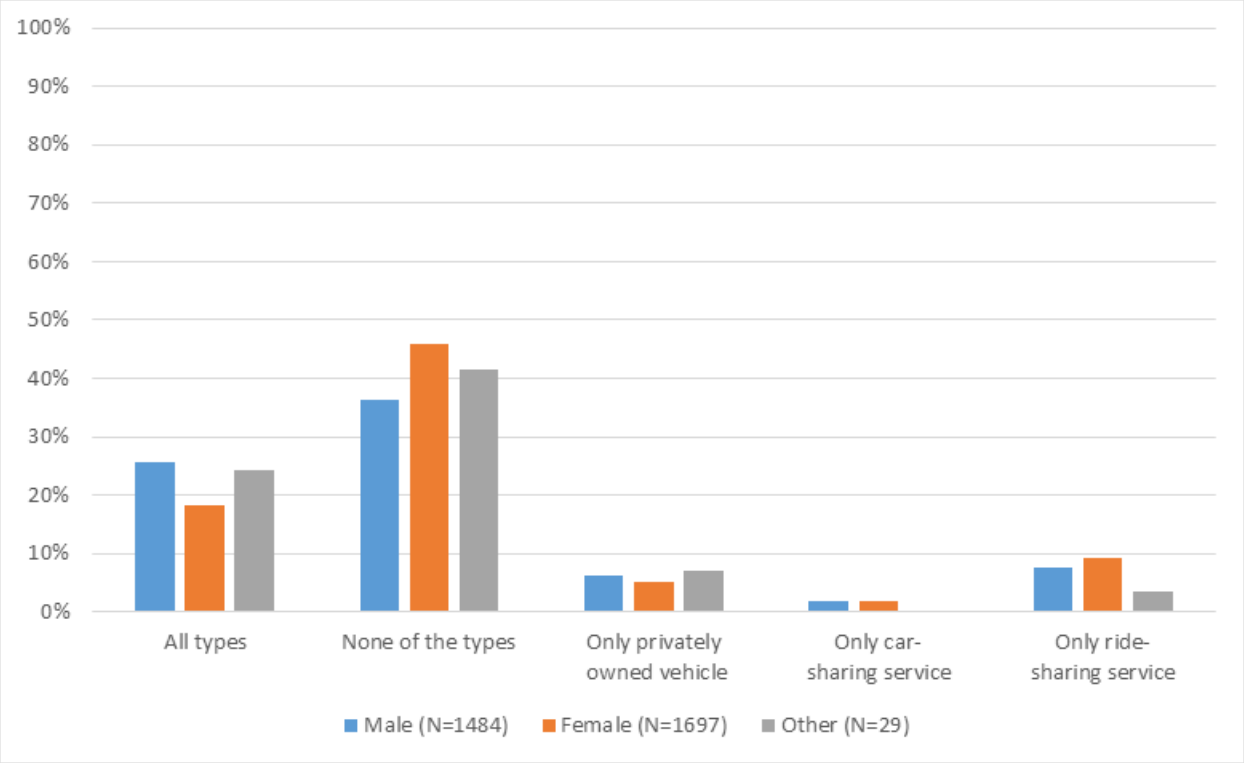


Figure 12. Intent to Use Different Types of Self-Driving Vehicles by Gender

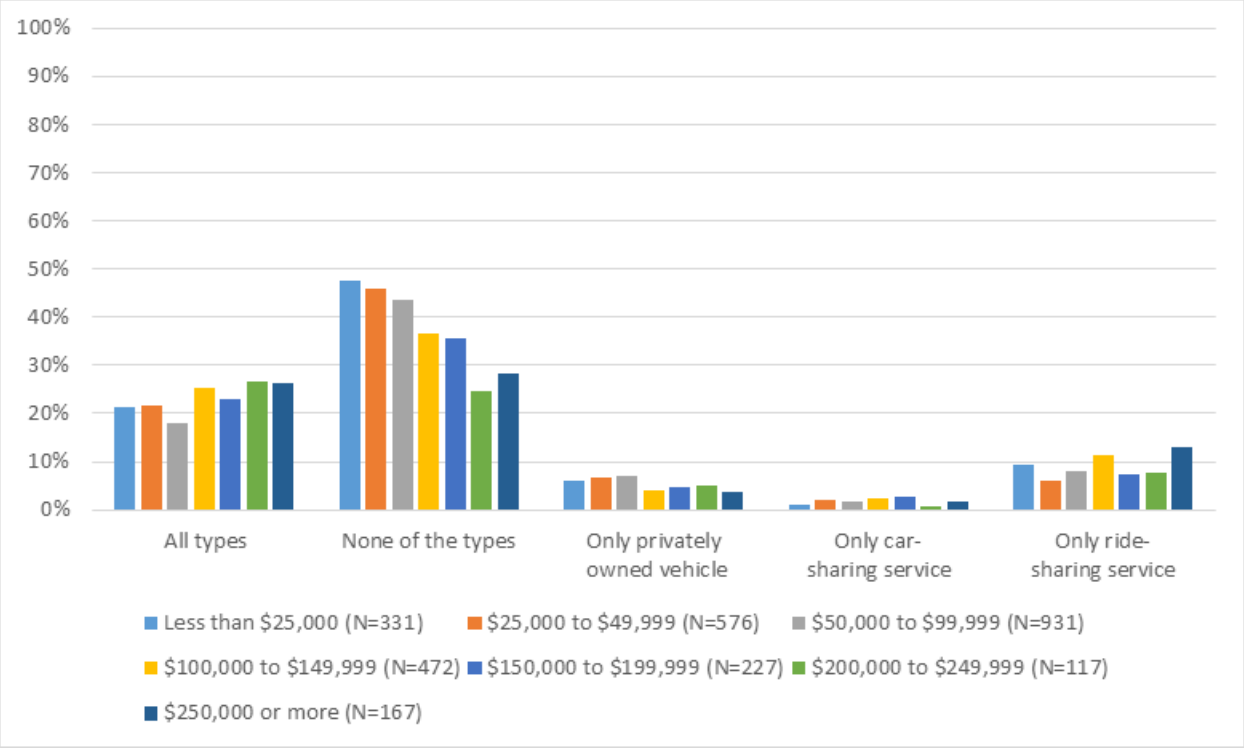


Figure 13. Intent to Use Different Types of Self-Driving Vehicles by Household Income

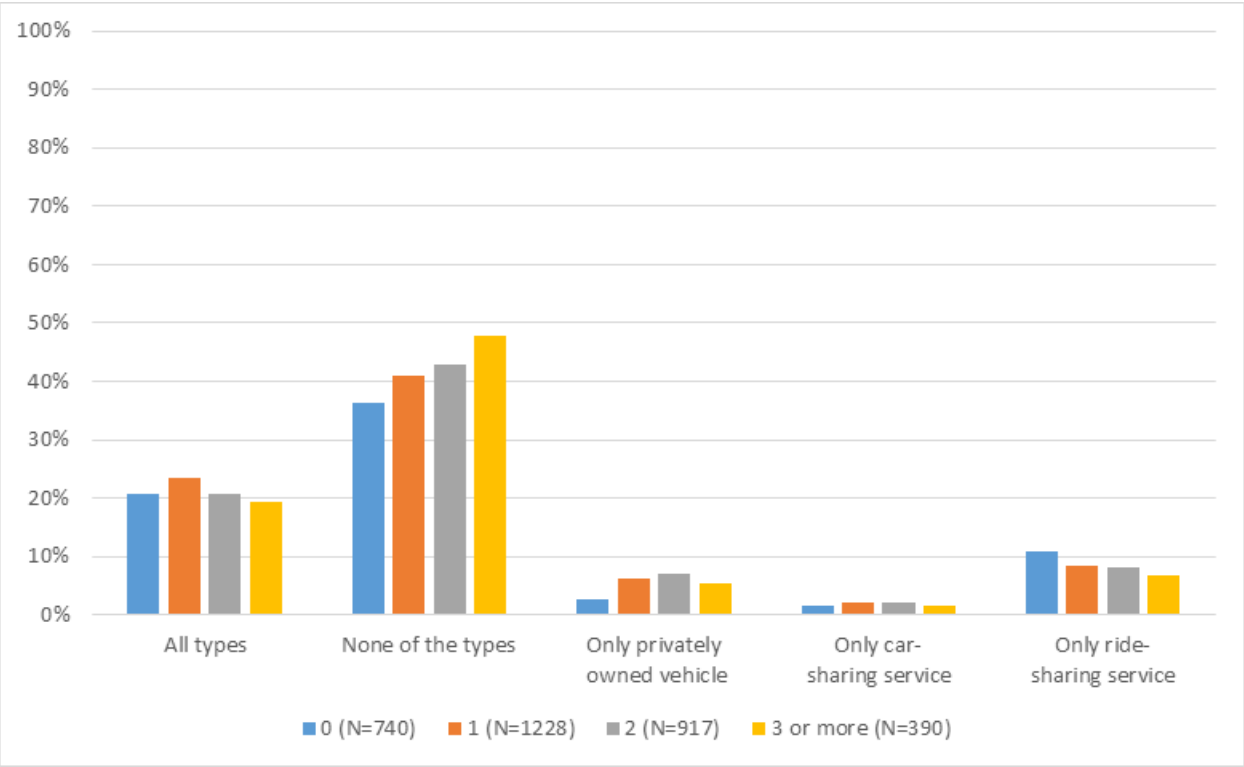


Figure 14. Intent to Use Different Types of Self-Driving Vehicles by Auto Ownership

Figure 15. Intent to Use Different Types of Self-Driving Vehicles by Household Income and Age

Figure 16. Intent to Use Different Types of Self-Driving Vehicles by Auto Ownership and Household Size

Intent to Use Self-Driving Vehicles as a Ride-Hailing Service: Pooled or Non-pooled

A significant amount of research has focused on whether the use of ride-hailing services has led to increased congestion and reduced use of public transportation in some urban areas (Hughes-Cromwick 2018). Because of this, vehicle occupancy rates in future self-driving vehicles are important. Will there be many single-occupancy trips or more high-occupancy trips, which would reduce the number of vehicles needed for transport?

In recent years, transportation network companies (TNCs) have launched several services that offer passengers the option of sharing a ride and splitting the cost with others, termed pooled services. In the survey, respondents who intended to use a self-driving vehicle as part of ride-hailing services were asked which version they would most likely use:

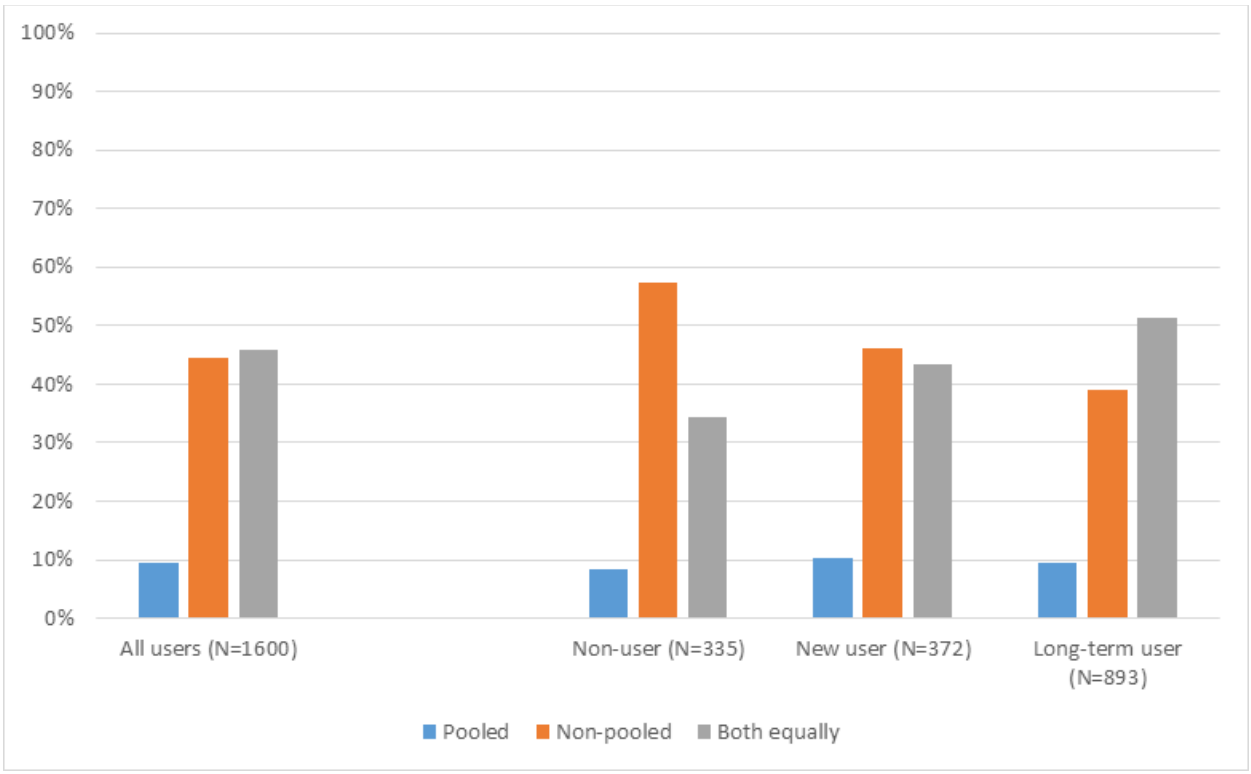
- Pooled/shared (with unknown persons).
- Non-shared (alone or with traveling companions).
- Equally likely (to use as a pooled/shared service or as a non-shared service).

Figure 17 presents the results based on the sample of respondents who indicated willingness to use a self-driving vehicle as part of ride-hailing services. The top graph presents the results for all three choices using the number of respondents as the base, and the bottom graph uses the total number of responses as the base by integrating the "equally likely" option into the pooled and non-pooled options.

Survey data suggested that people who intended to use the ride-hailing version of self-driving vehicles would be less likely to use the pooled or high-occupancy versions of them. Policy instruments may be necessary to incentivize the use of high-occupancy versions. Generally, price is an important factor; persons with lower household incomes were most likely to intend to use the pooled versions of self-driving vehicles.

The reasons for not using the pooled version also provided important insights. The most frequently cited reason was the inconvenience or discomfort associated with riding with strangers, especially in the absence of a designated driver in the case of a self-driving vehicle. This was followed by the additional time associated with the pooled version and not being a current user of the pooled version of ride-hailing services. For the latter, respondents did not see a reason to change their behavior just because the service was offered as a self-driving vehicle.

Finally, regional differences were observed. Figure 18 presents the city-wise distribution of respondents choosing pooled versus non-pooled versions of ride-hailing services. The figure uses the total number of responses provided by the sample of respondents who indicated willingness to use a self-driving vehicle as part of ride-hailing services for each city. The results indicated that residents of Boston were the most likely to use pooled services (closely followed by residents of San Francisco), whereas residents of Phoenix were the least likely. Follow-up interview findings indicated that such preferences were driven by the differing land uses in the cities, such as people in San Francisco were much more focused on potential congestion impacts.



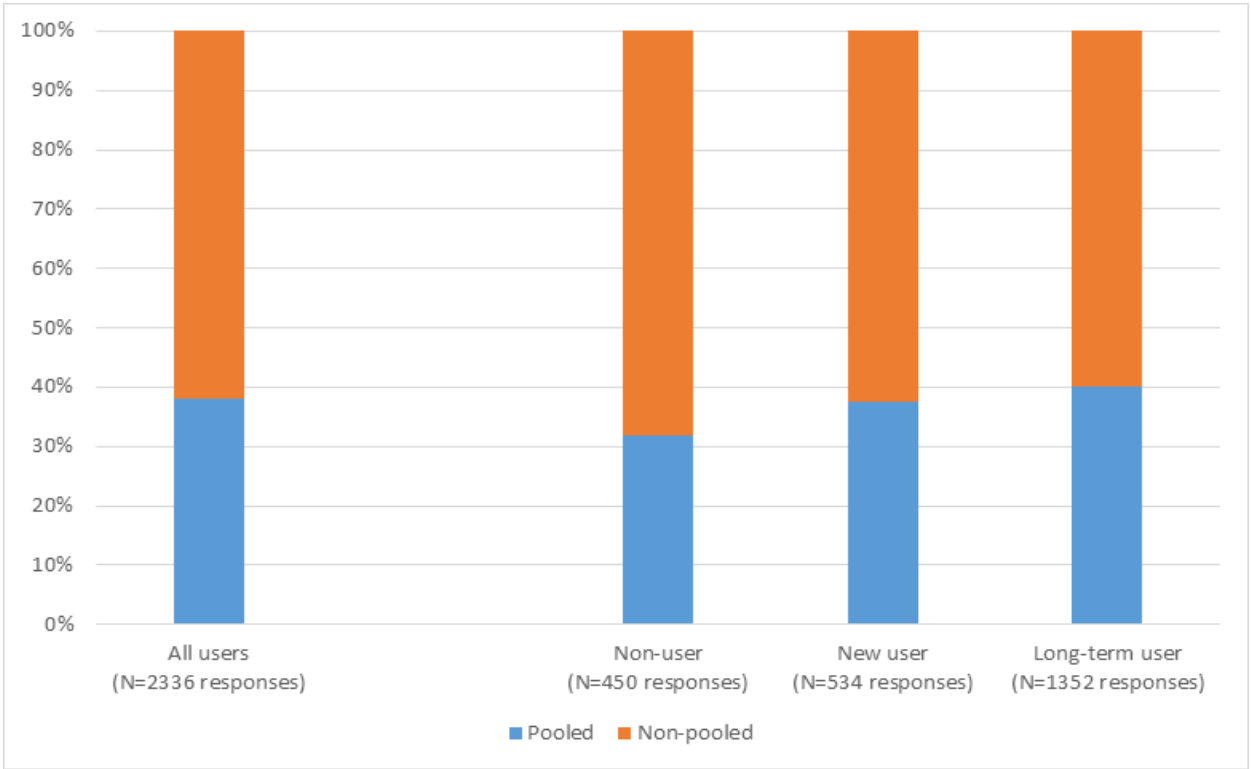


Figure 17. Intent to Use a Self-Driving Vehicle as a Ride-Hailing Service: Pooled or Non-pooled

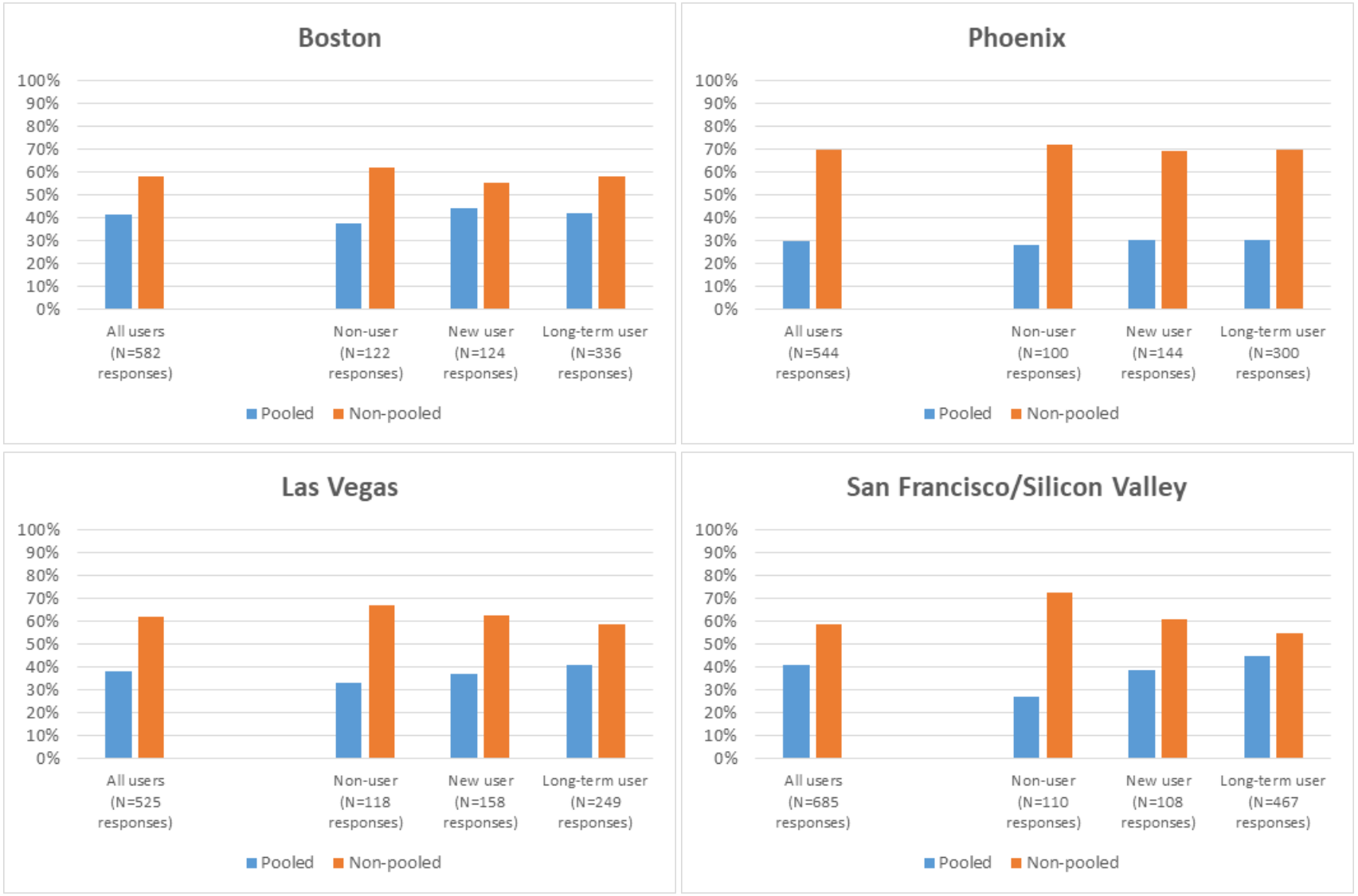


Figure 18. Intent to Use a Self-Driving Vehicle as a Ride-Hailing Service: Pooled or Non-pooled by City

Characteristics of Ride-Hailing Users Who Intended to Use Self-Driving Vehicles

This study found that current users of ride-hailing services are expected to be early adopters of self-driving vehicles as a mobility service. Interestingly, according to the follow-up interviews with some of these ride-hailing users, using self-driving vehicles as a ride-hailing service was the safest and most appropriate self-driving technology option for early adopters.

So, who are these early adopters?

Figure 19, Figure 20, and Figure 21 present the characteristics of survey respondents who used ride-hailing services and reported likely use of self-driving vehicles of any type. These people were found to be:

- Evenly split among males and females.
- Young adults (18–34 years old).
- In the middle-income class ($50,000–100,000).
- Part of a one- or two-person household.
- Without children.
- Owners of no or one household vehicle.
- Persons with privacy concerns, but for whom such concerns do not influence their likelihood of using a self-driving vehicle.
- Currently very aware of self-driving vehicles.

An important observation from the follow-up interviews was the interest among early adopters of ride-hailing services toward a fleet of low-speed, fully automated, shared vehicles that can serve multiple persons at one time (like micro-transit). These interviewees generally liked the idea of micro-transit and thought it might be a way to be "greener," might encourage transit use, or might operate like on-demand transit replacement. In contrast, the corresponding level of interest in trying micro-transit among interviewees not intending to use self-driving vehicles was generally low; most stated that they would prefer to wait until it was fully vetted.

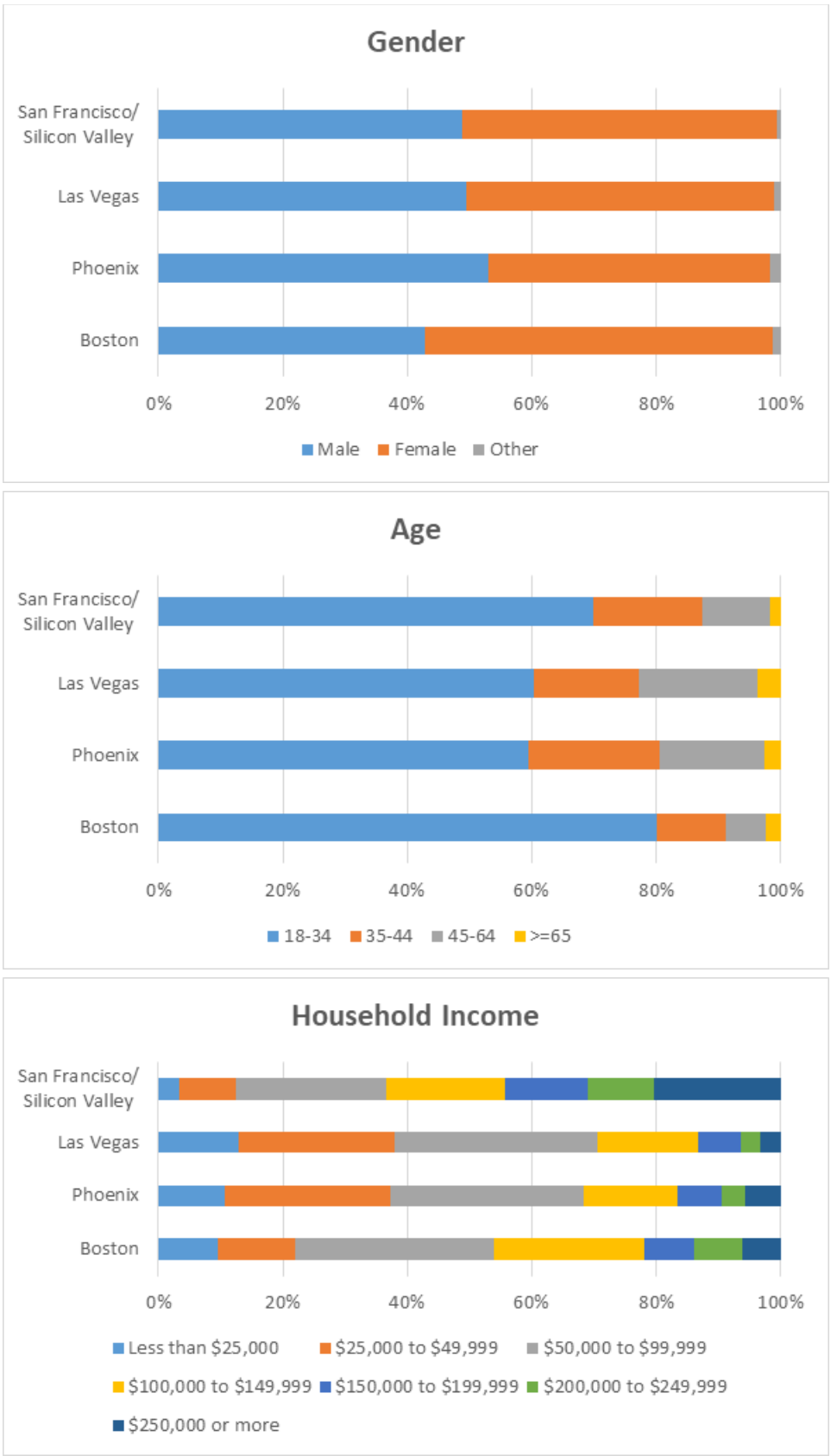


Figure 19. Ride-Hailing Users Who Intended to Use Self-Driving Vehicles—Individual Characteristics

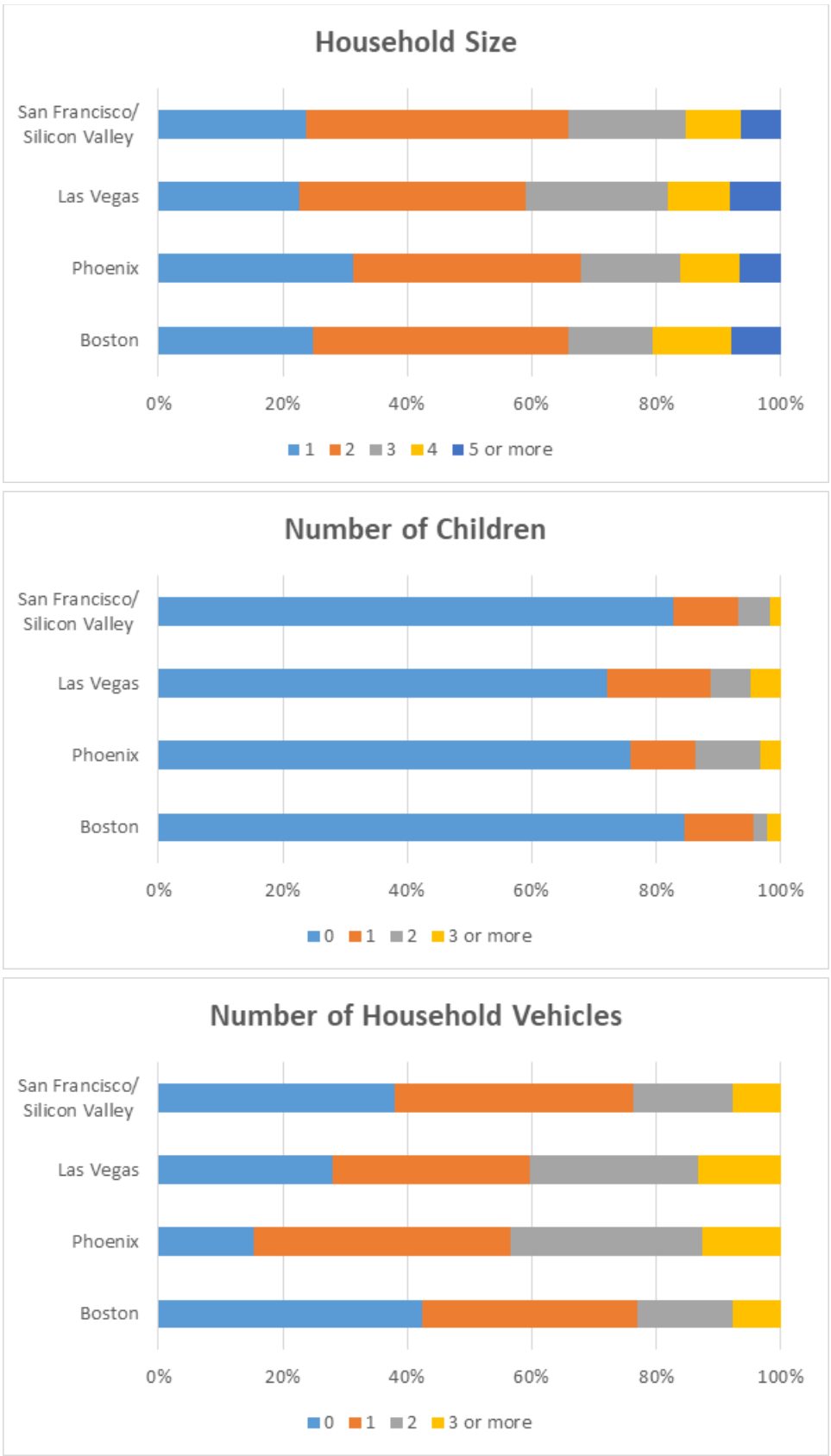


Figure 20. Ride-Hailing Users Who Intended to Use Self-Driving Vehicles—Household Characteristics

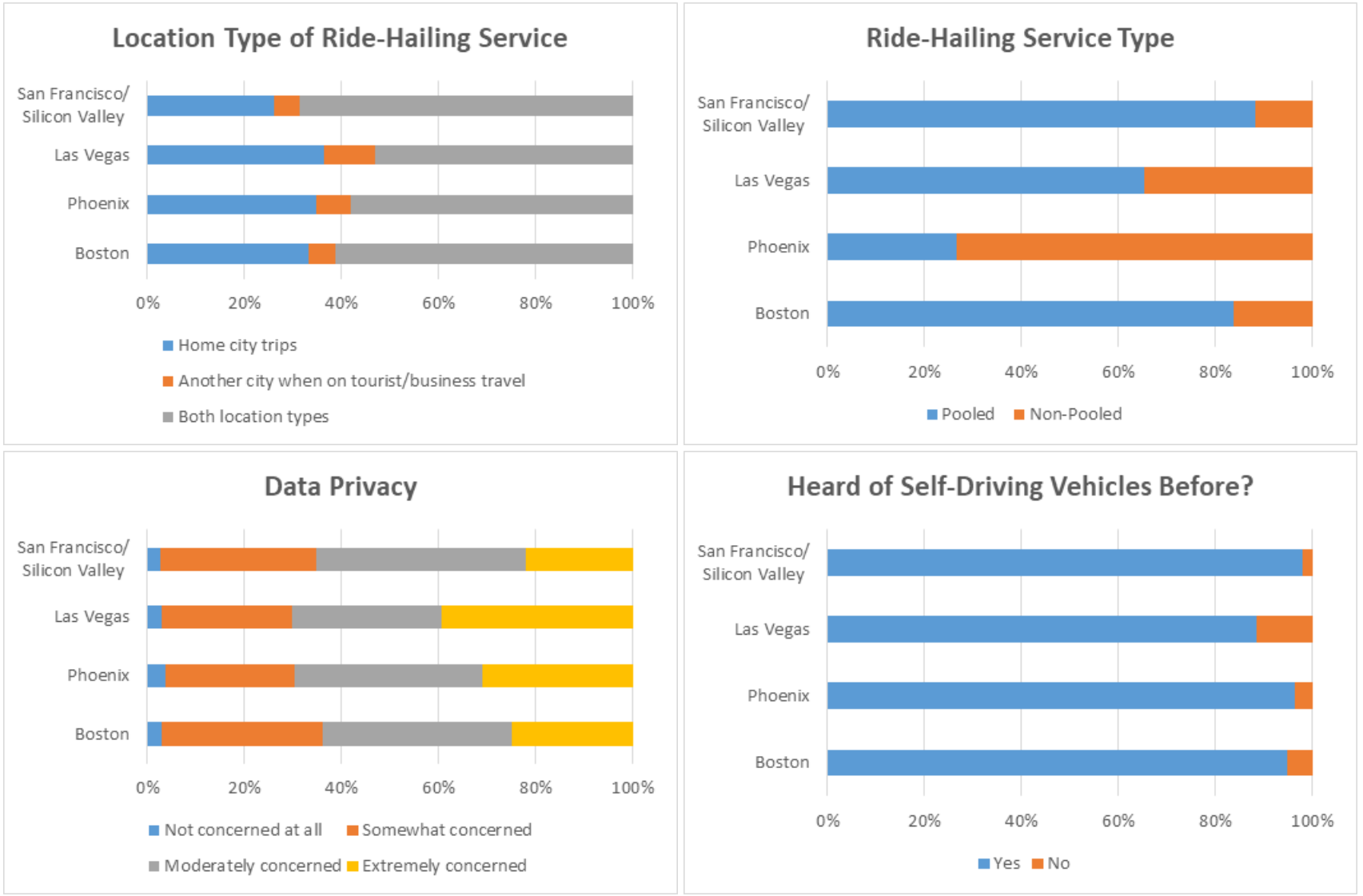


Figure 21. Ride-Hailing Users Who Intended to Use Self-Driving Vehicles—Shared Mobility Use, Attitudes toward Technology, and Awareness

Perceived Benefits and Concerns about Self-Driving Vehicles

People differentiated benefits and concerns among the different types of self-driving vehicles, which influenced their intent to use. These benefits and concerns also showed variations across different user types.

Table 5 and Table 6 present the top five reasons for intending and not intending to use different types of self-driving vehicles, respectively. The results indicate significant differences in how consumers perceive different types of self-driving vehicles. Research that does not distinguish the different types would not be able to parse out these important differences. In summary:

- Safety concerns and lack of trust are barriers to owning or using self-driving vehicles.
- Owning a self-driving vehicle is perceived as more expensive than using one as a car-sharing or ride-hailing service.
- Testing before owning via car sharing or ride hailing is an important incentive.
- The capability to be productive while driving is more important to ownership than to using via a mobility service.
- Privacy and cybersecurity concerns are associated with use of self-driving ride-hailing fleets.

Table 5. Top Ranked Reasons for Intending to Use Different Types of Self-Driving Vehicles

Rank	Privately Owned Vehicles	Car-Sharing Services	Ride-Hailing Services
1	Relieves stress of driving	Costs will be lower than owning	Ridesharing convenient for me
2	Trust technology will be tested	Want to test before owning	Costs will be lower than owning
3	Will be productive while driving	Relieves stress of driving	Want to test before owning
4	Safer than human drivers	Trust technology will be tested	Will be productive while driving
5	Lower insurance costs	Will be productive while driving	Relieves stress of driving

Table 6. Top Ranked Reasons for Not Intending to Use Different Types of Self-Driving Vehicles

Rank	Privately Owned Vehicles	Car-Sharing Services	Ride-Hailing Services
1	Vehicles' ability to react safely	Lack of information	Privacy—my trips will be tracked
2	Cost (purchase)	Don't trust technology	Vehicle may be hacked
3	No need to own car	Lack of control in crash situation	Vehicles' ability to react safely
4	Like to drive	Vehicles' ability to react safely	Don't trust the technology
5	Cost (maintenance and repair)	Safety of vehicle I do not own	Lack of information

Table 7 and Table 8 disaggregate the top five reasons for intending and not intending to use different types of self-driving vehicles, respectively, by user type. Safety was the top reason among users of ride-hailing services for not intending to use self-driving vehicles of any type. During follow-up interviews with ride-hailing users who were interested in only the ride-hailing service option of self-driving vehicles, respondents generally indicated hesitance to state that self-driving vehicles would be safer in all conditions. Most felt more comfortable with having a "human override" option and believed that humans would perform better in making snap decisions. On the other hand, interviewees who were likely to use a self-driving vehicle only as a privately owned vehicle thought that self-driving technology would be safer than traditional human driver-based vehicles.

Table 7. Top Ranked Reasons for Intending to Use Different Types of Self-Driving Vehicles by User Type

Type	Rank	Non-user	New User	Long-Term User
Privately owned vehicles	1	Trust technology will be tested	Relieves stress of driving myself	
	2	Relieves stress of driving myself	Will be productive while driving	
	3	Safer than human drivers	Trust technology will be tested	
	4	Attracted to newest driving technology	Lower insurance costs	
	5	Will be productive while driving	Safer than human drivers	
Car-sharing services	1	Safer than human drivers	Want to test before owning	Costs will be lower than owning
	2	Trust technology will be tested	Costs will be lower than owning	Want to test before owning
	3	Mobility enabler if unable to drive	Relieves stress of driving myself	
	4	Costs will be lower than owning	Will be productive while driving	Car sharing convenient for me
	5	Don't want to purchase another household vehicle	Trust technology will be tested	Will be productive while driving
Ride-hailing services	1	Safer than human drivers	Ridesharing convenient for me	
	2	Attracted to newest driving technology	Want to test before owning	Costs will be lower than owning
	3	Will be productive while driving	Costs will be lower than owning	Want to test before owning
	4	Trust technology will be tested	Relieves stress of driving myself	
	5	Costs will be lower than owning	Trust technology will be tested	Will be productive while driving

Table 8. Top Ranked Reasons for Not Intending to Use Different Types of Self-Driving Vehicles by User Type

User Type	Rank	Non-user	New User	Long-Term User
Privately owned vehicles	1	Cost (purchase)	Vehicles' ability to react safely	
	2	Vehicles' ability to react safely	Cost (purchase)	
	3	Like to drive	Don't trust technology	
	4	Lack information	Cost (maintenance and repair)	No need for it
	5	No need for it	Lack of control in crash situation	Cost (maintenance and repair)
Car-sharing services	1	Lack information	Vehicles' ability to react safely	
	2	Don't trust technology		
	3	Lack of control in crash situation		Safety of vehicle I do not own
	4	Privacy—my trips will be tracked	Safety of vehicle I do not own	Lack of control in crash situation
	5	Cost (too expensive)	No need for it	Vehicle may be hacked
Ride-hailing services	1	Privacy—my trips will be tracked	Vehicles' ability to react safely	
	2	Like to drive	Safety of vehicle I do not own	Don't trust technology
	3	Vehicle may be hacked	Don't trust technology	Safety of vehicle I do not own
	4	Lack information	Vehicle may be hacked	Uncertainty about who to contact in case of emergency
	5	Convenience of owning own vehicle	Lack information	Vehicle may be hacked

Factors Influencing Intent to Use a Self-Driving Vehicle

Multivariate choice models were developed to identify the factors associated with intent to use a self-driving vehicle. Specifically, three binary choice models were estimated to examine the likely use of self-driving vehicles as a privately owned vehicle, a car-sharing service, and a ride-sharing service. Several variables were found to be associated with intent to use self-driving vehicles. While some results were similar across all types, others showed variations. The following subsections discuss the results within four variable categories (i.e., individual and household demographics, residential characteristics, technology and shared mobility use, and attitudes and perceptions toward technology). Table 9 presents the final model results for intent to use self-driving vehicles.

Table 9. Model Results for Intent to Use Self-Driving Vehicles

Variables			Privately Owned Vehicle		Car-Sharing Service		Ride-Hailing Service	
			Estimate	t-stat.	Estimate	t-stat.	Estimate	t-stat.
Individual and Household Characteristics	Age		−0.010	−3.21	−0.008	−2.72	−0.017	−5.33
	Female		−0.283	−3.14	—	—	−0.309	−3.37
	Have medical conditions that prohibit driving		1.282	5.13	0.566	2.36	0.690	2.71
	Household income >= $100,000		—	—	—	—	0.253	2.52
	No motorized vehicles in the household		−0.333	−2.91	—	—	—	—
Residential Characteristics	Neighborhood density		—	—	—	—	0.095	1.80
	City of residence (Base: Boston)	Phoenix	0.262	2.41	—	—	0.199	1.90
		Las Vegas	0.485	4.52	—	—	—	—
		San Francisco/Silicon Valley	—	—	0.217	2.20	—	—
Technology and Shared Mobility Use	Ride-hailing experience (Base: non-user)	New user	−0.233	−1.82	0.724	5.91	0.831	6.53
		Long-term user	−0.289	−2.44	0.772	6.85	1.133	9.34
	Car-share membership		—	—	0.586	4.73	0.426	3.07
	Frequent Internet shopping		0.166	3.74	0.179	4.20	0.185	4.15
Attitudes and Perceptions	Concern with data privacy about using online technologies	Not concerned	0.466	1.99	—	—	—	—
		Very concerned	—	—	—	—	−0.113	−1.14
	Technology adoption	Late adopter—Wait awhile before adopting	−0.383	−3.91	−0.245	−2.60	—	—
		Laggard—Among the last to adopt new technology or not adopt at all	−0.779	−4.32	−0.443	−2.64	−0.370	−2.39
	Attitudes toward self-driving vehicles	Self-driving vehicles would be fun and make traveling more interesting	0.840	16.19	0.792	16.33	0.877	17.52
		Using a self-driving vehicle would increase accident risk	−0.438	−10.35	−0.357	−8.81	−0.495	−11.20
Constant			−2.243	−6.50	−2.954	−8.88	−1.950	−5.55
N (sample size)			3179		3197		3171	
Log-likelihood at convergence			−1598.899		−1675.507		−1557.742	

Individual and Household Characteristics

Prior studies have found that attitudinal variables were more significantly associated with the acceptance and likely use of new technology than were demographic characteristics. While this study's models support the notion of very strong association of attitudes and perceptions with intent to use self-driving vehicles, some individual and household characteristics also influenced the decision-making process.

First, age mattered. The results indicated a decreased likelihood of intent to use with an increase in age, and the effect was consistently observed across all types of self-driving vehicles. The follow-up interviews equated the unlikeliness of using a self-driving vehicle among older respondents to their lack of knowledge of technology and indifference toward educating themselves on it. Gender differences were also observed, indicating a lower likelihood of use among females, though this impact was only relevant for the use of a self-driving vehicle as a privately owned vehicle or as a ride-hailing service. Next, individuals who had medical conditions that prohibited them from driving were more likely to accept self-driving vehicles in their future regardless of the type.

The next two variables in this category were related to household characteristics. Specifically, the results indicated a higher tendency toward using self-driving vehicles as a ride-hailing service among higher-income individuals. This effect is probably highlighting the concern of ride-hailing service cost, which might be considered higher than owning a car, among lower-income households. While there are several hidden costs of owning a car, these costs might not be obvious in everyday life when compared to paying the actual ride-share service cost for everyday use. The follow-up interview findings suggested another potential reason related to the expectation of increased (initial) cost with ride-hailing services of self-driving vehicles. Specifically, interviewees who intended to use self-driving vehicles thought that the ride-hailing version of self-driving vehicles would be more expensive than traditional human-driver-based ride hailing at first, but the costs would come down over time.

Finally, and as might be expected, individuals from households with no vehicles were less likely to own a self-driving vehicle.

Residential Characteristics

Individuals' residential locations were found to have different impacts on intent to use. First, individuals residing in denser neighborhoods had a higher intent to use self-driving vehicles as a ride-hailing service.

The city of residence also had varying impact. As discussed earlier, this study covered four cities: Boston, Phoenix, Las Vegas, and San Francisco/Silicon Valley. Residents of Phoenix were observed to be more enthusiastic about self-driving vehicle use, particularly as a ride-hailing service. The intent to own a self-driving vehicle was highest in Las Vegas, followed by Phoenix. Last, intent to use was highest in the form of a car-sharing service in San Francisco/Silicon Valley.

Technology and Shared Mobility Use

As the primary interest of this study, ride-hailing experience was significantly associated with likely use of self-driving vehicles. As expected, intent to use was higher across ride-hailing users compared to non-users but only for shared mobility services. The impact was reversed for privately owned vehicles; in other words, ride-hailing users were less likely to own a self-driving vehicle compared to non-users. These results are likely related to the loyalty of ride-hailing users to mobility services. The conducted interviews also indicated that ride-hailing users would not consider buying a car just because it is self-

driving; they would instead continue using it as a mobility service. The results also highlighted the increased intent to use self-driving vehicles as a mobility service among long-term users compared to new users of ride-hailing services.

Intent to use as a mobility service was also found higher among individuals who currently or previously had car-share memberships. The final variable of this category showed an interesting relationship between Internet shopping and intent to use. For all types of vehicles, intent to use was higher among individuals who were frequent Internet shoppers. This result might be indicative of time expected to be gained due to relief from driving, which might then be spent on online shopping during travel.

Attitudes and Perceptions

The final set of variables involved attitudes and perceptions toward technology. The first impact was related to data privacy concerns. Individuals who were not concerned at all with data privacy related to using online technologies and services were more likely to own a self-driving vehicle. Conversely, those who were extremely concerned with data privacy were less likely to use self-driving vehicles as a ride-hailing service. However, this latter impact was not very significant. Evolving since the late 2000s, ride-hailing services rely on smartphone apps to connect paying passengers with drivers who provide rides (for a fee) in their private vehicles. Payment is managed through the app, which stores credit card information. The would-be passenger requests a real-time ride through the mobile application, which then communicates the passenger's location to drivers via GPS. TNCs design and operate these online platforms, which might be related to the data privacy concerns of using self-driving vehicles as a ride-hailing service. Interesting to note that follow-up interview findings indicated that respondents did not see using self-driving technology as presenting a data privacy issue greater than that related to using a cell phone or using current ride-sharing services.

Where people fell on the technology adoption curve was strongly associated with their intent to use. As might be expected, people who were early adopters of new technology also tended to be more likely users of self-driving vehicles in any form (purchase or mobility service use).

The last two attitudinal variables indicated very strong and consistent associations across all types of self-driving vehicles. Specifically, individuals who had a positive attitude toward self-driving vehicles (i.e., thought self-driving vehicles would be fun and make traveling more interesting) had a higher preference for using or purchasing them. On the other hand, users who were worried about safety and thought that self-driving vehicles would increase accident risk had a lower preference for using or purchasing those vehicles.

CONCLUSIONS

The advent of automated vehicles could be transformative to the existing transportation system. However, the ways in which changes could happen are uncertain. Because these vehicles are not yet present in the traffic streams, with the exception of a few test vehicles, it is difficult to reliably predict future consumer demand. Studies are needed to build an evidence base for transportation decision making and policy making.

Considering the premise of current ride-hailing users as early adopters of mobility alternatives, this research was aimed at contributing to the current literature of acceptance and likely use of self-driving vehicles and the role of ride hailing in this decision-making process. In particular, this research examined

the hypothesis of increased likelihood of acceptance and use of self-driving vehicles among current ride-hailing users compared to non-ride-hailing users. Based on the survey bivariate descriptive results, the overall intent to use was found to be exceptionally higher among users of ride-hailing services than among non-users of such services. Intent to use was highest among long-term users of ride-hailing services, who were more likely to use a self-driving vehicle technology than non-users by a margin of almost 2 to 1. This study also provided an extensive picture of self-driving vehicle intent-to-use behavior and characteristics.

In addition to developing an extensive descriptive analyses, multivariate choice models were developed to identify the significant factors influencing the acceptance of use across different application types, including privately owned vehicle, car-sharing service, and ride-hailing service. Three distinct models were developed based on a rich set of variables, including individual and household demographics, residential characteristics, technology and shared mobility use factors, and attitudes and perceptions. The results highlighted both similarities and differences in intent to use self-driving vehicles across different types of vehicles. The hypothesis of higher likelihood of acceptance among ride-hailing users was confirmed for self-driving vehicles as a mobility service (with increased tendency among long-term ride-hailing users), but the effect was found to be the opposite for privately owned vehicles. That is, while ride-hailing users were more likely to use self-driving vehicles as a mobility service (ride-hailing or car-sharing services), non-users had a higher intent to use them as a privately owned vehicle.

The results of this research could inform several important policy issues. First, size of the ride-hailing market in a city might be a good estimate of the likely scope of the early future self-driving market, particularly as a mobility service. Second, the characteristics of ride hailing might be representative of the characteristics of early users of self-driving vehicles. Third, the travel patterns of ride-hailing users within a city or state could inform potential automated use cases. Fourth, the likely success of fleet-based automated vehicles (with associated mobility, congestion, and environmental benefits) versus privately owned automated vehicles in a city or state could be determined.

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APPENDIX A: ONLINE RIDE-HAILING SURVEY DRAFT WITH FREQUENCIES[2]

Informed Consent

You are being invited to take part in a research study, which includes an online survey conducted by the Texas A&M Transportation Institute (TTI) and funded by Lyft. The purpose of this study is to examine the factors that might influence people's future use of self-driving vehicles. This survey will take about 10 minutes to complete.

The questions that you will be asked to answer pose no more risks to you than you would come across in everyday life. Your participation is entirely voluntary, and you can refuse to take part at any time. You will be compensated by Lyft for participating in the study in the form of a $5 credit toward your next Lyft ride. If you decide you do not want to participate, there will be no penalty to you.

Information about you and related to this study will be kept confidential to the extent required or permitted by law. No identifier linking you to this study will be included in any report that might be published. Information about you will be stored in computer files that are protected with a password. Only the principal investigator and research study personnel have access to your information.

You may read the Lyft User Survey Information Sheet for additional information.

If you would like more details or have any concerns about this research, you may contact TTI researcher Chris Simek at 512-407-1153 or c-simek@tti.tamu.edu. For questions about your rights as a research participant, to provide input regarding this research, or if you have questions, complaints, or concerns about the research, you may call the Texas A&M University Human Subjects Protection Program office by phone at 1-979-458-4067 or toll-free at 1-855-795-8636, or by email at irb@tamu.edu.

If you would like to take part in the study, please continue by clicking the "Next" button below.

[2] These frequencies are based on survey completion (i.e., respondents who answered every question they should have; N = 2003).

Questionnaire

1. How old are you? [RECORD OPEN NUMERIC RESPONSE; IF LESS THAN 18, THANK AND TERMINATE]
    - 18–24 (19.6%)
    - 25–34 (45.4%)
    - 35–44 (15.8%)
    - 45–54 (9.8%)
    - 55–64 (5.7%)
    - 65+ (2.3%)
2. In which city/region do you live?
    - Boston (25.2%)
    - Phoenix (24.9%)
    - Las Vegas (24.8%)
    - San Francisco/Silicon Valley (25.1%)
3. Using a scale of 1 (strongly disagree) to 5 (strongly agree), to what extent do you agree or disagree with the following statements? [SCALE: 1 = STRONGLY DISAGREE, 2 = SOMEWHAT DISAGREE, 3 = NEITHER DISAGREE NOR AGREE, 4 = SOMEWHAT AGREE, 5 = STRONGLY AGREE]
    - It is important to keep up with the latest trends in technology. (1 = 4.7%, 2 = 3.5%, 3 = 7.0%, 4 = 39.9%, 5 = 44.8%)
    - New technology makes life more complicated. (1 = 20.3%, 2 = 31.0%, 3 = 25.4%, 4 = 19.2%, 5 = 4.2%)
    - Technology will provide solutions to many of our problems. (1 = 3.1%, 2 = 4.6%, 3 = 14.2%, 4 = 46.2%, 5 = 31.9%)
4. How often do you use the following technologies? (6 = several times per hour, 5 = several times per day, 4 = several times per week, 3 = several times per month, 2 = a few times per year, and 1 = never) [IF “NEVER” TO ALL OPTIONS, SKIP TO Q6]
    - Smartphones (1 = 0.6%, 2 = 0.3%, 3 = 0.4%, 4 = 1.4%, 5 = 22.5%, 6 = 74.6%)
    - Facebook (1 = 10.8%, 2 = 4.5%, 3 = 6.5%, 4 = 21.4%, 5 = 43.3%, 6 = 13.4%)
    - Internet shopping (1 = 1.6%, 2 = 13.4%, 3 = 35.6%, 4 = 37.4%, 5 = 8.0%, 6 = 3.8%)
    - Emailing (1 = 0.5%, 2 = 2.6%, 3 = 5.5%, 4 = 12.1%, 5 = 31.5%, 6 = 47.7%)
    - Text messaging (1 = 0.4%, 2 = 0.9%, 3 = 2.4%, 4 = 8.3%, 5 = 38.5%, 6 = 49.4%)
5. How concerned are you about the privacy of your personal information when you use internet-enabled technologies or services today?
    - Not concerned at all (2.8%)
    - Somewhat concerned (in some situations) (28.1%)
    - Moderately concerned (in most situations) (37.4%)
    - Extremely concerned (in all situations) (31.8%)
6. When it comes to adopting new technology, are you typically a(n) early adopter, late adopter, or laggard?
    - Early adopter—I am among the first of my friends to adopt new technology. (42.3%)
    - Late adopter—I wait awhile before adopting new technology. (51.3%)
    - Laggard—I am among the last of my friends to adopt new technology, if I adopt at all. (6.4%)

7. How many vehicles are in your household (including cars, trucks, SUVs, and vans—owned, leased, and company vehicles)?

    - 0 [SKIP TO Q11] (31.5%)
    - 1 (36.6%)
    - 2 (21.0%)
    - 3 or more (10.8%)

8. Are any of your vehicles electric or hybrid?

    - Yes (9.3%)
    - No (90.7%)

9. Which of the following advanced driver assistance systems features do any of your vehicles have? (Select all that apply.)

    - None (42.9%)
    - Emergency breaking assist (14.8%)
    - Lane keeping assist or lane departure warning system (9.5%)
    - Lane change assist (8.9%)
    - Automatic parking assist (7.6%)
    - Collision warning system (13.3%)
    - Other advanced driver assistance systems feature (8.2%)

10. Is one of the household vehicles for your sole use?

    - Yes (69.9%)
    - No (30.1%)

11. Are you, or have you been, a member of a car-share program (e.g., car2go or Zipcar)?

    - Yes (21.9%)
    - No (78.1%)

12. How often do you currently use ride-sharing services (e.g., Lyft and Uber)?

    - Very frequently—at least once per day (16.9%)
    - Frequently—at least once per week (53.6%)
    - Occasionally—at least once per month (24.5%)
    - Rarely—at least once per year (3.9%)
    - Never [SKIP TO STUDY TEXT] (1.0%)

13. How long have you been using ride-sharing services (e.g., Lyft and Uber)?

    - Less than three months (6.5%)
    - 4–11 months (11.4%)
    - 1–3 years (50.4%)
    - More than 3 years (30.6%)
    - I do not know (1.2%)

14. Have you ever used the carpooling option of ride-sharing services (e.g., Lyft Line or Uber Pool)?

    - Yes (64.6%)
    - No (35.45%)

15. In which type of location do you most often use ride-sharing services: as a resident of your home city, when visiting another city on tourist or business travel, or in both location types?

    - Home city trips (34.3%)
    - Another city when on tourist/business travel (7.6%)
    - Both location types (58.1%)

16. Please select the three most common trips you make using ride-sharing services.

    - To or from a restaurant or social or recreational activity (79.8%)
    - To or from an airport or inter-city train station (Amtrak or commuter rail) (57.2%)
    - To or from work (or work-related activity) (52.8%)
    - To or from public transit (bus, subway, or light rail) (16.6%)
    - To or from shopping (25.9%)
    - To or from school, university, college, or educational institution (11.6%)
    - Other (specify) (3.8%)

17. Please drag and drop the ride-sharing trip types presented below so that the trip you most commonly make is on top (number 1) and the trip you least commonly make is on bottom (number 3). [PROGRAMMER NOTE: THE THREE SELECTED RESPONSES IN Q16 ARE PRESENTED BELOW. IF ONLY ONE SELECTED IN Q16, SKIP THIS QUESTION.]

    - To or from a restaurant or social or recreational activity (Priority 1, Priority 2, Priority 3; 746, 462, 242)
    - To or from an airport or inter-city train station (Amtrak or commuter rail) (Priority 1, Priority 2, Priority 3; 197, 503, 381)
    - To or from work (or work-related activity) (Priority 1, Priority 2, Priority 3; 459, 245, 259)
    - To or from public transit (bus, subway, or light rail) (Priority 1, Priority 2, Priority 3; 59, 118, 139)
    - To or from shopping (Priority 1, Priority 2, Priority 3; 69, 191, 246)
    - To or from school, university, college, or educational institution (Priority 1, Priority 2, Priority 3; 64, 83, 76)
    - Other (specify) (Priority 1, Priority 2, Priority 3; 28, 20, 14)

18. In general, if ride-sharing services were unavailable, which transportation alternatives would you use for the trips that you now make using ridesharing? (Select all that apply.)

    - Walk (46.2%)
    - Bike (16.4%)
    - Public transit (65.1%)
    - Drive alone (29.9%)
    - Carpool (14.8%)
    - Taxi (40.5%)
    - Car-sharing service (10.4%)
    - No suitable alternative (2.2%)
    - Other (specify) (1.9%)

Please watch the following video on self-driving vehicles before continuing with the next questions. In our study, we are interested in your opinions about self-driving vehicles. Self-driving vehicles, also known as autonomous or driverless cars, are capable of responding to the environment and navigating without a driver controlling the vehicle. In the following questions, whenever you read the term *self-driving vehicle*, imagine a car with no steering wheel that operates like a chauffeur. You may be able to buy a self-driving vehicle from major manufacturers or access one through a ride- or car-sharing service within the next three to five years.

[PROGRAMMER NOTE: VIDEO INSERTED ON NEXT PAGE]

19. Have you ever heard of self-driving vehicles before participating in this survey?

    - Yes (93.0%)
    - No (5.7%)
    - I do not know (1.3%)

20. Using a scale of 1 (not true of me) to 5 (very true of me), to what extent do the following statements describe you? [SCALE: 1 = NOT TRUE OF ME, 2 = SOMEWHAT UNTRUE OF ME, 3 = NEUTRAL, 4 = SOMEWHAT TRUE OF ME, 5 = VERY TRUE OF ME]

    - I have concerns about using self-driving vehicles. (1 = 10.6%, 2 = 10.5%, 3 = 20.5%, 4 = 37.1%, 5 = 21.3%)
    - Self-driving vehicles are somewhat frightening to me. (1 = 15.3%, 2 = 14.8%, 3 = 23.0%, 4 = 31.8%, 5 = 15.1%)
    - Learning to operate a self-driving vehicle would be easy for me. (1 = 5.5%, 2 = 8.5%, 3 = 28.4%, 4 = 30.4%, 5 = 27.2%)

21. Using a scale of 1 (strongly disagree) to 5 (strongly agree), to what extent do you disagree or agree with the following statements? [SCALE: 1 = STRONGLY DISAGREE, 2 = SOMEWHAT DISAGREE, 3 = NEITHER DISAGREE NOR AGREE, 4 = SOMEWHAT AGREE, 5 = STRONGLY AGREE]

    - Self-driving vehicles would make traveling more interesting. (1 = 6.5%, 2 = 8.8%, 3 = 23.9%, 4 = 34.2%, 5 = 26.5%)
    - Using a self-driving vehicle would be fun. (1 = 6.7%, 2 = 8.8%, 3 = 26.0%, 4 = 34.3%, 5 = 24.1%)
    - Using a self-driving vehicle would increase accident risk. (1 = 13.8%, 2 = 17.7%, 3 = 35.4%, 4 = 22.6%, 5 = 10.5%)

22. Imagine that self-driving vehicles were on the market now 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. [SCALE: 1 = EXTREMELY UNLIKELY, 2 = SOMEWHAT UNLIKELY, 3 = SOMEWHAT LIKELY, 4 = EXTREMELY LIKELY]

Action	(1) Extremely Unlikely	(2) Somewhat Unlikely	(3) Somewhat Likely	(4) Extremely Likely
Purchase a self-driving vehicle	35.5%	28.7%	27.2%	8.7%
Use a self-driving vehicle as part of **car-sharing** services (e.g., Zipcar or car2go)	23.5%	26.2%	35.4%	14.8%
Use a self-driving vehicle as part of **ride-sharing** services (e.g., Lyft or Uber)	17.2%	20.5%	36.9%	25.4%

23. Why would you be **likely** to **purchase** a self-driving vehicle? (Select all that apply.) [RESPONSES ARE RANDOMIZED]

- Ability to be productive while in vehicle because not driving (21.0%)
- Attraction of newest driving technology (13.2%)
- Trust that technology will be adequately tested before operational on public roads (17.9%)
- Safer than conventional vehicle (15.2%)
- Mobility enabler for seniors, disabled, or other persons who are unable to drive (9.0%)
- Relieves stress of driving myself (23.2%)
- Lower insurance costs (16.2%)
- Other (specify) (0.8%)

24. Why would you be **unlikely** to **purchase** a self-driving vehicle? (Select all that apply.) [RESPONSES ARE RANDOMIZED]

- Concern about vehicle's capability to safely react to other cars, bicyclists, pedestrians, etc. (31.6%)
- Concern that vehicle may be hacked (20.9%)
- Cost (too expensive at purchase) (29.7%)
- Lack information about self-driving vehicles (15.4%)
- Lack of trust in technology (too new) (28.4%)
- Privacy concerns and that my trips will be tracked (14.8%)
- No need for it (24.6%)
- Like to drive myself in general (21.2%)
- I won't be able to take over control in a potential crash situation (23.8%)
- Insurance/liability uncertainties in case of accident (20.6%)
- Cost (too expensive to maintain and repair) (25.1%)
- Other (specify) (3.0%)

25. Why would you be **likely** to use a self-driving vehicle in the form of a **car-sharing service**? (Select all that apply.) [RESPONSES ARE RANDOMIZED]

- Ability to be productive while in vehicle because not driving (19.0%)
- Attraction of newest driving technology (14.0%)
- Trust that technology will be adequately tested before operational on public roads (18.0%)
- Safer than conventional vehicle (13.4%)

- Costs of sharing a vehicle will be lower than owning a self-driving vehicle (23.2%)
- Mobility enabler for seniors, disabled, or other persons who are unable to drive (8.0%)
- Relieves stress of driving myself (21.6%)
- Carsharing is a very convenient option for me (19.9%)
- Want to avoid having to purchase another household vehicle (self-driving or otherwise) (14.9%)
- Want to test (experience) self-driving vehicles without having to own one (22.8%)
- Other (specify) (0.4%)

26. Why would you be **unlikely** to use a self-driving vehicle in the form of a **car-sharing service**? (Select all that apply.) [RESPONSES ARE RANDOMIZED]

    - Concern about vehicle's capability to safely react to other cars, bicyclists, pedestrians, etc. (20.7%)
    - Concern that vehicle may be hacked (12.4%)
    - Cost (too expensive) (9.6%)
    - Lack information about self-driving, car-sharing vehicles (11.4%)
    - Lack of trust in technology (too new) (17.9%)
    - Privacy concerns and that my trips will be tracked (10.0%)
    - No need for it (11.8%)
    - Like to drive myself in general (9.0%)
    - Car-sharing options are not convenient for me to use (7.8%)
    - I don't use carsharing now, and I'm not likely to change (11.9%)
    - Uncertainty about who to contact in case of emergency while on a trip (11.6%)
    - Concerns about operational safety of vehicle I do not own (16.1%)
    - I like to own my own vehicle instead of share one (8.2%)
    - I won't be able to take over control in a potential crash situation (15.9%)
    - Insurance/liability uncertainties in case of accident (11.5%)
    - Other (specify) (1.4%)

27. Why would you be **likely** to use a self-driving vehicle in the form of a **ride-sharing service**? (Select all that apply.) [RESPONSES ARE RANDOMIZED]

    - Ability to be productive while in vehicle because not driving (23.1%)
    - Attraction of newest driving technology (17.6%)
    - Trust that technology will be adequately tested before operational on public roads (23.3%)
    - Safer than conventional vehicle (16.4%)
    - Costs of ridesharing will be lower than owning a self-driving vehicle (28.6%)
    - Mobility enabler for seniors, disabled, or other persons who are unable to drive (9.7%)
    - Relieves stress of driving myself (24.5%)
    - Ridesharing is a very convenient option for me (32.6%)
    - Want to avoid having to purchase another household vehicle (self-driving or otherwise) (16.2%)
    - Want to test (experience) self-driving vehicles without having to own one (26.2%)
    - Other (specify) (1.0%)

28. Would you most **likely** use the self-driving ride-sharing service as a **pooled/shared service** (where you ride with people you do not know) or as **non-shared service** (where you ride alone or with your traveling companions)?

    - Pooled/shared with unknown persons [GO TO Q29, THEN Q32] (9.8%)
    - Non-shared, alone or with traveling companions [GO TO Q30, THEN Q32] (41.1%)

- Equally likely to use as a pooled/shared service or as a non-shared service [GO TO Q32] (49.1%)

29. What would be your motivation for using a self-driving ride-sharing service as a pooled/shared service? [RECORD OPEN TEXT RESPONSE]

    - The reduced cost of using self-driving ridesharing as a pooled/shared service (34.7%)
    - The ability to use the latest technology as a pooled/shared service (8.3%)
    - The experience of using self-driving ridesharing as a pooled/shared service (14.6%)
    - The convenience or comfort offered by using self-driving ridesharing as a pooled/shared service (12.5%)
    - The efficiency and productivity of using self-driving ridesharing as a pooled/shared service (9.7%)
    - The liability or safety of using self-driving ridesharing as a pooled/shared service (16.7%)
    - The convenience or comfort offered by using self-driving ridesharing as a pooled/shared service (12.5%)
    - I would like to use using self-driving ridesharing as a pooled/shared service for my commute (2.1%)
    - The environmental friendliness offered by using self-driving ridesharing as a pooled/shared service (3.5%)
    - I would be more trusting of self-driving ride-sharing services when used as a pooled/shared service (0.7%)
    - Some other reason (11.8%)

30. Why would you **not** use a self-driving ride-sharing service as a pooled/shared service? [RECORD OPEN TEXT RESPONSE]

    - The reduced cost of using self-driving ridesharing as a pooled/shared service is not significant enough or not as inexpensive as public transit (2.0%)
    - The technology is still too new/not vetted (2.3%)
    - The experience of using self-driving ridesharing as a pooled/shared service is not attractive to me because I'm not comfortable riding with strangers (35.6%)
    - The inconvenience or discomfort associated with using self-driving ridesharing as a pooled/shared service is a turn-off (11.7%)
    - Using self-driving ridesharing as a pooled/shared service would take too long, adding time to my trip (12.7%)
    - The unknown liability if there was an accident or feeling unsafe when using self-driving ridesharing as a pooled/shared service (1.2%)
    - My commute would not align well with using self-driving ridesharing as a pooled/shared service (2.1%)
    - I don't use the pooled/shared option for ride-sharing services now. Why would I use them when offered as a self-driving service? (13.8%)
    - I would have a difficult time trusting the vehicle or the technology (7.3%)
    - Privacy issues (4.9%)
    - Some other reason (12.4%)

31. Why would you be **unlikely** to use a self-driving vehicle in the form of a **ride-sharing service**? (Select all that apply.) [RESPONSES ARE RANDOMIZED]

    - Concern about vehicle's capability to safely react to other cars, bicyclists, pedestrians, etc. (20.2%)
    - Concern that vehicle may be hacked (11.5%)
    - Cost (too expensive) (6.2%)
    - Lack information about self-driving ride-sharing services (10.2%)
    - Lack of trust in technology (14.8%)
    - Privacy concerns and that my trips will be tracked (8.6%)
    - No need for it (8.3%)
    - Like to drive myself in general (6.1%)
    - Ride-sharing options are not convenient for me to use (4.0%)
    - I don't use ridesharing now, and I'm not likely to change (4.0%)
    - Uncertainty about who to contact in case of emergency while on trip (11.2%)
    - Concerns about operational safety of vehicle I do not own (14.1%)
    - I like convenience of owning my own vehicle instead of hailing one (4.9%)
    - Other (specify) (0.8%)

32. What type of neighborhood do you currently live in?

    - Downtown (25.8%)
    - Residential neighborhood in a central area (50.4%)
    - Residential neighborhood in the suburbs (19.3%)
    - Small town (2.6%)
    - Rural area (1.9%)

33. What is your gender?

    - Male (44.0%)
    - Female (54.3%)
    - Other (1.7%)

34. What is your current level of employment?

    - Employed full time (75.4%)
    - Employed part time (11.9%)
    - Retired (3.9%)
    - Not retired and not currently employed (8.7%)

35. Are you a full- or part-time student?

    - Full-time student (14.8%)
    - Part-time student (6.4%)
    - Not a student (78.7%)

36. Do you have any medical conditions that prohibit you from driving?

    - Yes (2.9%)
    - No (97.1%)

37. Do you currently have a driver's license?

    - Yes (82.4%)
    - No (17.6%)

38. How many persons live in your household (including you)?

    - One [GO TO Q40] (26.7%)
    - Two (37.8%)
    - Three (16.9%)
    - Four (10.7%)
    - Five or more (7.9%)

39. How many children 16 or younger live in your household?

    - None (78.4%)
    - One (11.2%)
    - Two (6.9%)
    - Three or more (3.5%)

40. What best describes your total household income for last year?

    - Less than $25,000 (9.0%)
    - $25,000 to $49,999 (17.5%)
    - $50,000 to $99,999 (26.4%)
    - $100,000 to $149,999 (14.9%)
    - $150,000 to $199,999 (7.8%)
    - $200,000 to $249,000 (4.8%)
    - $250,000 or more (7.1%)
    - I prefer not to answer (12.5%)

41. How much did viewing the video influence your intention to use a self-driving vehicle?

    - Extremely (6.6%)
    - Somewhat (35.9%)
    - Very little (30.2%)
    - Not at all (27.4%)

42. We are interested in conducting a follow-up study on future travel behaviors. Would you be interested in participating in a telephone interview? You would receive an additional $10 ride discount from Lyft. Please note that your agreement to participate does not guarantee your selection for the follow-up study. [THIS QUESTION WORKS OFF A QUOTA. ONCE 10 INDIVIDUALS FROM EACH MAJOR GEOGRAPHY AGREE AND PROVIDE CONTACT INFORMATION, THIS QUESTION IS NO LONGER ASKED FOR THAT SPECIFIC GEOGRAPHY]

    - Yes (52.7%)
    - No (47.3%)

43. Please provide the following information so we may contact you for the follow-up telephone interview.

    - First name
    - Last name
    - Phone (123-123-1234)

APPENDIX B: ONLINE NON-RIDE-HAILING SURVEY DRAFT WITH FREQUENCIES[3]

Informed Consent

You are being invited to take part in a research study, which includes an online survey conducted by the Texas A&M Transportation Institute (TTI). The purpose of this study is to examine the factors that might influence people's future use of self-driving vehicles. This survey will take about 10 minutes to complete.

The questions that you will be asked to answer pose no more risks to you than you would come across in everyday life. Your participation is entirely voluntary, and you can refuse to take part at any time. You will be compensated by ResearchNow for participating in the study in the form of virtual currency based on your earlier agreement as a panel survey member.

Information about you and related to this study will be kept confidential to the extent required or permitted by law. No identifier linking you to this study will be included in any report that might be published. Information about you will be stored in computer files that are protected with a password. Only the principal investigator and research study personnel have access to your information.

You may read the Survey Information Sheet for additional information.

If you would like more details or have any concerns about this research, you may contact TTI researcher Ipek Sener at 512-407-1119 or i-sener@tti.tamu.edu. For questions about your rights as a research participant, to provide input regarding this research, or if you have questions, complaints, or concerns about the research, you may call the Texas A&M University Human Subjects Protection Program office by phone at 1-979-458-4067 or toll-free at 1-855-795-8636, or by email at irb@tamu.edu.

If you would like to take part in the study, please continue by clicking the "Next" button below.

[3] These frequencies are based on survey completion (i.e., respondents who answered every question they should have; N = 1206).

Questionnaire

1. How old are you? [RECORD OPEN NUMERIC RESPONSE; IF LESS THAN 18, THANK AND TERMINATE]
    - 18–24 (6.9%)
    - 25–34 (18.0%)
    - 35–44 (24.6%)
    - 45–54 (9.3%)
    - 55–64 (15.8%)
    - 65+ (25.4%)
2. In which city/region do you live?
    - Boston (25.6%)
    - Phoenix (25.0%)
    - Las Vegas (24.5%)
    - San Francisco/Silicon Valley (25.0%)
3. Have you ever used ride-sharing services (e.g., Lyft or Uber)?
    - No (100%)
4. Using a scale of 1 (strongly disagree) to 5 (strongly agree), to what extent do you agree or disagree with the following statements? [SCALE: 1 = STRONGLY DISAGREE, 2 = SOMEWHAT DISAGREE, 3 = NEITHER DISAGREE NOR AGREE, 4 = SOMEWHAT AGREE, 5 = STRONGLY AGREE]
    - It is important to keep up with the latest trends in technology. (1 = 6.4%, 2 = 8.6%, 3 = 23.8%, 4 = 43.1%, 5 = 18.1%)
    - New technology makes life more complicated. (1 = 10.8%, 2 = 24.1%, 3 = 36.1%, 4 = 23.5%, 5 = 5.6%)
    - Technology will provide solutions to many of our problems. (1 = 2.9%, 2 = 6.4%, 3 = 30.4%, 4 = 44.4%, 5 = 15.9%)
5. How often do you use the following technologies? (6 = several times per hour, 5 = several times per day, 4 = several times per week, 3 = several times per month, 2 = a few times per year, and 1 = never) [IF “NEVER” TO ALL OPTIONS, SKIP TO Q7]
    - Smartphones (1 = 13.0%, 2 = 2.4%, 3 = 3.3%, 4 = 6.6%, 5 = 40.8%, 6 = 33.9%)
    - Facebook (1 = 26.9%, 2 = 6.3%, 3 = 8.8%, 4 = 18.3%, 5 = 31.5%, 6 = 8.2%)
    - Internet shopping (1 = 6.6%, 2 = 27.4%, 3 = 35.7%, 4 = 23.3%, 5 = 5.1%, 6 = 1.8%)
    - Emailing (1 = 2.8%, 2 = 5.4%, 3 = 10.4%, 4 = 24.8%, 5 = 42.2%, 6 = 14.3%)
    - Text messaging (1 = 10.5%, 2 = 4.6%, 3 = 8.6%, 4 = 22.2%, 5 = 38.8%, 6 = 15.2%)
6. How concerned are you about the privacy of your personal information when you use internet-enabled technologies or services today?
    - Not concerned at all (4.7%)
    - Somewhat concerned (in some situations) (34.2%)
    - Moderately concerned (in most situations) (33.8%)
    - Extremely concerned (in all situations) (27.3%)

7. When it comes to adopting new technology, are you typically a(n) early adopter, late adopter, or laggard?

    - Early adopter—I am among the first of my friends to adopt new technology. (17.0%)
    - Late adopter—I wait awhile before adopting new technology. (61.9%)
    - Laggard—I am among the last of my friends to adopt new technology, if I adopt at all. (21.1%)

8. How many vehicles are in your household (including cars, trucks, SUVs, and vans—owned, leased, and company vehicles)?

    - 0 [SKIP TO Q12] (7.2%)
    - 1 (39.0%)
    - 2 (39.9%)
    - 3 or more (13.9%)

9. Are any of your vehicles electric or hybrid?

    - Yes (9.6%)
    - No (90.4%)

10. Which of the following advanced driver assistance systems features do any of your vehicles have? (Select all that apply.)

    - None (67.7%)
    - Emergency breaking assist (12.3%)
    - Lane keeping assist or lane departure warning system (10.6%)
    - Lane change assist (6.9%)
    - Automatic parking assist (4.4%)
    - Collision warning system (11.5%)
    - Other advanced driver assistance systems feature (8.1%)

11. Is one of the household vehicles for your sole use?

    - Yes (82.3%)
    - No (17.7%)

12. Are you, or have you been, a member of a car-share program (e.g., car2go or Zipcar)?

    - Yes (2.3%)
    - No (97.7%)

In our study, we are interested in your opinions about self-driving vehicles. Self-driving vehicles, also known as autonomous or driverless cars, are capable of responding to the environment and navigating without a driver controlling the vehicle. In the following questions, whenever you read the term *self-driving vehicle*, imagine a car with no steering wheel that operates like a chauffeur. You may be able to buy a self-driving vehicle from major manufacturers or access one through a ride- or car-sharing service within the next three to five years.

Please click "Next Page," and watch the video on self-driving vehicles before continuing with the next questions.

[PROGRAMMER NOTE: VIDEO INSERTED ON NEXT PAGE]

13. Have you ever heard of self-driving vehicles before participating in this survey?

    - Yes (85.7%)
    - No (12.3%)
    - I do not know (2.0%)

14. Using a scale of 1 (not true of me) to 5 (very true of me), to what extent do the following statements describe you? [SCALE: 1 = NOT TRUE OF ME, 2 = SOMEWHAT UNTRUE OF ME, 3 = NEUTRAL, 4 = SOMEWHAT TRUE OF ME, 5 = VERY TRUE OF ME]

    - I have concerns about using self-driving vehicles. (1 = 4.6%, 2 = 5.5%, 3 = 19.5%, 4 = 37.8%, 5 = 32.6%)
    - Self-driving vehicles are somewhat frightening to me. (1 = 9.0%, 2 = 12.4%, 3 = 26.0%, 4 = 30.3%, 5 = 22.2%)
    - Learning to operate a self-driving vehicle would be easy for me. (1 = 8.5%, 2 = 10.7%, 3 = 37.6%, 4 = 28.2%, 5 = 15.0%)

15. Using a scale of 1 (strongly disagree) to 5 (strongly agree), to what extent do you disagree or agree with the following statements? [SCALE: 1 = STRONGLY DISAGREE, 2 = SOMEWHAT DISAGREE, 3 = NEITHER DISAGREE NOR AGREE, 4 = SOMEWHAT AGREE, 5 = STRONGLY AGREE]

    - Self-driving vehicles would make traveling more interesting. (1 = 10.0%, 2 = 10.8%, 3 = 25.7%, 4 = 37.0%, 5 = 16.5%)
    - Using a self-driving vehicle would be fun. (1 = 11.9%, 2 = 13.3%, 3 = 30.5%, 4 = 29.6%, 5 = 14.7%)
    - Using a self-driving vehicle would increase accident risk. (1 = 7.8%, 2 = 14.3%, 3 = 37.7%, 4 = 24.0%, 5 = 16.2%)

16. Imagine that self-driving vehicles were on the market now 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. [SCALE: 1 = EXTREMELY UNLIKELY, 2 = SOMEWHAT UNLIKELY, 3 = SOMEWHAT LIKELY, 4 = EXTREMELY LIKELY]

Action	(1) Extremely Unlikely	(2) Somewhat Unlikely	(3) Somewhat Likely	(4) Extremely Likely
Purchase a self-driving vehicle	39.8%	31.2%	23.3%	5.7%
Use self-driving vehicles as part of **car-sharing** services (e.g., Zipcar or car2go)	43.4%	33.4%	19.5%	3.6%
Use self-driving vehicles as part of **ride-sharing** services (e.g., Lyft or Uber)	40.7%	31.6%	22.0%	5.7%

17. Why would you be **likely** to **purchase** a self-driving vehicle? (Select all that apply.) [RESPONSES ARE RANDOMIZED]

- Ability to be productive while in vehicle because not driving (12.9%)
- Attraction of newest driving technology (8.7%)
- Trust that technology will be adequately tested before operational on public roads (15.1%)
- Safer than conventional vehicle (11.8%)
- Mobility enabler for seniors, disabled, or other persons who are unable to (12.7%)
- Relieves stress of driving myself (18.2%)
- Lower insurance costs (12.8%)
- Other (specify) (1.7%)

18. Why would you be **unlikely** to **purchase** a self-driving vehicle? (Select all that apply.) [RESPONSES ARE RANDOMIZED]

- Concern about vehicle's capability to safely react to other cars, bicyclists, pedestrians, etc. (37.6%)
- Concern that vehicle may be hacked (27.1%)
- Cost (too expensive at purchase) (34.6%)
- Lack information about self-driving vehicles (16.6%)
- Lack of trust in technology (too new) (37.6%)
- Privacy concerns and that my trips will be tracked (16.6%)
- No need for it (25.8%)
- Like to drive myself in general (31.4%)
- I won't be able to take over control in a potential crash situation (27.4%)
- Insurance/liability uncertainties in case of accident (26.9%)
- Cost (too expensive to maintain and repair) (29.7%)
- Other (specify) (2.5%)

19. Why would you be **likely** to use a self-driving vehicle in the form of a **car-sharing service**? (Select all that apply.) [RESPONSES ARE RANDOMIZED]

- Ability to be productive while in vehicle because not driving (7.9%)
- Attraction of newest driving technology (5.9%)

- Trust that technology will be adequately tested before operational on public roads (7.9%)
- Safer than conventional vehicle (5.2%)
- Costs of sharing a vehicle will be lower than owning a self-driving vehicle (9.5%)
- Mobility enabler for seniors, disabled, or other persons who are unable to drive (7.8%)
- Relieves stress of driving myself (9.7%)
- Carsharing is a very convenient option for me (4.6%)
- Want to avoid having to purchase another household vehicle (self-driving or otherwise) (6.1%)
- Want to test (experience) self-driving vehicles without having to own one (10.1%)
- Other (specify) (0.5%)

20. Why would you be **unlikely** to use a self-driving vehicle in the form of a **car-sharing service**? (Select all that apply.) [RESPONSES ARE RANDOMIZED]

    - Concern about vehicle's capability to safely react to other cars, bicyclists, pedestrians, etc. (21.3%)
    - Concern that vehicle may be hacked (16.5%)
    - Cost (too expensive) (17.2%)
    - Lack information about self-driving, car-sharing vehicles (13.8%)
    - Lack of trust in technology (too new) (22.1%)
    - Privacy concerns and that my trips will be tracked (11.0%)
    - No need for it (27.2%)
    - Like to drive myself in general (23.4%)
    - Car-sharing options are not convenient for me to use (22.6%)
    - I don't use carsharing now, and I'm not likely to change (38.0%)
    - Uncertainty about who to contact in case of emergency while on a trip (11.5%)
    - Concerns about operational safety of vehicle I do not own (21.0%)
    - I like to own my own vehicle instead of share one (32.3%)
    - I won't be able to take over control in a potential crash situation (16.0%)
    - Insurance/liability uncertainties in case of accident (14.8%)
    - Other (specify) (1.5%)

21. Why would you be **likely** to use a self-driving vehicle in the form of a **ride-sharing service**? (Select all that apply.) [RESPONSES ARE RANDOMIZED]

    - Ability to be productive while in vehicle because not driving (8.6%)
    - Attraction of newest driving technology (6.8%)
    - Trust that technology will be adequately tested before operational on public roads (8.4%)
    - Safer than conventional vehicle (5.1%)
    - Costs of ridesharing will be lower than owning a self-driving vehicle (11.2%)
    - Mobility enabler for seniors, disabled, or other persons who are unable to drive (9.0%)
    - Relieves stress of driving myself (11.6%)
    - Ridesharing is a very convenient option for me (4.7%)
    - Want to avoid having to purchase another household vehicle (self-driving or otherwise) (7.8%)
    - Want to test (experience) self-driving vehicles without having to own one (11.9%)
    - Other (specify) (0.7%)

22. Would you most **likely** use the self-driving ride-sharing service as a **pooled/shared service** (where you ride with people you do not know) or as **non-shared service** (where you ride alone or with your traveling companions)?

- Pooled/shared with unknown persons [GO TO Q23, THEN Q26] (8.4%)
- Non-shared, alone or with traveling companions [GO TO Q24, THEN Q26] (57.2%)
- Equally likely to use as a pooled/shared service or as a non-shared service [GO TO Q26] (34.4%)

23. What would be your motivation for using a self-driving ride-sharing service as a pooled/shared service? [RECORD OPEN TEXT RESPONSE]

    - It would reduce the cost of ride-sharing services (5.9%)
    - Would not have to make small talk with driver or passengers (5.9%)
    - Don't have a driver's license/don't drive well (17.6%)
    - There is no risk of driver issues (11.8%)
    - No specific reason (5.9%)
    - It would be more environmentally friendly (5.9%)
    - It would reduce driving under the influence of drugs or alcohol (11.8%)
    - Some other reason (35.3%)

24. Why would you **not** use a self-driving ride-sharing service as a pooled/shared service? [RECORD OPEN TEXT RESPONSE]

    - The cost is too high (2.5%)
    - I like to interact with passengers/drivers (10.0%)
    - It would make my trip longer than necessary (time or distance) (5.0%)
    - It would make me feel unsafe (7.5%)
    - I'm just not interested in ridesharing or the technology or don't see a need for it (35.0%)
    - I don't trust the technology (5.0%)
    - It would take jobs away from drivers (12.5%)
    - Some other reason (22.5%)

25. Why would you be **unlikely** to use a self-driving vehicle in the form of a **ride-sharing service**? (Select all that apply.) [RESPONSES ARE RANDOMIZED]

    - Concern about vehicle's capability to safely react to other cars, bicyclists, pedestrians, etc. (19.5%)
    - Concern that vehicle may be hacked (13.8%)
    - Cost (too expensive) (14.7%)
    - Lack information about self-driving ride-sharing services (12.0%)
    - Lack of trust in technology (18.5%)
    - Privacy concerns and that my trips will be tracked (10.0%)
    - No need for it (30.4%)
    - Like to drive myself in general (24.5%)
    - Ride-sharing options are not convenient for me to use (25.0%)
    - I don't use ridesharing now, and I'm not likely to change (36.2%)
    - Uncertainty about who to contact in case of emergency while on trip (9.8%)
    - Concerns about operational safety of vehicle I do not own (17.7%)
    - I like convenience of owning my own vehicle instead of hailing one (25.4%)
    - Other (specify) (0.7%)

26. What type of neighborhood do you currently live in?

    - Downtown (4.0%)

- Residential neighborhood in a central area (27.7%)
- Residential neighborhood in the suburbs (50.2%)
- Small town (10.9%)
- Rural area (7.1%)

27. What is your gender?

- Male (49.3%)
- Female (50.5%)
- Other (0.2%)

28. What is your current level of employment?

- Employed full time (39.8%)
- Employed part time (12.1%)
- Retired (29.6%)
- Not retired and not currently employed (18.5%)

29. Are you a full- or part-time student?

- Full-time student (6.6%)
- Part-time student (3.6%)
- Not a student (89.9%)

30. Do you have any medical conditions that prohibit you from driving?

- Yes (3.1%)
- No (96.9%)

31. Do you currently have a driver's license?

- Yes (90.0%)
- No (10.0%)

32. How many persons live in your household (including you)?

- One [GO TO Q34] (22.2%)
- Two (38.3%)
- Three (16.2%)
- Four (13.7%)
- Five or more (9.6%)

33. How many children 16 or younger live in your household?

- None (65.7%)
- One (16.3%)
- Two (11.9%)
- Three or more (6.1%)

34. What best describes your total household income for last year?

- Less than $25,000 (12.8%)
- $25,000 to $49,999 (18.8%)
- $50,000 to $99,999 (33.4%)
- $100,000 to $149,999 (14.5%)

- $150,000 to $199,999 (5.8%)
- $200,000 to $249,000 (1.7%)
- $250,000 or more (2.0%)
- I prefer not to answer (10.9%)

35. How much did viewing the video influence your intention to use a self-driving vehicle?

    - Extremely (7.8%)
    - Somewhat (35.3%)
    - Very little (29.9%)
    - Not at all (26.9%)

36. We are interested in conducting a follow-up study on future travel behaviors. Would you be interested in participating in a telephone interview? You would receive an additional $10 gift card from the research team. Please note that your agreement to participate does not guarantee your selection for the follow-up study. [THIS QUESTION WORKS OFF A QUOTA. ONCE 10 INDIVIDUALS FROM EACH MAJOR GEOGRAPHY AGREE AND PROVIDE CONTACT INFORMATION, THIS QUESTION IS NO LONGER ASKED FOR THAT SPECIFIC GEOGRAPHY]

    - Yes (32.3%)
    - No (67.7%)

37. Please provide the following information so we may contact you for the follow-up telephone interview.

    - First name
    - Last name
    - Phone (123-123-1234)