Will Car-less Millennials Start Owning Cars Anytime Soon?

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Mobility of Millennials in California
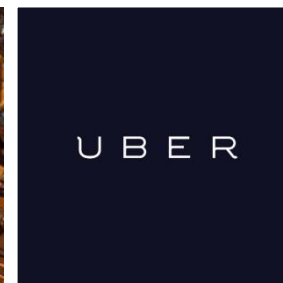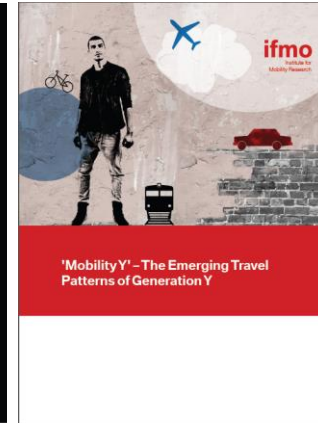
Interest in better understanding:

- The relationships among *millennials' personal attitudes*, *lifestyles* and *actual behaviors*

  …do they behave differently from previous generations?

- Impact of *classical* (economic and non-economic) variables vs. *specific factors affecting millennials' choices* (e.g. adoption of technology, shared mobility, etc.)

- Their *aspirations for/opinions about life and future mobility* (e.g. major life changes, purchase and use of cars vs. use of other modes)

(2)

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"Millennials"

- Millennials comprise a large and active segment of the population

- Often described as heavy adopters of *technology* and *social media*

- Less dependent on cars, and adaptable to the *sharing economy*

- Suffered economic recession, and now climbing the income ladder

- *Often* prefer urban locations and social lifestyles (at least *in some regions*)

- The focus is mainly on *urban population*…

Potential Factors Affecting the Mobility of Millennials

Economic	Auto Costs	Technology	Demographic Change
• Recession • Unemployment 	• Gasoline • Auto insurance • Driver's education • Auto repairs • Other fees	• Communication technology • Transportation technology (Über)	• Delayed marriage • Fewer children • Boomerang
Residential Location • More likely to move to and live in cities	**Cultural** • Environmentalists • Less materialistic 	**Regulatory Changes** • Graduated Driver's Licensing • Texting while driving laws	**Alternative Modes** • **Better transit** • **Improved infrastructure for walking/biking**

(Source: Blumenberg, 2014)

Common Limitations of Previous Studies

Lack of information on key variables:

- e.g. *personal attitudes and preferences* for studies based on the analysis of National Household Travel Survey data

Use of non-random samples:

- e.g. *convenience samples* for studies on university students

California Millennial Study

- Statewide study of emerging trends in transportation in California

- Design of a detailed online survey to collect information from millennials

- Survey distributed through an opinion panel to a sample of Millennials (18-34) and Generation X (35-50) during fall 2015

- Quota sampling by geographic region and neighborhood type

- Part of a longitudinal study of millennials' behavior (with rotating panel)

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- Lew Fulton

- Pat Mokhtarian

- Susan Handy

- Farzad Alemi

- Rosaria Berliner

- Kate Tiedeman

- Yongsung Lee

Survey Content

A. *Individual Attitudes and Preferences (general, environmental, technology, lifestyles, etc.)*
B. *Online Social Media and Adoption of Technology*
C. *Residential Location and Living Arrangements*
D. *Employment and Work/Study Activities*
E. *Transportation Mode Perceptions*
F. *Current Travel Behavior*
G. *Shared Mobility Services (e.g. car-sharing, Uber, Lyft, etc.)*
H. *Driver's License and Vehicle Ownership*
I. *Previous Travel Behavior and Residential Location*
J. *Aspirations for/Opinions about Future Mobility*
K. *Sociodemographic Traits*

Individual Attitudes and Preferences

UCDAVIS
UNIVERSITY OF CALIFORNIA

Section A: Your Opinions on Various Topics

To begin, we'd like to learn more about your opinions on various issues related to transportation, residential location and lifestyles. This will give us a more complete context for understanding your answers to later questions. We want your honest opinion on each statement contained in the next three tables (or your best guess, for topics you are not very familiar with) – **there are no *"right"* or *"wrong"* answers in this survey!**

Please choose the response that most closely fits your reaction to each of the following statements.

(1 of 3) Your opinions and preferences about personal lifestyles and residential location

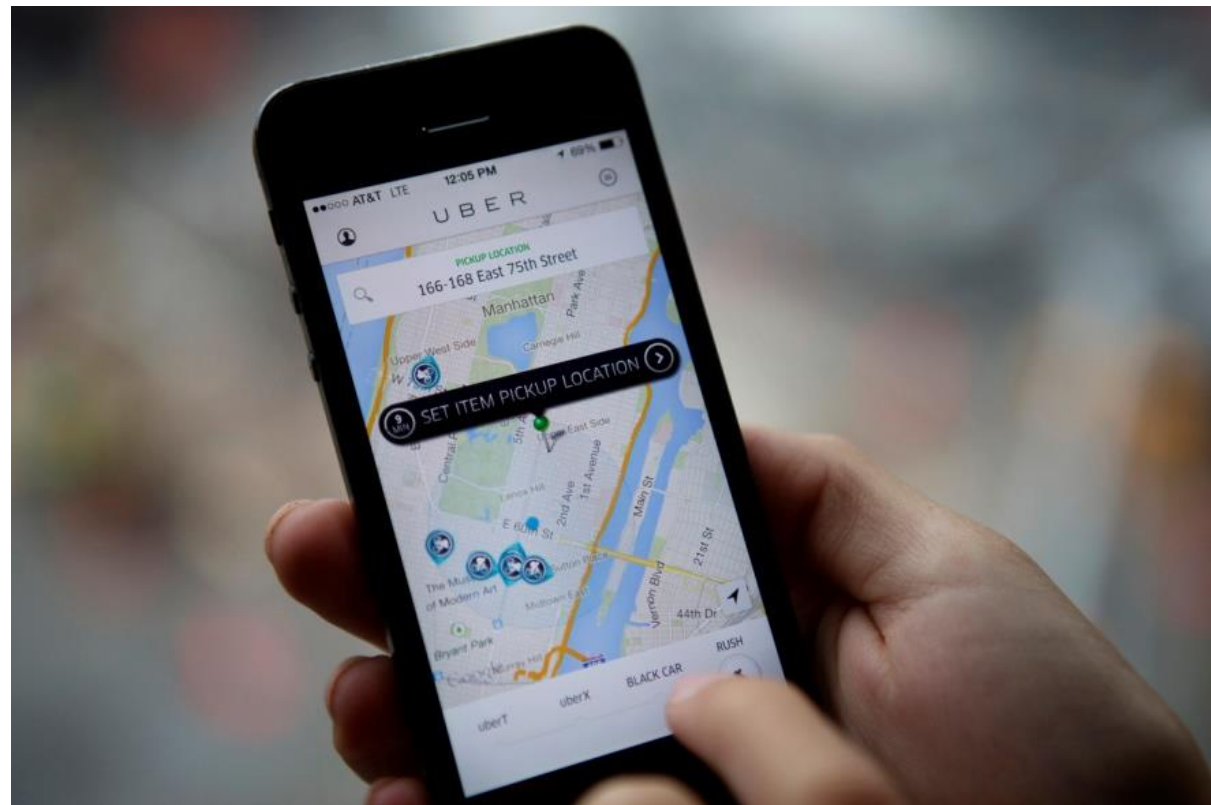|	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I prefer to live close to transit, even if it means I'll have a smaller home and live in a more crowded area.	○	○	○	○	○
Getting regular exercise is very important to me.	○	○	○	○	○
I like sticking to a routine.	○	○	○	○	○
I prefer to live in a spacious home, even if it is farther from public transportation and most destinations.	○	○	○	○	○
Individuals should generally put the needs of the group ahead of their own.	○	○	○	○	○
Doing two or more activities at the same time is the most efficient way to use my time.	○	○	○	○	○
I like the idea of having different types of businesses (such as stores, offices, post office, bank, library) mixed in with the homes in my neighborhood.	○	○	○	○	○
The importance of exercise is overrated.	○	○	○	○	○

What is the Impact of Emerging Technologies?

- Smartphones (GPS, access to more info)

- Increasing opportunities to multitask

- Integrated ride-sharing / shared mobility

- Lower levels of car-ownership

- Extend range of public transportation

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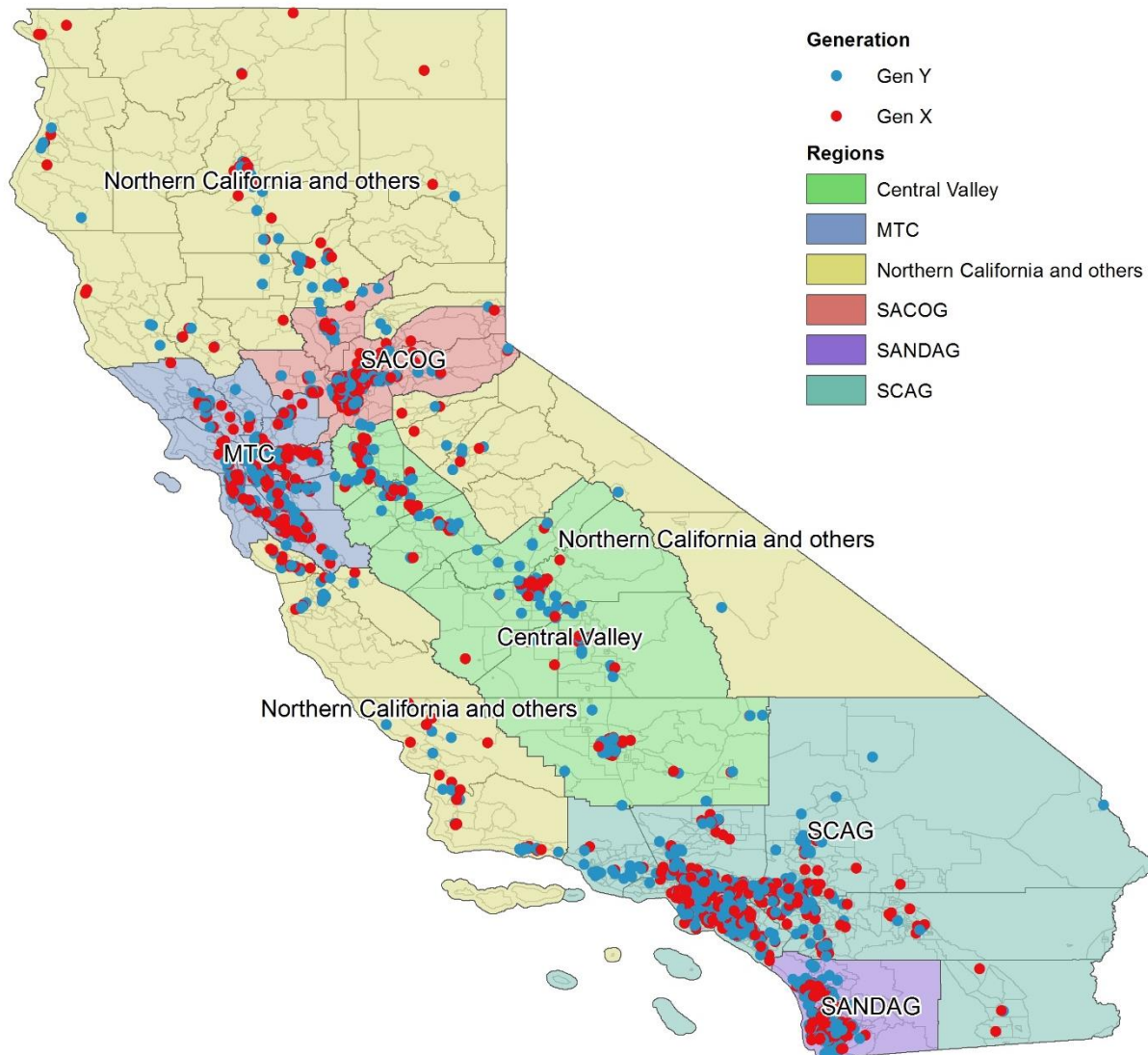# Car Ownership vs. Shared Mobility
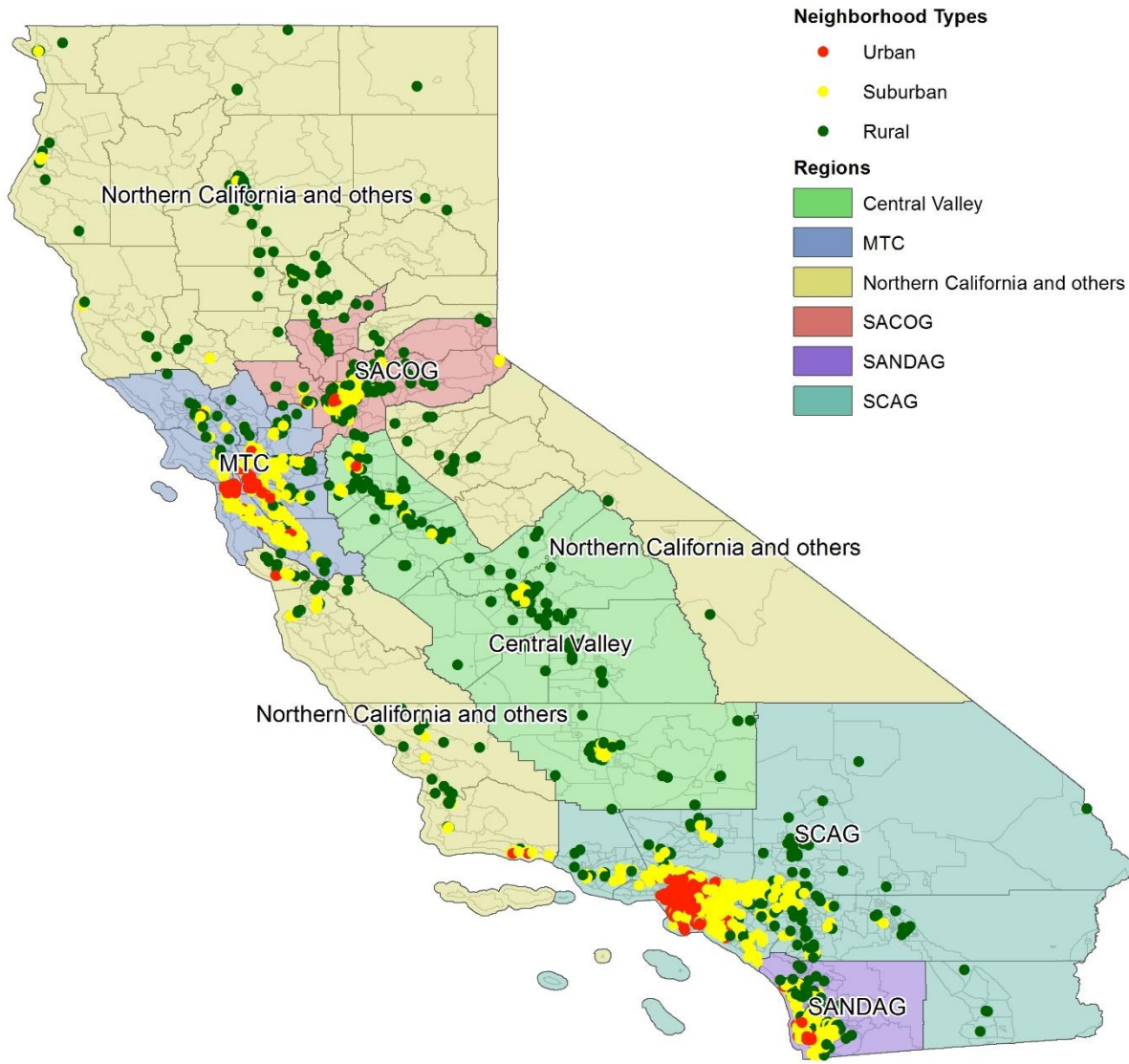
The Dataset

California Millennial Dataset

Generation
- • Gen Y
- • Gen X

Regions
- Central Valley
- MTC
- Northern California and others
- SACOG
- SANDAG
- SCAG

Map labels: Northern California and others, SACOG, MTC, Central Valley, Northern California and others, Northern California and others, SCAG, SANDAG

All cases were geocoded based on residential location.

We *weighted* the dataset to correct for the quota-based sampling on *age*, *region* and *neighborhood type*.

We also applied *IPF raking* to represent California's population by
1. *Race and Ethnicity*
2. *Employment/Student Status*
3. *Gender*
4. *Presence of Children*
5. *Household Income*

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California Millennial Dataset

Neighborhood Types
- ● Urban
- ● Suburban
- ● Rural

Regions
- Central Valley
- MTC
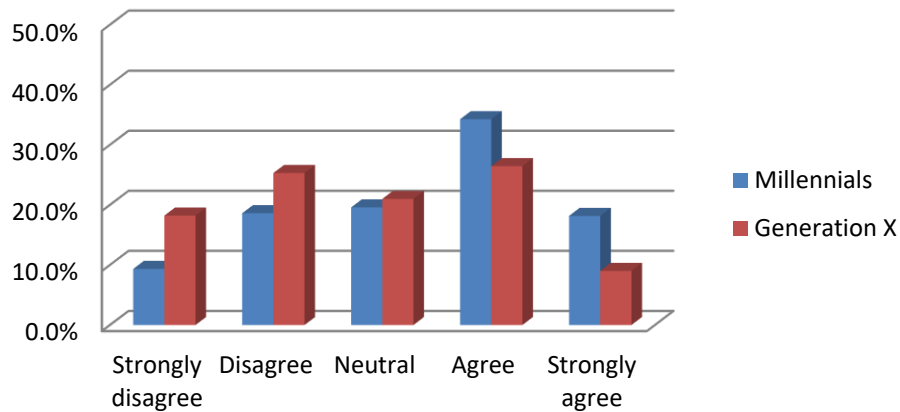- Northern California and others
- SACOG
- SANDAG
- SCAG

We integrated data from other sources, e.g. US Census, US EPA Smart Location Data, Walkscore.com, etc.
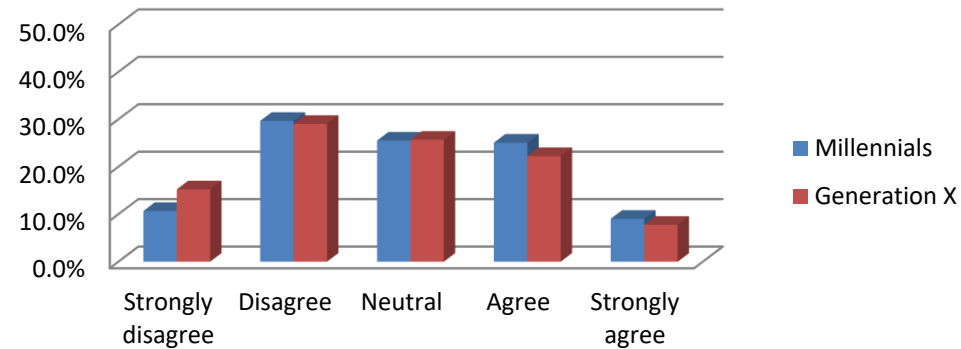
We classified the NH type as *urban*, *suburban* or *rural*, based on land use features at the census tract.

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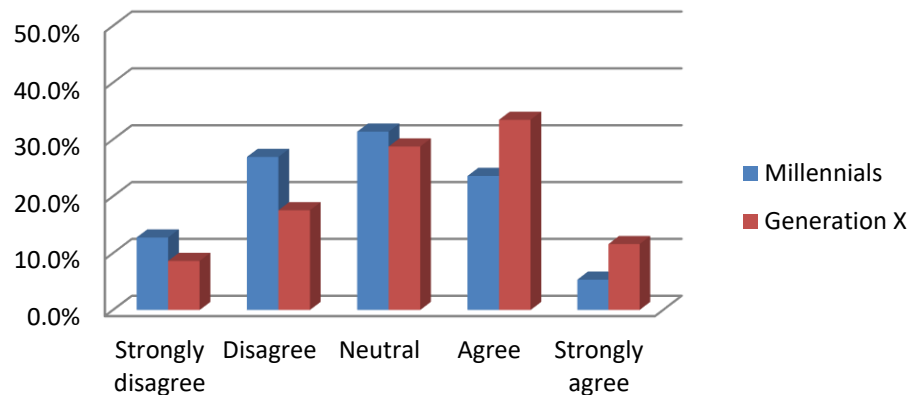
A Transient, Green Generation

"I'm still trying to figure out my career (e.g. what I want to do, where I'll end up)"
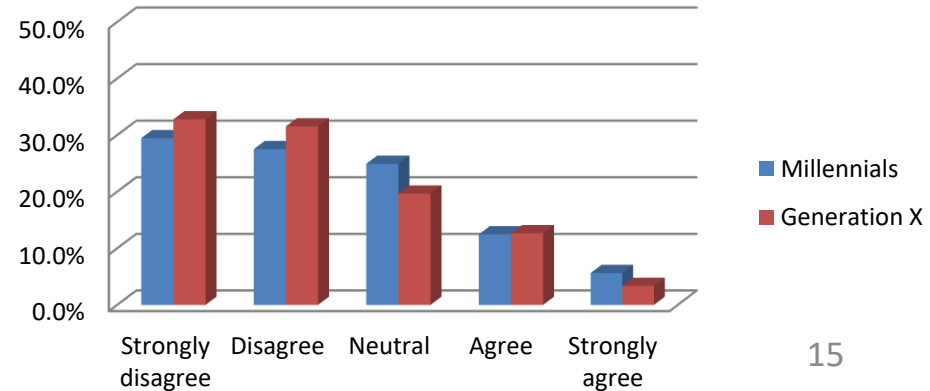
"I prefer to live close to transit even if it means I'll have a smaller home and live in a more crowded area"
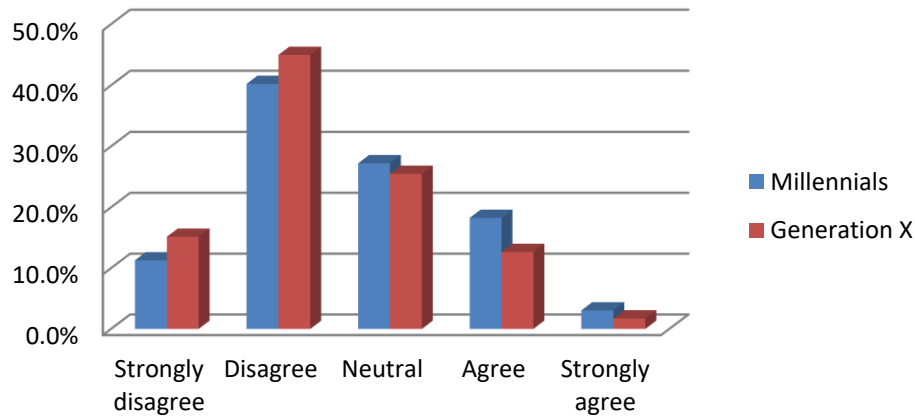
"I'm already well-established in my field of work"

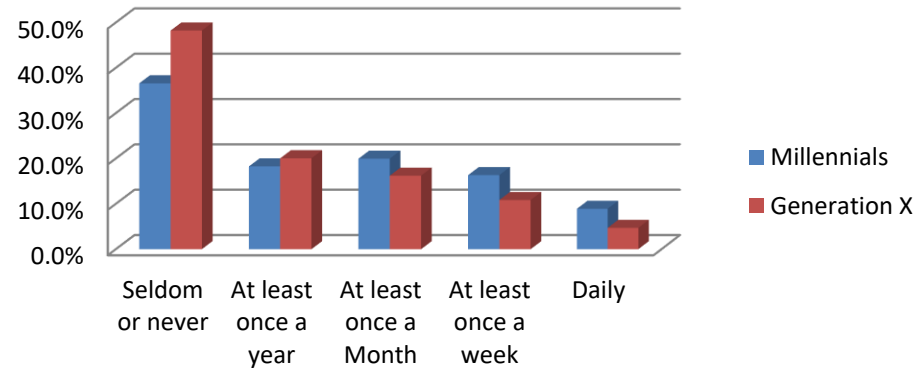**"We should raise the price of gasoline to reduce the negative impacts on the environment"**
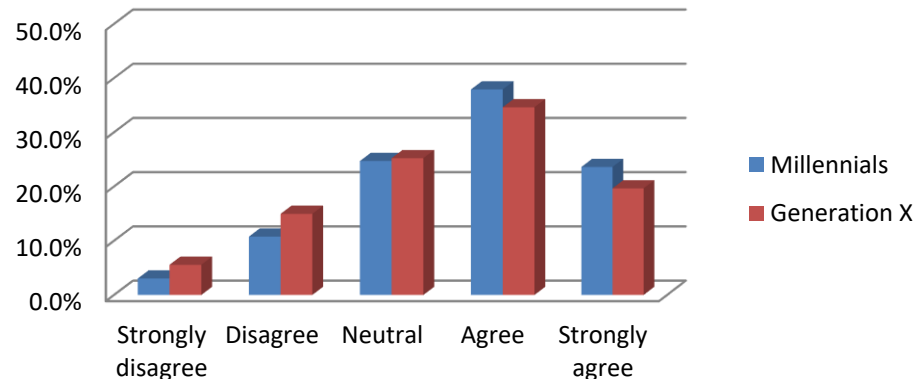
Tech-Savvy, Smartphone-Oriented

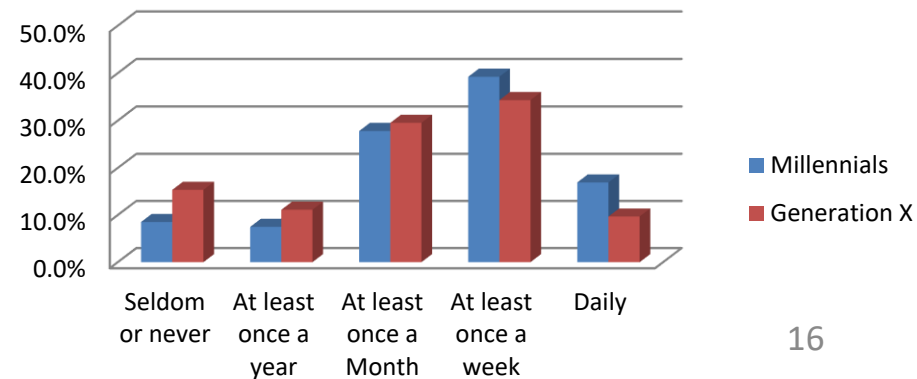"I avoid doing things that I know my friends would not approve"

"Use smartphone to decide which means of transportation, or combinations of multiple means, to use for a trip "

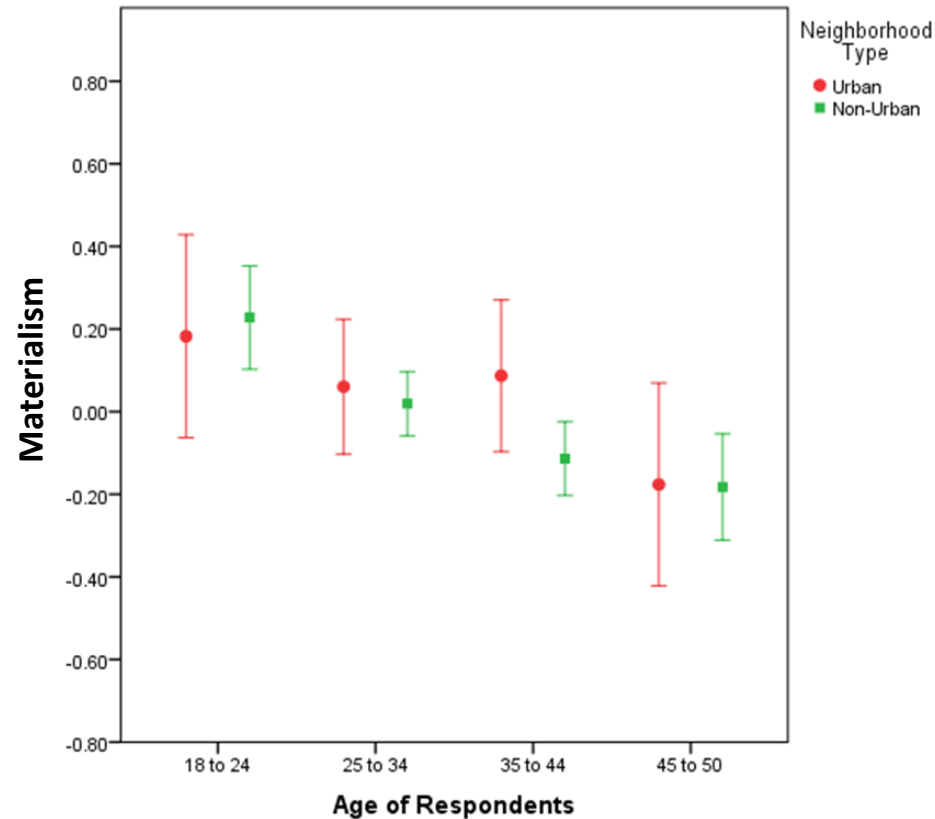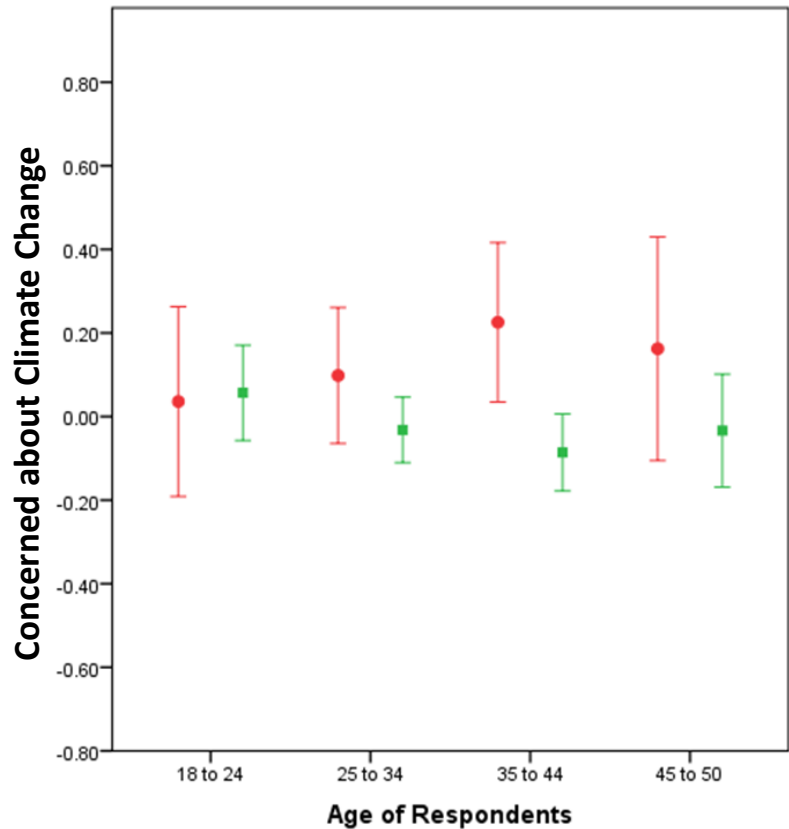"Having Wi-Fi and/or 3G/4G connectivity everywhere I go is essential to me"

"Use smartphone to identify possible destinations (e.g. restaurant, cafe, etc.) "

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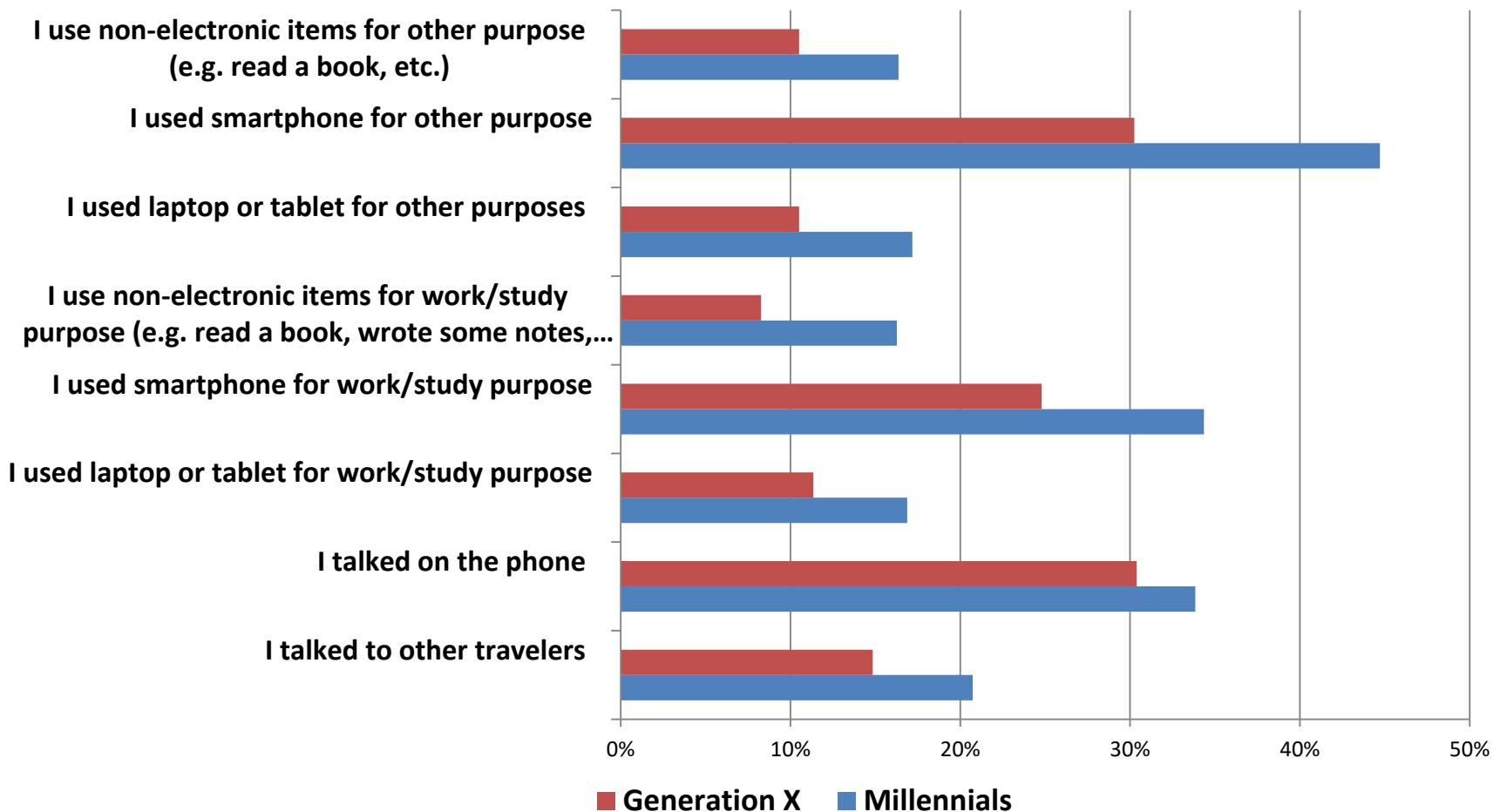- We applied factor analysis to the 66 attitudinal statements in the survey, and extracted 17 factors

Millennial Multitaskers
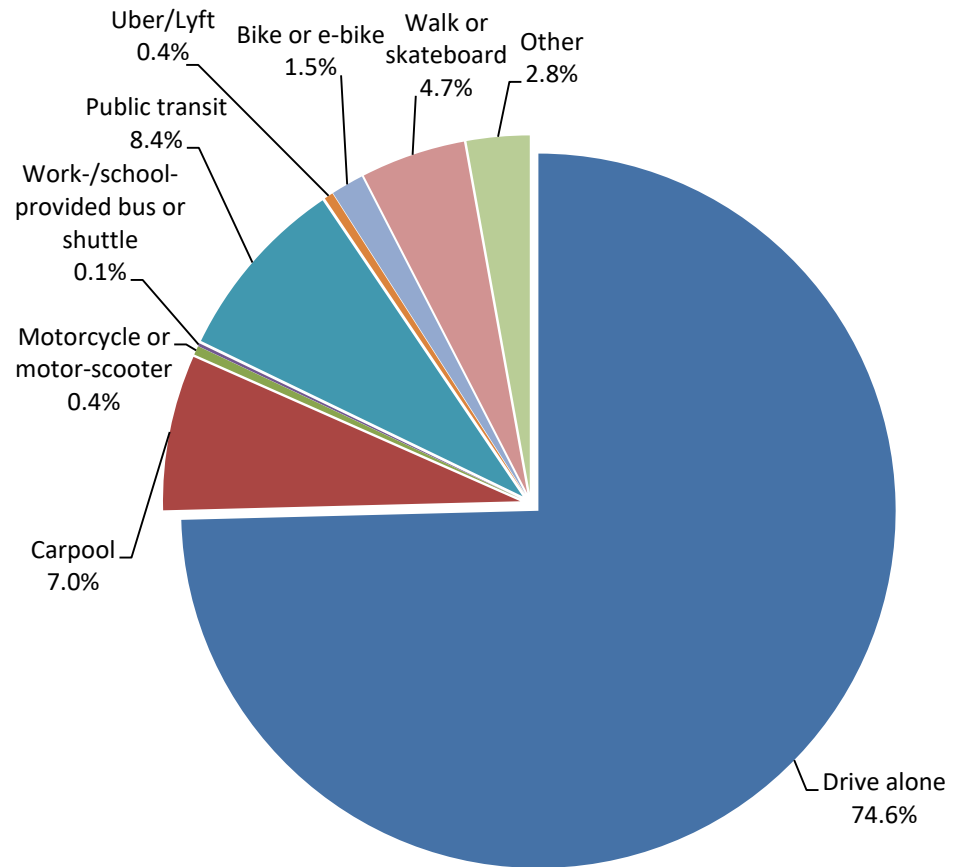
Multi-tasking activity during last commute trip

Legend: ■ Generation X ■ Millennials

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Most Recent Commute - Mode Choice

Millennials

- Uber/Lyft 0.6%
- Bike or e-bike 2.9%
- Walk or skateboard 6.1%
- Other 1.9%
- Public transit 9.2%
- Work-/school-provided bus or shuttle 1.0%
- Motorcycle or motor-scooter 0.4%
- Carpool 9.3%
- Drive alone 68.7%

Generation X

- Uber/Lyft 0.4%
- Bike or e-bike 1.5%
- Walk or skateboard 4.7%
- Other 2.8%
- Public transit 8.4%
- Work-/school-provided bus or shuttle 0.1%
- Motorcycle or motor-scooter 0.4%
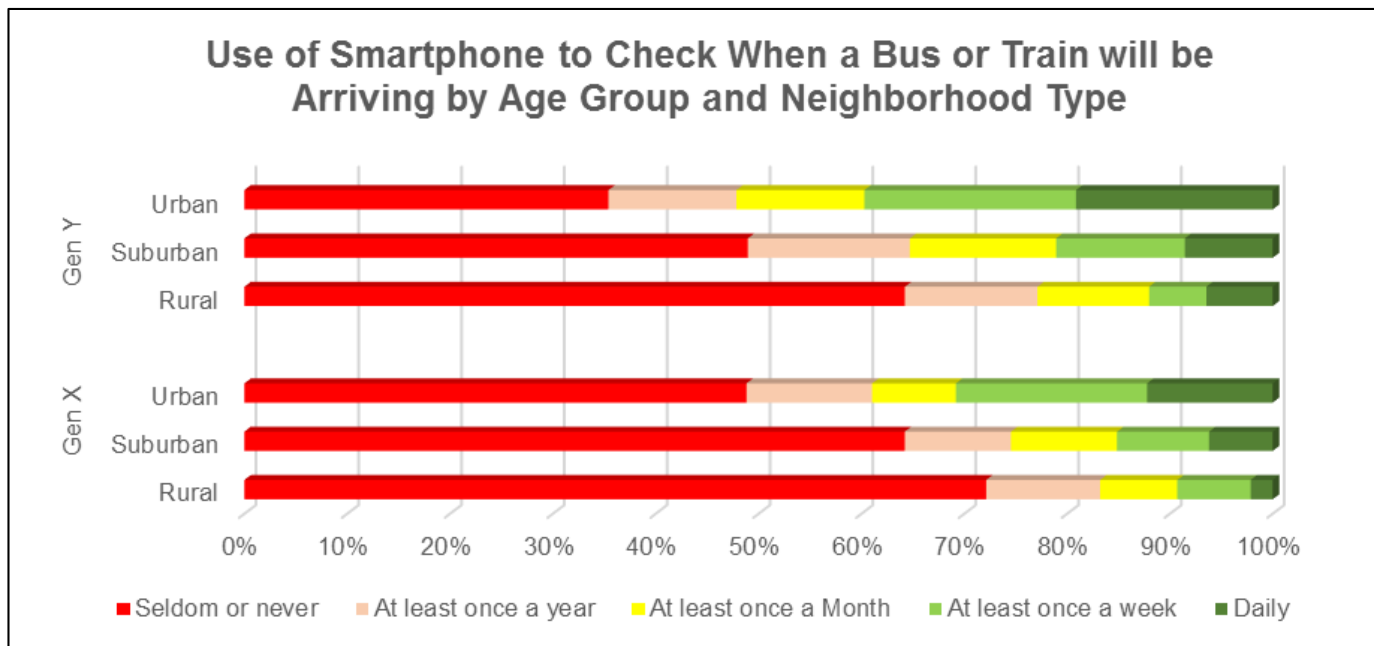- Carpool 7.0%
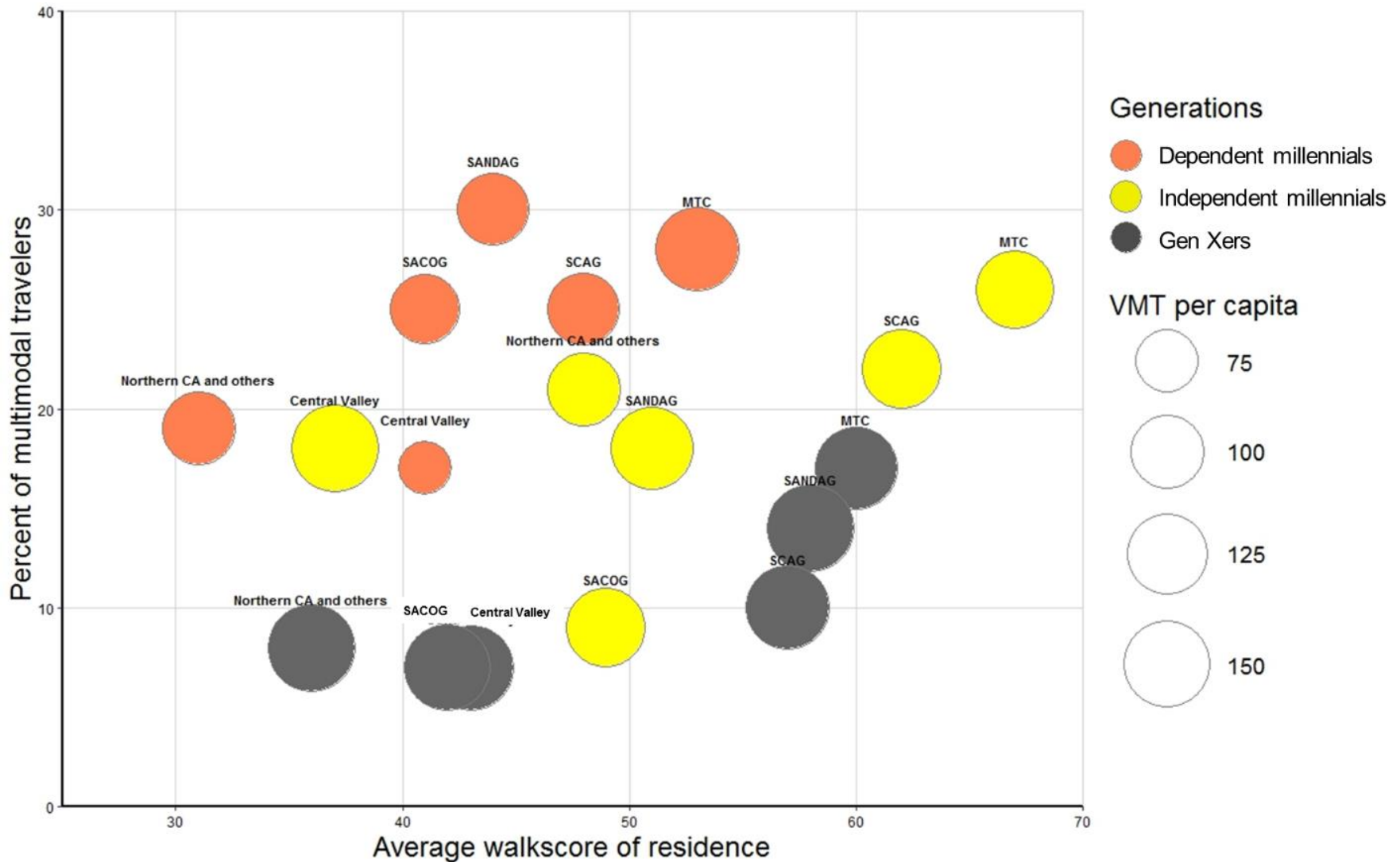- Drive alone 74.6%
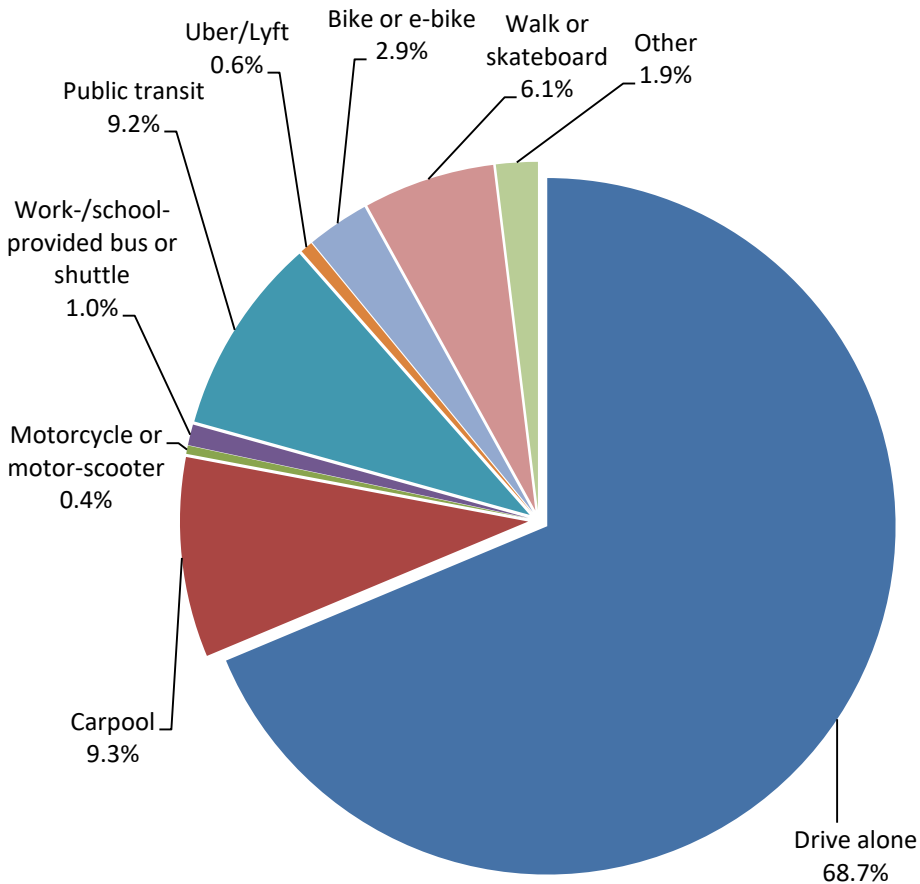
N=1776, weighted sample

Adoption of Technology

Consistent with expectations, millennials are found to:
- Drive less
- Multitask during their commute
- Use smartphone apps and technology services more often. For example:

Use of Smartphone to Check When a Bus or Train will be Arriving by Age Group and Neighborhood Type

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Residential Location and Travel Multimodality

Adoption of Shared Mobility

Shared Mobility Services

Type of Services		Ownership and Operational Models
Carsharing	CAR2GO, zipcar, TURO	• Fleet-based or peer-to-peer • Round trip or one way
Bikesharing	BAY AREA BikeShare, Spinlister The global bike share, citi bike	• Fleet-based or peer-to-peer • Dock-based or GPS-based
Dynamic Ridesharing	scoop	• Private-public partnership • Carpooling, vanpooling, and dynamic ridesharing
On-demand Ride Services	Uber, lyft	• Private (may be subsidized by public in future) • Uber X and Lyft; Uber pool and LyftLine

Use of Car-Sharing

**Familiarity with and usage of car-sharing
(e.g. Zipcar, Car2Go)**
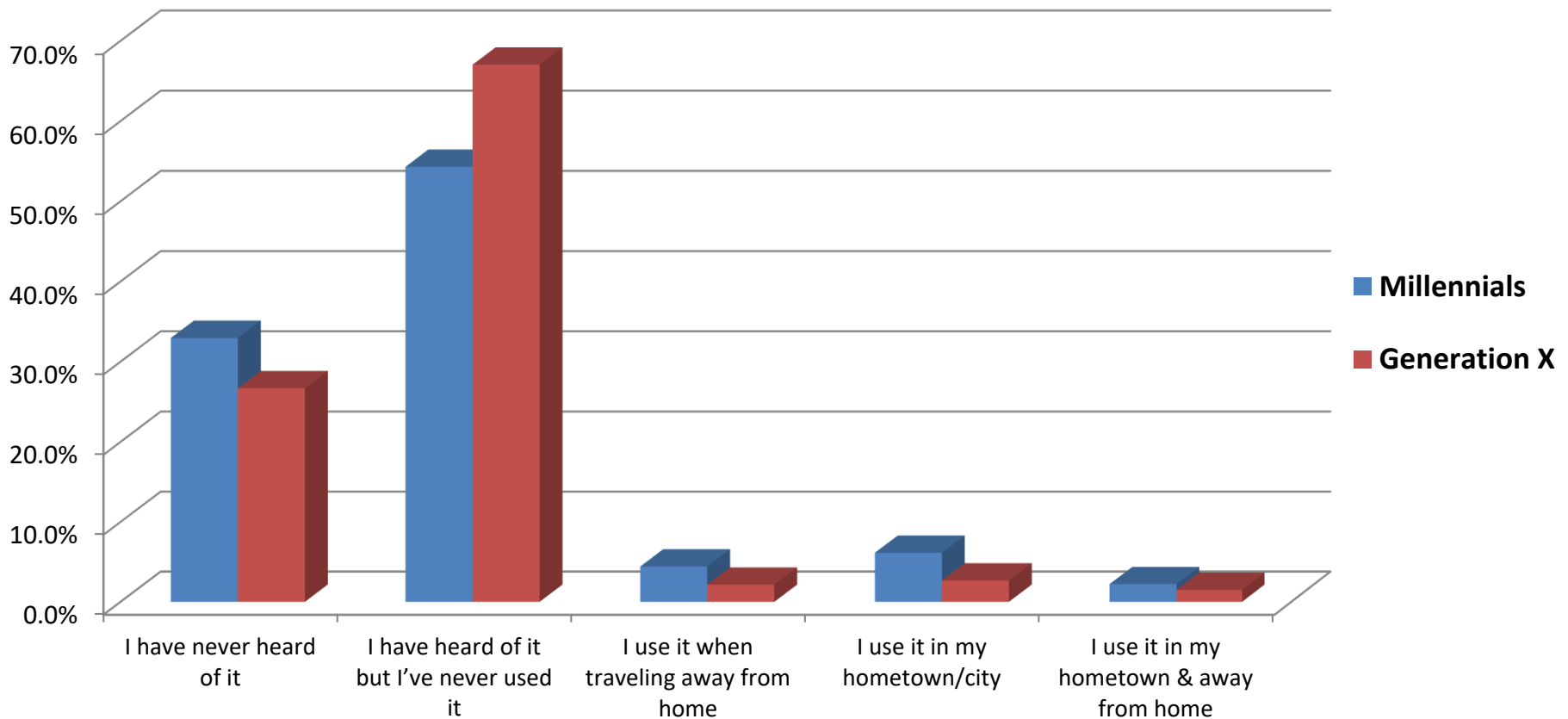
N=2391, weighted sample

An Uber-Friendly Generation?

Familiarity with and usage of on-demand ride services (e.g. Uber, Lyft)
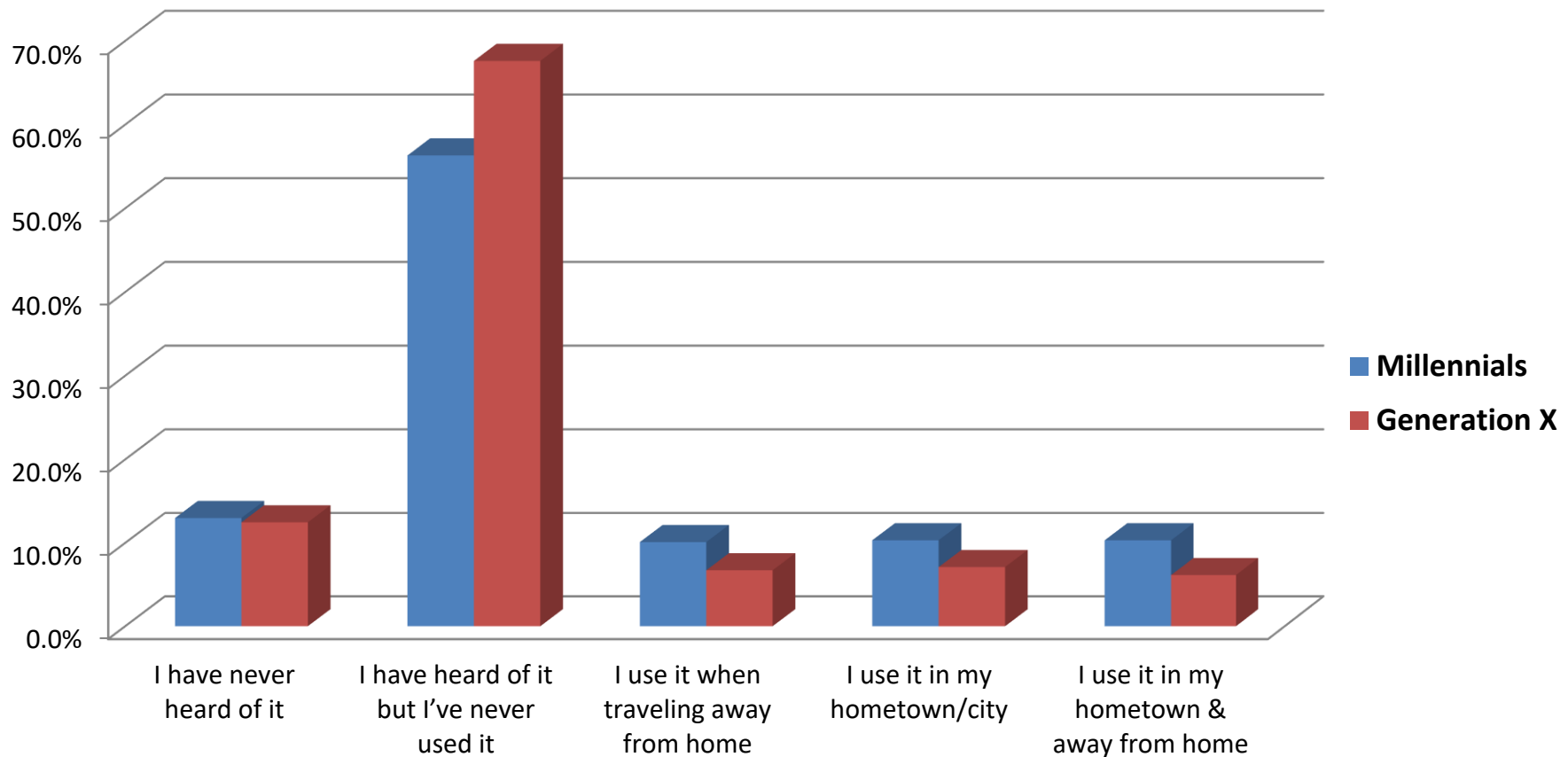
N=2391, weighted sample

Use of Car-Sharing

Legend

Region3
- Other CA
- SCAG
- SF MTC

Yes 17%
No 83%

Yes 5%
No 95%

Yes 10%
No 90%

Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

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Use of Uber/Lyft

Yes 32%
No 68%

Yes 21%
No 79%

Yes 31%
No 69%

Legend
Region3
Other CA
SCAG
SF MTC
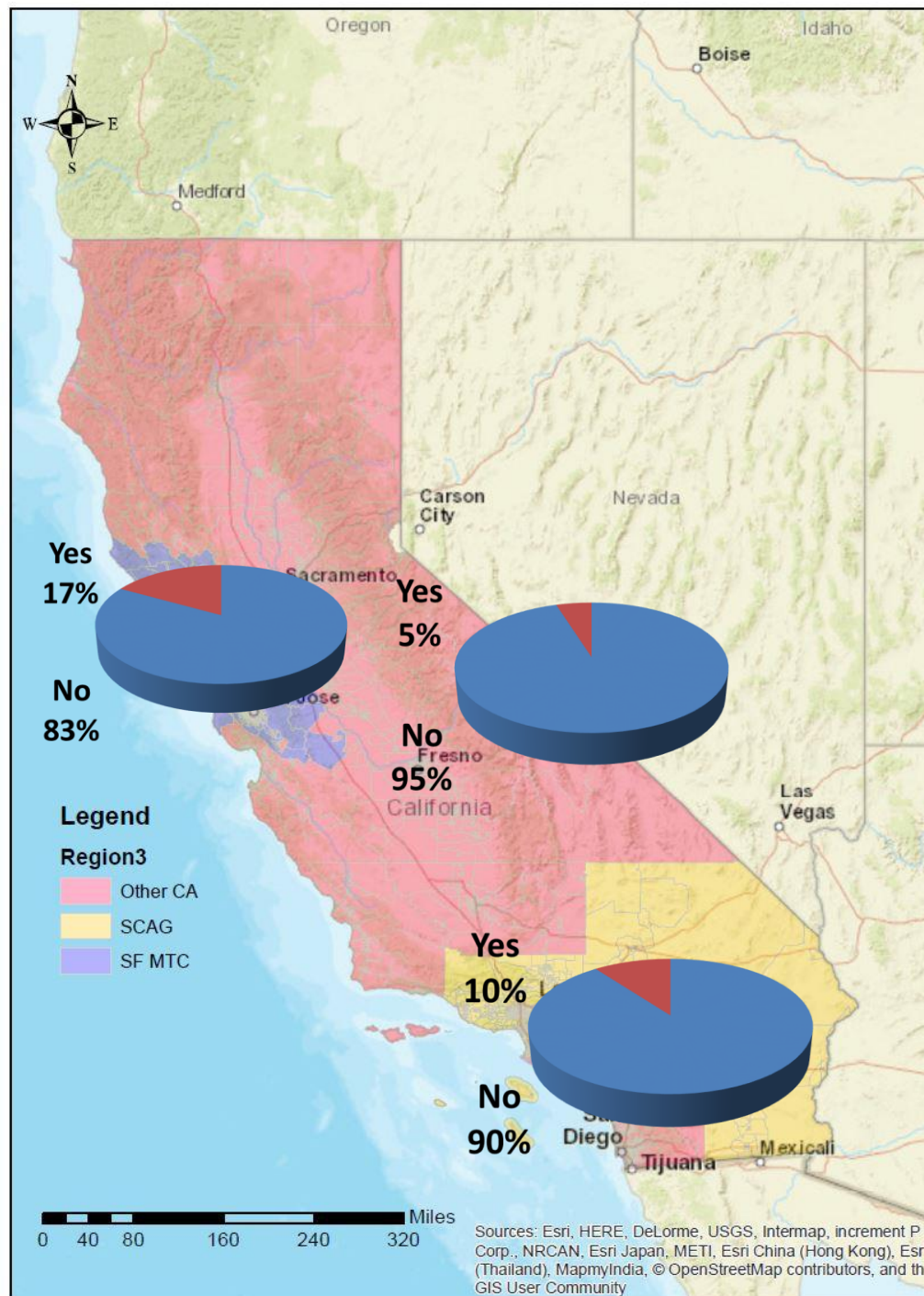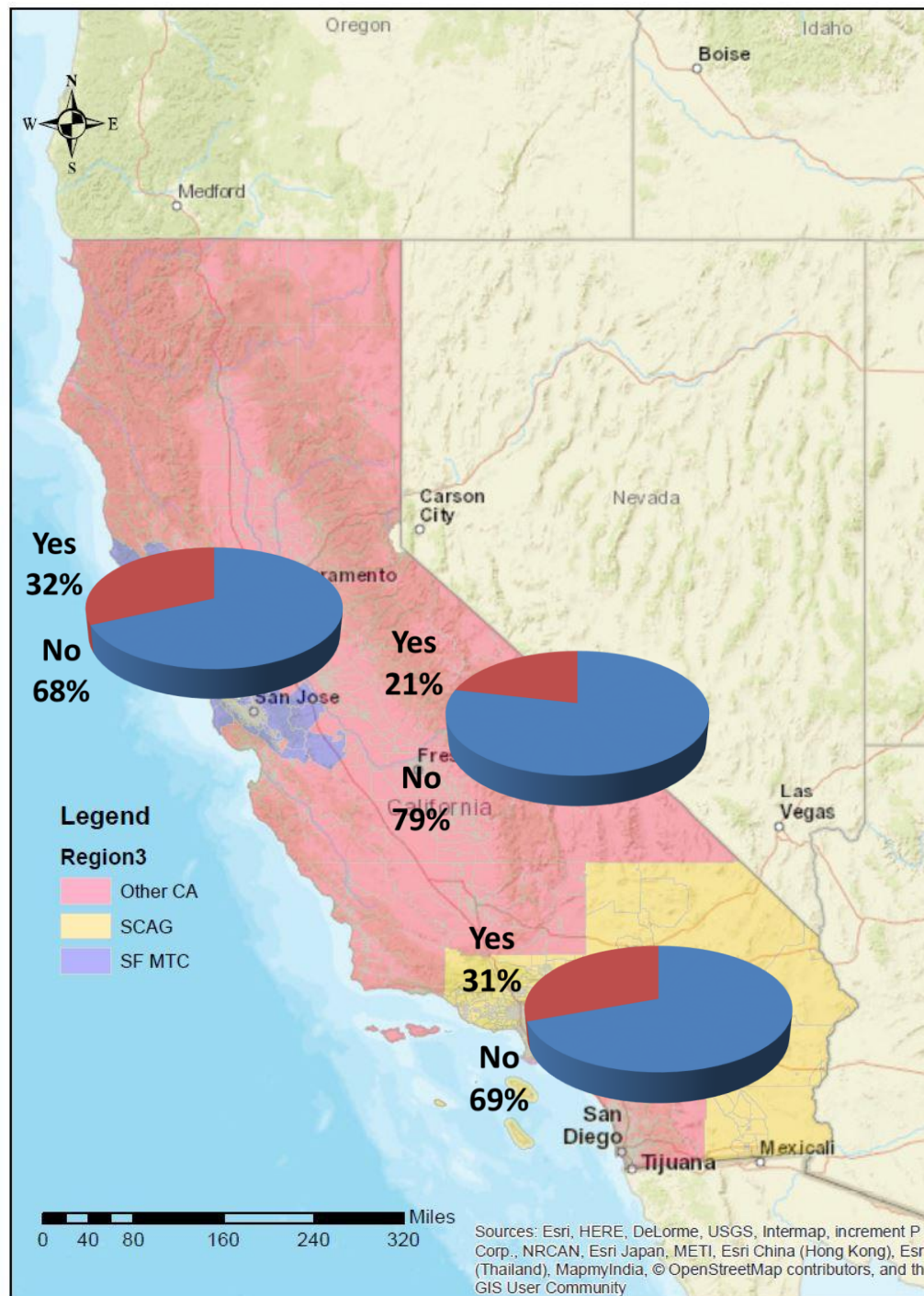
Users of Uber/Lyft
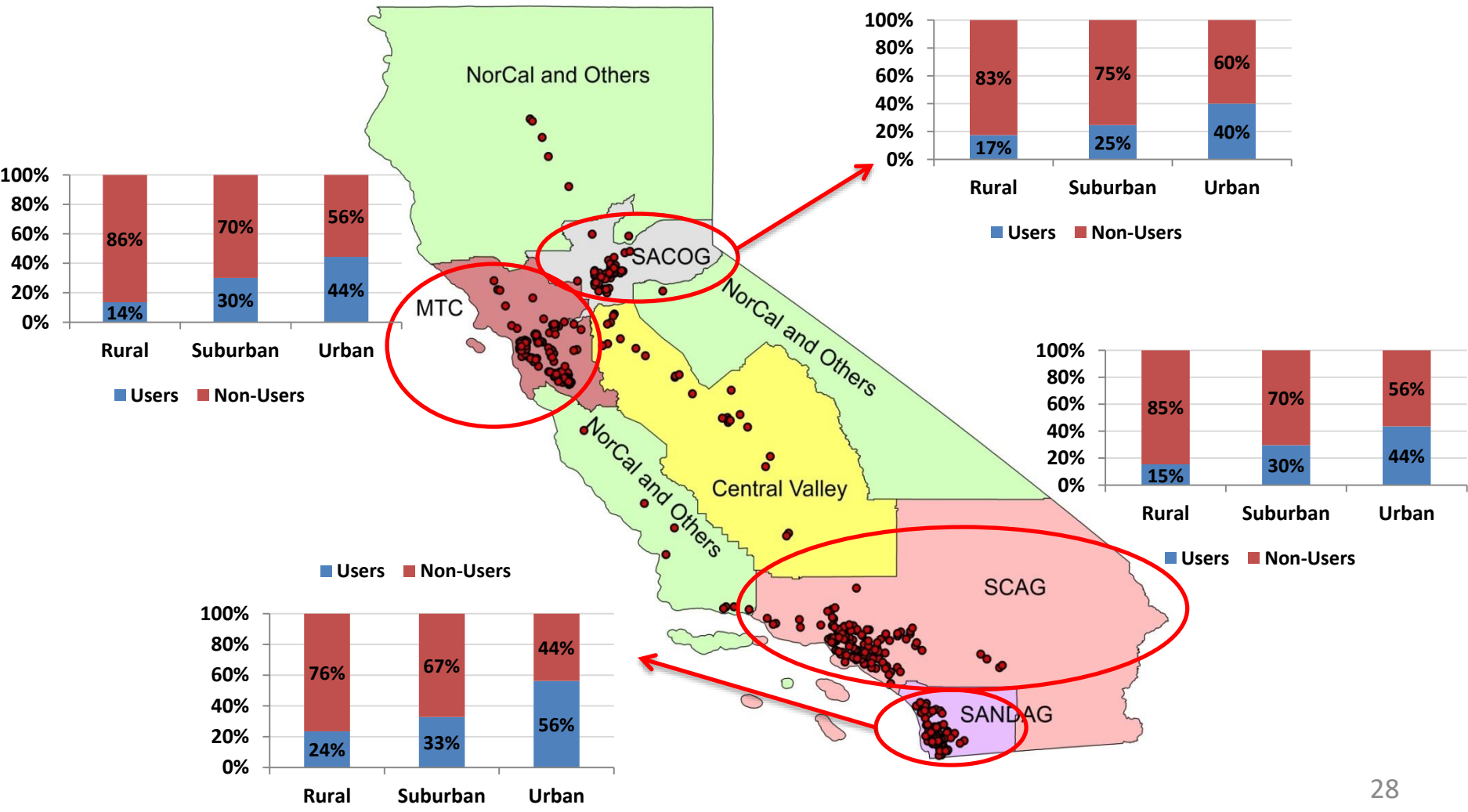
What Replaces What?

Impact of Last Uber Trip

Bar chart comparing Generation X and Millennials on the impact of their last Uber trip.

- Reduced the amount of driving I did — Generation X ~44%, Millennials ~39%
- Reduced the amount of walking/biking I did — Generation X ~16%, Millennials ~24%
- Reduced my use of public transportation — Generation X ~23%, Millennials ~24%
- Increased the amount of walking/biking I did — Generation X ~2%, Millennials ~2%
- Increased my use of public transportation(improving flexibility) — Generation X ~7%, Millennials ~5%
- Increased my use of public transportation (improving access/egress) — Generation X ~6%, Millennials ~3%
- Other — Generation X ~2%, Millennials ~1%

Millennials' Behavior

- Millennials drive fewer VMT, on average, than older peers (in *all NH types*).

- Differences explained by a combination of *individual/HH characteristics, land use features, technology adoption* and *personal attitudes*.

- More **heterogeneity** observed among millennials. Land use features explain smaller portion of millennials' VMT.

- Higher adoption of **shared mobility services** among millennials.

- Use of Uber associated with significantly fewer miles driven.

- Millennials more often adopt **multimodal travel behavior**, but…
  - *Independent millennials* (who already established their households) choose more accessible residential locations (more conducive to use of other modes).
  - *Dependent millennials* (who still live with their parents) often live in less accessible locations. Still, they often adopt multimodal travel.

- **Gen Xers** often live in more accessible locations than dependent millennials. However, they are more car-dependent.

Results available in 2017 TRB papers.

Research Question

How many millennials match the stereotype of the *urbanites* common in the media?

Latent class analysis to analyze different profiles of people (urbanites vs. others, etc.)

Stereotype common in the media:
- Live in urban areas
- Have dynamic lifestyles
- Heavy users of social media
- Own zero (or few) cars
- Use public transportation
- Adopt new technologies

How many *millennials* vs. *Gen Xers* fit this profile?

Research Question 2

- Incorporate latent behavioral constructs into modeling travel behavior and the use of shared mobility services

- *Latent class choice model* to analyze differences in travel behavior and in the adoption of shared mobility services among different groups, e.g.:
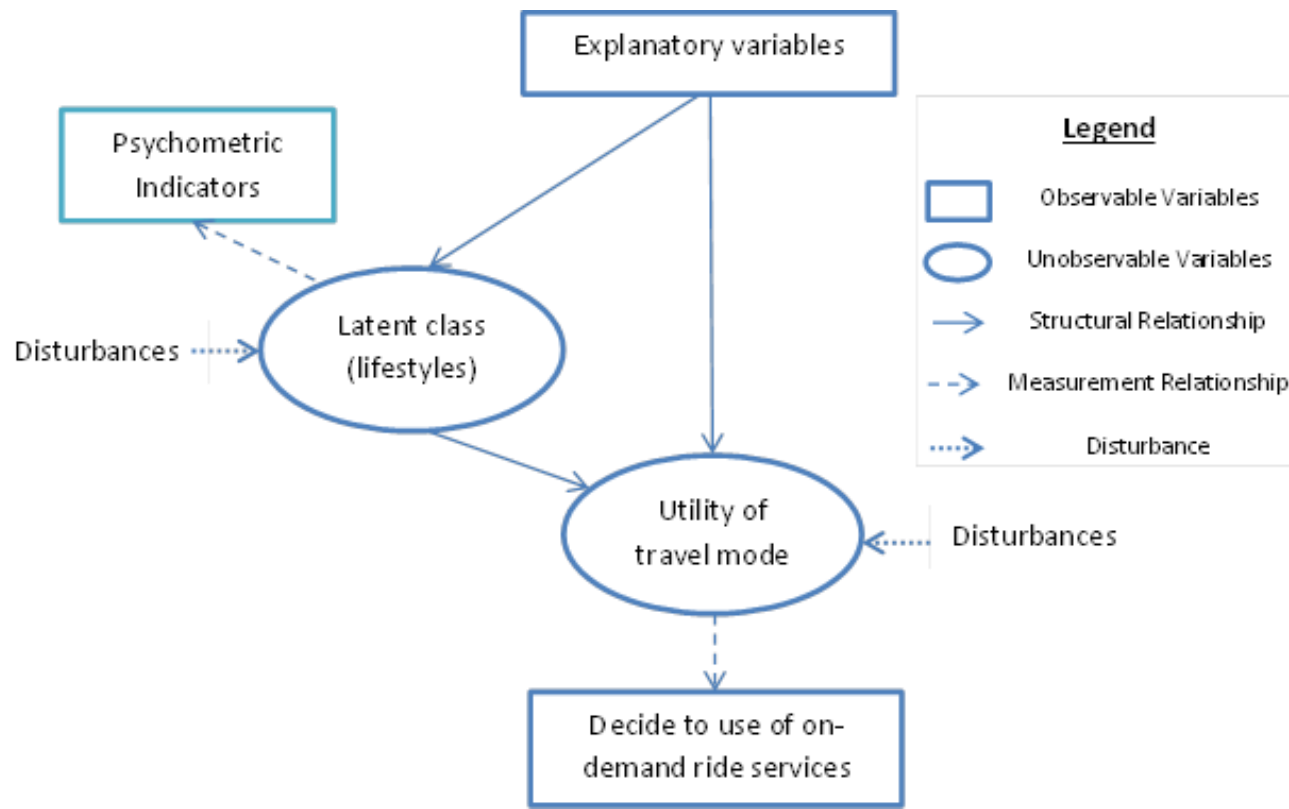
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How does the adoption of *shared mobility* affect other components of *travel behavior* and *vehicle ownership*?
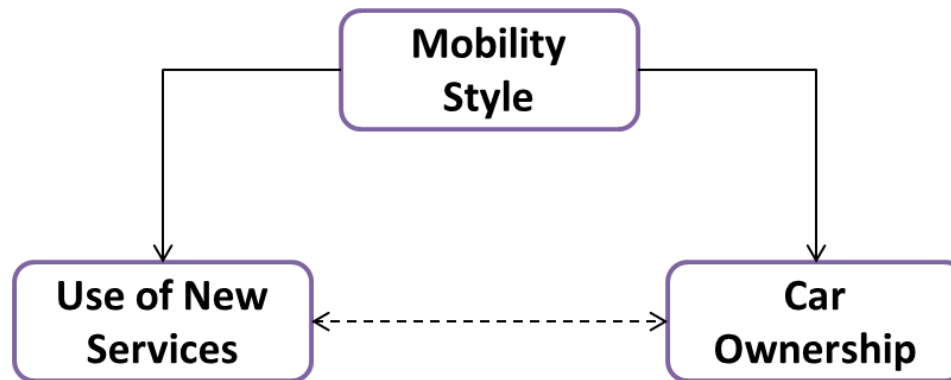
Jointly model the adoption of shared mobility and the use of other travel modes (or vehicle ownership, propensity to modify VO, etc.), controlling for the impacts of attitudes, adoption of technology, household, individual and built environment characteristics.

Potential modeling approaches: *bivariate ordered Probit*, *recursive Probit*, or *latent-class structural equation models*.

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Millennials and Cars

What about Vehicle Ownership?

Independent Millennials

0	6.4%
1	41.8%
2	41.6%
3+	10.2%

Dependent Millennials

0	2.2%
1	23.1%
2	33.6%
3+	41.1%

Gen Xers

0	5.9%
1	34.0%
2	43.6%
3+	16.6%

 # Vehicles per driver

	Urban	Non-Urban
Millennials	.79	.92
Gen X	.87	.96

Percentage of time car is available for use

Millennials	85.0%
Gen X	91.4%

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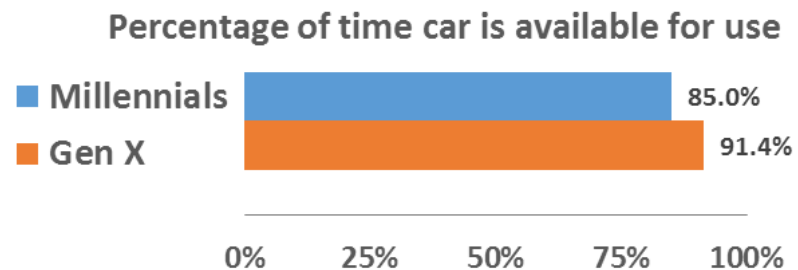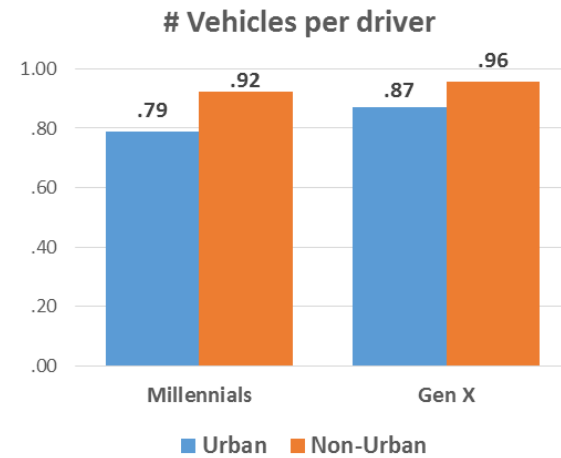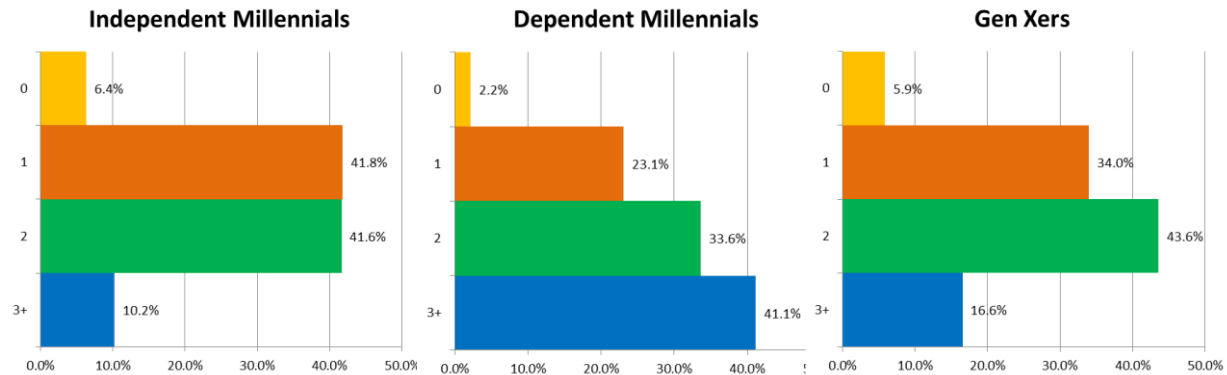
Propensity to Modify Vehicle Ownership

- Millennials often report that they want to increase their vehicle ownership.

- This more often happens among millennials who live in zero-vehicle households.

	Propensity to Change VO	Number of Vehicles			
		0	1	2	3+
Millennials	Decrease	0.0%	4.0%	3.7%	9.2%
	Remain Unchanged	36.7%	70.0%	79.1%	68.4%
	Increase	**63.3%**	26.1%	17.2%	22.4%
Gen X	Decrease	0.0%	3.2%	4.0%	13.9%
	Remain Unchanged	54.3%	74.8%	81.5%	73.0%
	Increase	45.7%	22.1%	14.6%	13.0%

Expectation to have a child, and number of children in the household	Propensity to change VO		
	Decrease	Remain Unchanged	Increase
Expect to have another child (already have children)	5.7%	71.1%	23.3%
Do not expect to have another child	5.8%	71.4%	22.8%
Expect to have their first child	3.3%	70.7%	**26.0%**
Do not expect to have any children	4.3%	77.9%	17.8%

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Modeling the Propensity to Modify Vehicle Ownership

- Multinomial Logit Model
- Three alternatives: Reduce VO, Maintain VO (*base*), Increase VO
- Combination of *propensity to buy* and/or *to sell/get rid of* a vehicle
- Unequal choice sets
- Factor analysis on attitudinal variables
- Exclude dependent millennials (their VO level presumably *mediated* with the family of origin)
- Sample size N = 1,275

$\mathcal{L}\left(\underline{\beta}\right)$ = -783.67

$\mathcal{L}(0)$ = -1386.54

$\rho^2 = 0.43$ $\qquad \qquad \rho^2 (MS \text{ base}) = 0.09$

$Adjusted\ \rho^2 = 0.42$ $\qquad Adjusted\ \rho^2(MS\ base) = 0.08$

Modeling the Propensity to Modify Vehicle Ownership (2)

Multinomial Logit Model Estimation Results

Variable	Reduce VO	Maintain Current VO	Increase VO
Young millennial (18-24) with less than one vehicle per household driver		base	1.222*** (0.379)
Older millennial (25-34) in zero vehicle household		base	3.602*** (0.778)
Older millennial (25-34) with less than one vehicle per household driver		base	1.368*** (0.219)
Gen Xer (35-50) in zero vehicle household		base	1.969*** (0.520)
Gen Xer (35-50) with less than one vehicle per household driver		base	0.640*** (0.213)
Have more than one car per driver and plan to move to more urban area	0.439* (0.229)	base	
Gender: female		base	-0.282* (0.151)
Young Gen Xer (35-44) with kid(s)		base	0.752*** (0.182)

***, **, * = significant at 1%, 5%, 10%.

Modeling the Propensity to Modify Vehicle Ownership (2)

Multinomial Logit Model Estimation Results

Variable	Reduce VO	Maintain Current VO	Increase VO
Young millennial (18-24) with less than one vehicle per household driver		base	1.222*** +++ (0.379)
Older millennial (25-34) in zero vehicle household		base	3.602*** +++ (0.778)
Older millennial (25-34) with less than one vehicle per household driver		base	1.368*** +++ (0.213)
Gen Xer (35-50) in zero vehicle household		base	1.969*** +++ (0.320)
Gen Xer (35-50) with less than one vehicle per household driver		base	0.640*** +++ (0.213)
Have more than one car per driver and plan to move to more urban area	0.439* + (0.229)	base	
Gender: female		base	-0.282* − (0.151)
Young Gen Xer (35-44) with kid(s)		base	0.752*** +++ (0.182)

***, **, * = significant at 1%, 5%, 10%.

Modeling the Propensity to Modify Vehicle Ownership (3)

Variable	Reduce VO	Maintain Current VO	Increase VO
Would like to use car less		base	-0.450** (0.201)
Not satisfied with current travel		base	0.890* (0.469)
Like biking	0.326* (0.174)	base	
Materialism		base	0.234*** (0.076)
Variety seeking (*Young millennial*, 18-24)	1.007*** (0.388)	base	
Variety seeking (*Older millennial*, 25-34)		base	0.327** (0.129)
Variety seeking (*Older Gen Xer*, 45-50)	0.737** (0.302)	base	
Must own car (*Older millennial*, 25-34)		base	0.290** (0.127
Constant	-3.817*** (0.429)	base	-1.566*** (0.140)

Modeling the Propensity to Modify Vehicle Ownership (3)

Variable	Reduce VO	Maintain Current VO	Increase VO
Would like to use car less		base	-0.450** -- (0.201)
Not satisfied with current travel		base	0.890* + (0.469)
Like biking	0.326* + (0.174)	base	
Materialism		base	0.234*** +++ (0.078)
Variety seeking (Young millennial, 18-24)	1.007*** +++ (0.388)	base	
Variety seeking (Older millennial, 25-34)		base	0.327** ++ (0.129)
Variety seeking (Older Gen Xer, 45-50)	0.737** ++ (0.302)	base	
Must own car (Older millennial, 25-34)		base	0.290** ++ (0.127)
Constant	-3.817*** --- (0.429)	base	-1.566*** --- (0.140)

Summary and closing thoughts

- Most millennials - and Gen Xers - have **access to cars**.

- Lower vehicle ownership among independent millennials, *but*...

- Millennials show higher propensity to purchase vehicles as they age and transition in their stage of life.

- Preliminary model of propensity to change VO: the zero-vehicle/low-vehicle ownership status might be short-lived...

- Most individuals in zero- or low-vehicle owning households plan to increase VO in the near future (with the *exception of young millennials in zero-vehicle households*).

- Impact of **stage in life** (*age* and *presence of children*) on propensity to change vehicle ownership.

- Several impacts of attitudinal traits:
  - Individuals who are **not satisfied with current amount of travel** → more likely to *increase* VO
  - Those who **want to travel less by car** → *less* likely to *increase* VO
  - More **materialistic** people → higher propensity to *increase* VO
  - **Like biking** → higher propensity to *decrease* VO
  - **Older millennials** that highly value "*owning a car*" → more likely to *increase* VO
  - Different effects of *variety seeking* for the various age groups: **young millennial and Gen Xer variety seekers** want to *reduce their VO*, middle group (**old millennials**) more attracted by *increasing* VO
- Interest in modeling **joint/conditional choices** of *current vehicle ownership* and *propensity to modify VO* (among several analyses being carried out with this dataset).

Project Report Available at:
ncst.ucdavis.edu

What Affects Millennials' Mobility?
PART I: Investigating the Environmental Concerns, Lifestyles, Mobility-Related Attitudes and Adoption of Technology of Young Adults in California

May 2016	A Research Report from the National Center for Sustainable Transportation

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What Affects Millennials' Mobility? PART II: The Impact of Residential Location, Individual Preferences and Lifestyles on Young Adults' Travel Behavior in California

January 2017

A Research Report from the National Center for Sustainable Transportation – FINAL DRAFT

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Thank you for your attention!

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