



# What Affects Millennials' Mobility?

*Investigating the Individual Attitudes,  
Lifestyles, Residential Location, the Adoption of  
Technology and Shared Mobility of Young  
Adults in California*

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**Georgia Institute  
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Sacramento, CA

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# Mobility of Millennials in California

Interest in better understanding:

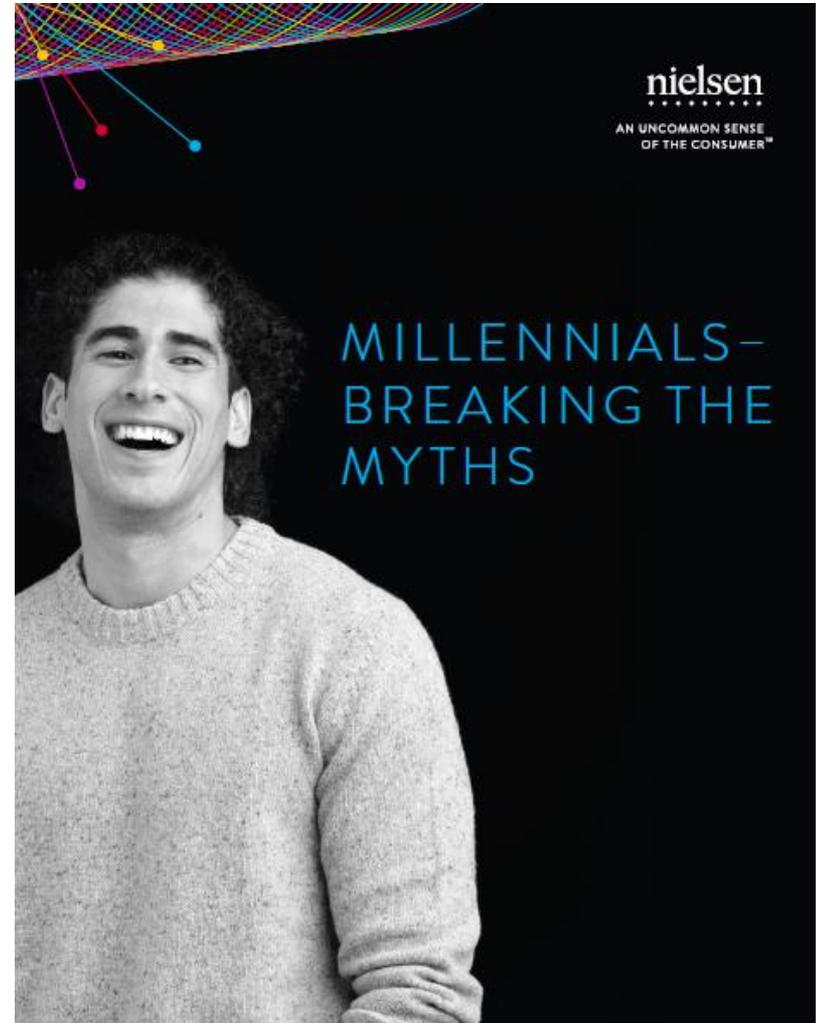
- The relationships among *millennials' personal attitudes, lifestyles* and *actual behaviors*  
*...do they behave differently from previous generations?*
- Impact of *classical* (economic and non-economic) variables vs. *specific factors affecting millennials' choices* (e.g. adoption of technology, 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)

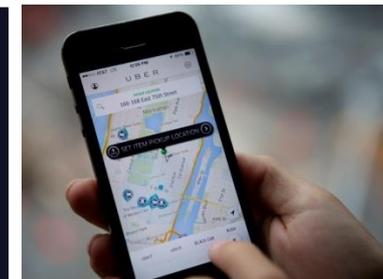
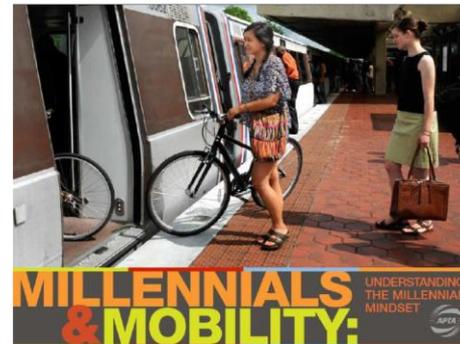
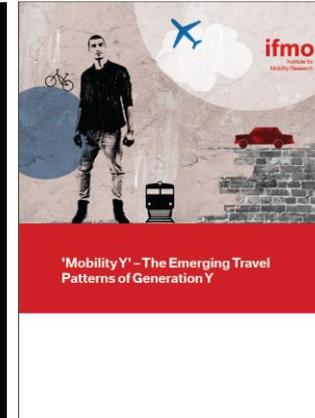
# “Millennials” (or “Generation Y”)

- Rapidly changing trends in:
  - Household size
  - Educational attainment
  - Economic influence / consumption
- *Very active segment* of the population
- Increasing economic power (and *still climbing the income ladder*)
- *“Diverse, Expressive and Optimistic”*



# “Millennials” (or “Generation Y”)

- Millennials are often described as heavy adopters of *technology* and *social media*
- Less dependent on cars, and adaptable to the *sharing economy*
- *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

<p><u>Economic</u></p> <ul style="list-style-type: none"> <li>• Recession</li> <li>• Unemployment</li> </ul> 	<p><u>Auto Costs</u></p> <ul style="list-style-type: none"> <li>• Gasoline</li> <li>• Auto insurance</li> <li>• Driver's education</li> <li>• Auto repairs</li> <li>• Other fees</li> </ul>	<p><u>Technology</u></p> <ul style="list-style-type: none"> <li>• Communication technology</li> <li>• Transportation technology (Über)</li> </ul>	<p><u>Demographic Change</u></p> <ul style="list-style-type: none"> <li>• Delayed marriage</li> <li>• Fewer children</li> <li>• Boomerang</li> </ul> 
<p><u>Residential Location</u></p> <ul style="list-style-type: none"> <li>• More likely to move to and live in cities</li> </ul>	<p><u>Cultural</u></p> <ul style="list-style-type: none"> <li>• Environmentalists</li> <li>• Less materialistic</li> </ul> 	<p><u>Regulatory Changes</u></p> <ul style="list-style-type: none"> <li>• Graduated Driver's Licensing</li> <li>• Texting while driving laws</li> </ul>	<p><u>Alternative Modes</u></p> <ul style="list-style-type: none"> <li>• Better transit</li> <li>• Improved infrastructure for walking/biking</li> </ul>

(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

## 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

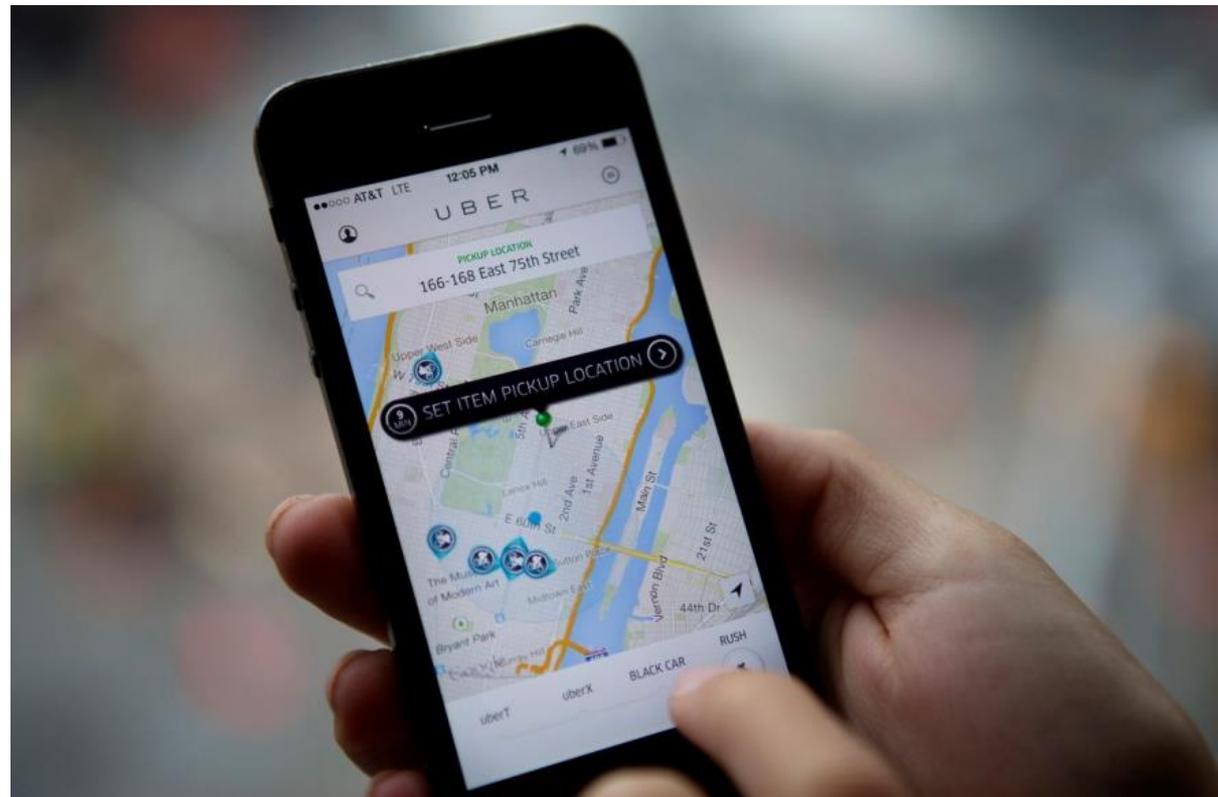
	<i>Strongly Disagree</i>	<i>Disagree</i>	<i>Neutral</i>	<i>Agree</i>	<i>Strongly Agree</i>
I prefer to live close to transit, even if it means I'll have a smaller home and live in a more crowded area.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Getting regular exercise is very important to me.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I like sticking to a routine.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I prefer to live in a spacious home, even if it is farther from public transportation and most destinations.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Individuals should generally put the needs of the group ahead of their own.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Doing two or more activities at the same time is the most efficient way to use my time.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
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.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The importance of exercise is overrated.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

# What is the Impact of Emerging Technologies?

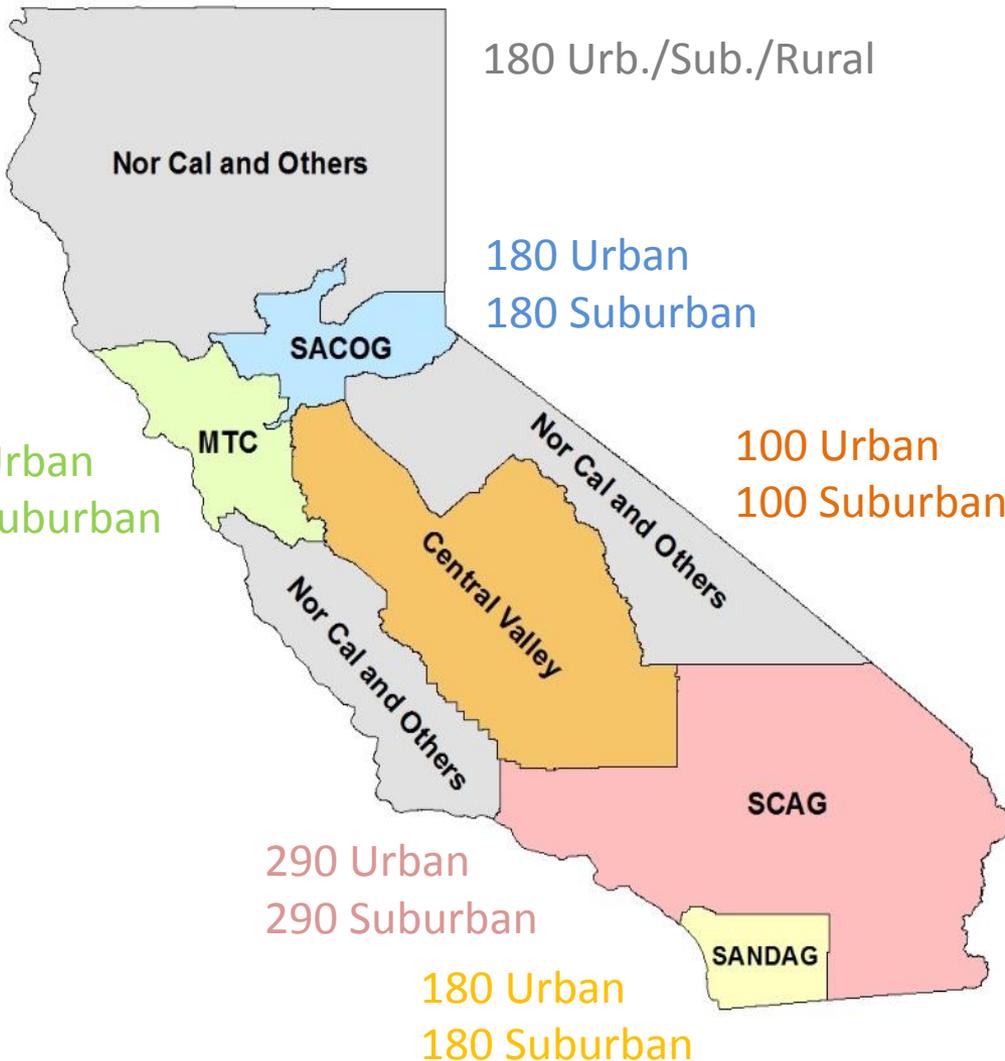
- Smartphones (GPS, access to more info)
- Increasing opportunities to multitask
- Integrated ride-sharing / shared mobility
- Lower levels of car-ownership
- Extend range of public transportation



# Car Ownership vs. Shared Mobility



# California Millennial Dataset



*+270 Rural (All California)*

Control for demographic targets:

- Age
- Gender
- Income
- Race and Ethnicity
- Presence of Children (Y/N)

*Data collection in Fall 2015*

*Target of:  
1400 Millennials  
1000 "Gen Xers"*

*N = 2400 Total sample size*



All cases were geocoded based on residential location

We weighted the dataset to correct for distribution by age, region and neighborhood type.

Application of IPF raking approach to represent California's population by

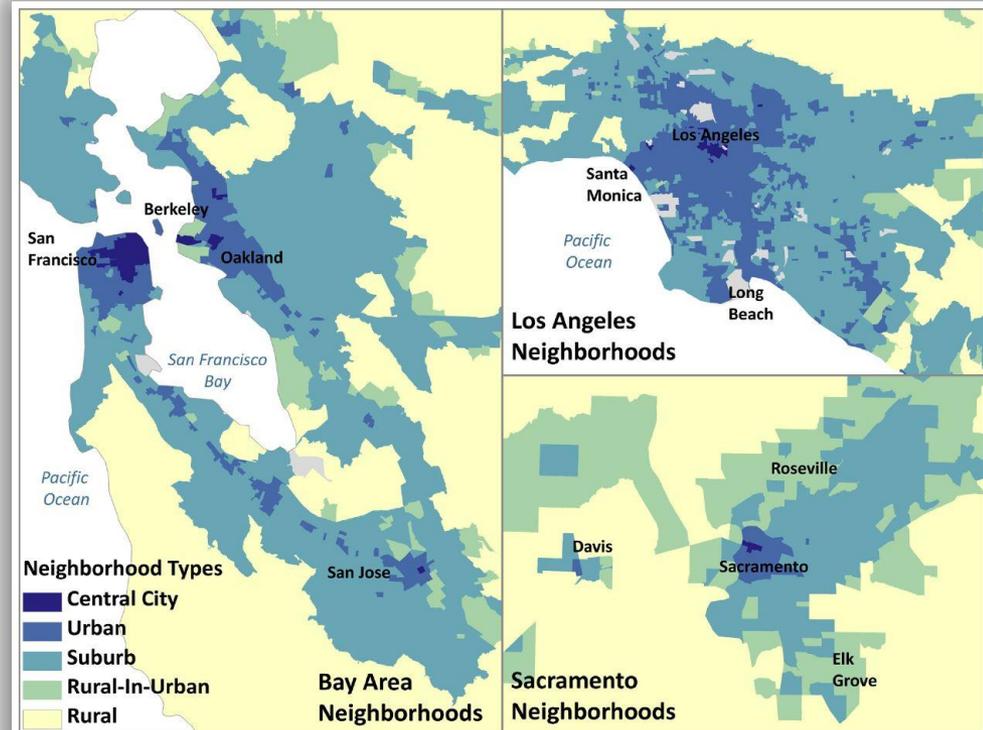
1. Race and Ethnicity
2. Employment by Student Status
3. Gender
4. Presence of Children
5. Household Income

# Classification Based on Land Use

Build on previous experience from other research projects (based on factor and cluster analysis) in California

Average characteristics of 2010 census tracts by neighborhood type

- Population density (1000's)
- Pct transit
- Pct walk/bike
- Pct single family homes
- Pct homes <10 years old
- Pct homes >60 years old
- Median home value
- Road density (miles per sq mile)
- Regional job access
- Local job access
- Activity mix
- # Restaurants in 10 min walk
- Number of 2010 census tracts for which data are available



**Source:** Salon, D. (2015). Heterogeneity in the relationship between the built environment and driving: Focus on neighborhood type and travel purpose. *Research in Transportation Economics*, 52, 34-45.

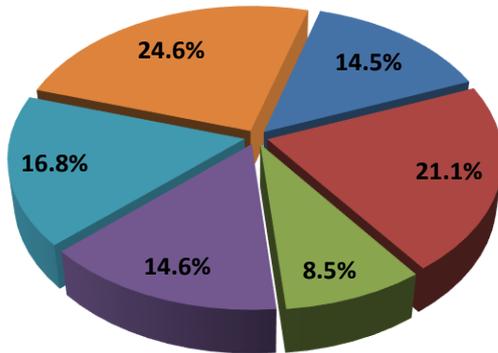
# Data Sources of Land Use Variables

Data Source	Latest release	Smallest Geography	Variables Available	Sample Land use Measurements
<b>US Census ACS</b> (American Community Survey)	<ul style="list-style-type: none"> <li>5 year estimate 2009-2013</li> </ul>	<ul style="list-style-type: none"> <li>Census Block Group</li> </ul>	<ul style="list-style-type: none"> <li>Population and household count</li> <li>Housing unit count (SFH or MFH, year structure built, etc.)</li> <li>Commute mode share</li> </ul>	<ul style="list-style-type: none"> <li>Population &amp; household Density</li> <li>Housing density, % of SFH, % of housing units built in pre WWII</li> <li>% transit commuters</li> </ul>
<b>US Census LEHD</b> (Longitudinal Employer household dynamic)	<ul style="list-style-type: none"> <li>2013</li> </ul>	<ul style="list-style-type: none"> <li>Census Block</li> </ul>	<ul style="list-style-type: none"> <li>Employment count by industry</li> </ul>	<ul style="list-style-type: none"> <li>Land use mix &amp; Job to housing ratio</li> <li>Job accessibility &amp; Population-serving job (retail/service) accessibility</li> </ul>
<b>US Census TIGER road shapefile</b>	<ul style="list-style-type: none"> <li>2015</li> </ul>		<ul style="list-style-type: none"> <li>Street network</li> <li>Block size (Area)</li> </ul>	<ul style="list-style-type: none"> <li>Street and intersection density</li> <li>Average block size and length of boundary</li> </ul>
<b>US EPA SLD</b> (Smart Location Database)	<ul style="list-style-type: none"> <li>2013 (DB year: 2010-2013)</li> </ul>	<ul style="list-style-type: none"> <li>Census Block Group</li> </ul>	<ul style="list-style-type: none"> <li>A rich set of pre-calculated land use measures for density, diversity, design, transit, and destination accessibility</li> </ul>	
<b>Google API</b>			<ul style="list-style-type: none"> <li>Transit routes and schedules by time of the day (GTFS)</li> </ul>	<ul style="list-style-type: none"> <li>Accessibility by transit in peak/non-peak hours</li> </ul>

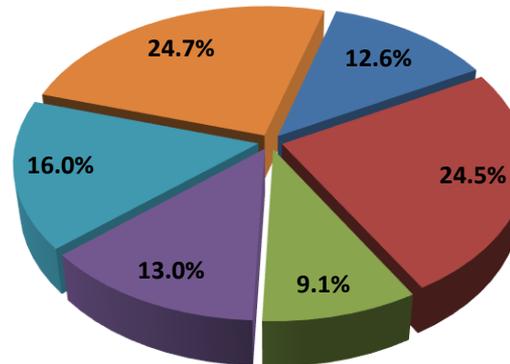
**Other land use data sources: MapQuest API, WalkScore API, Yellow Page API, Uber API...**

# Sample Characteristics (N=2391)

### Millennials

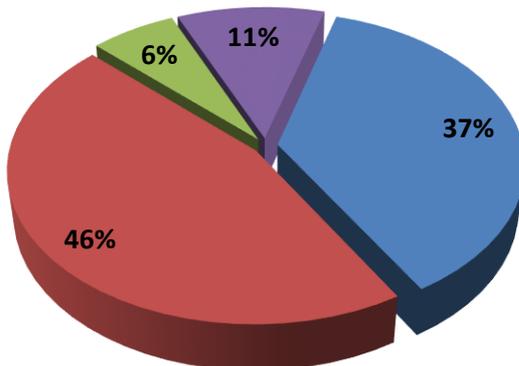


### Generation X

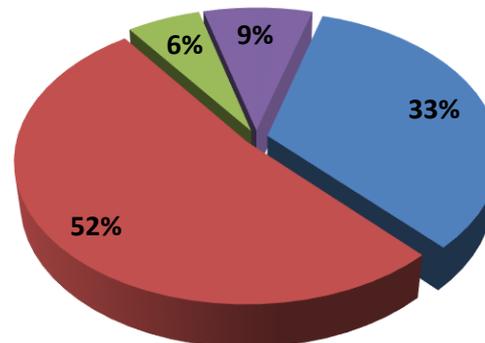


- Central Valley
- MTC
- NorCal and Others
- SACOG
- SANDAG
- SCAG

### Millennials



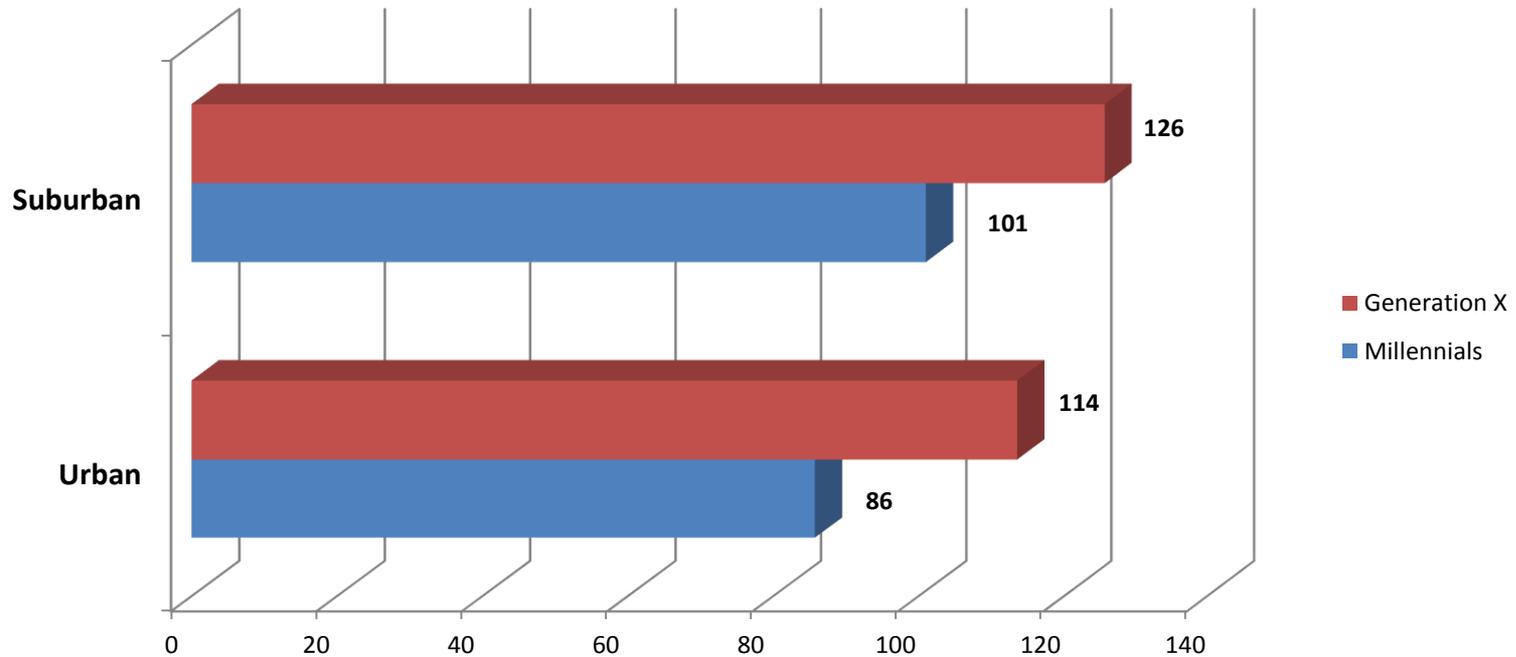
### Generation X



- Urban
- Suburban
- Rural
- Small town

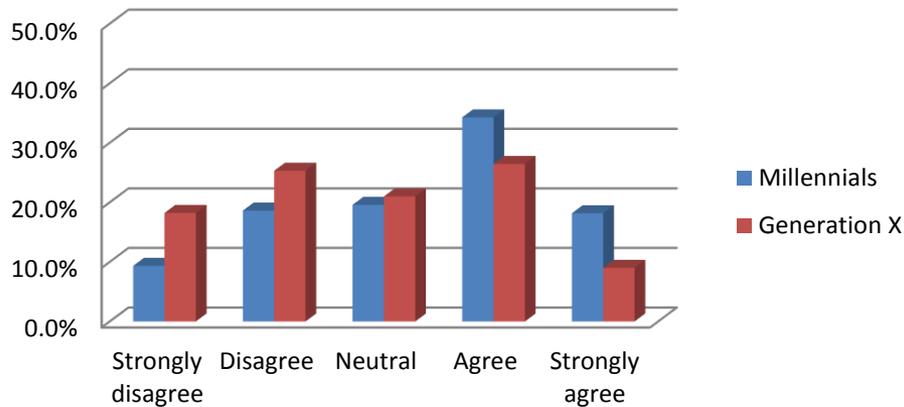
# Vehicle Miles Traveled

Average Weekly VMT by Neighborhood Types and Age

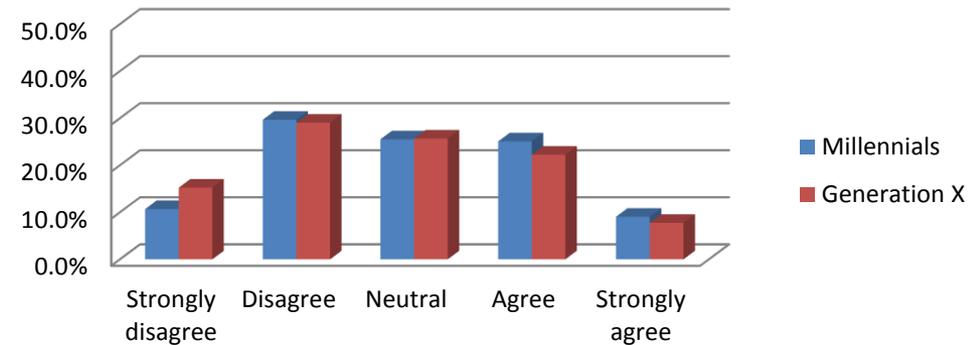


# A Transient, Green Generation

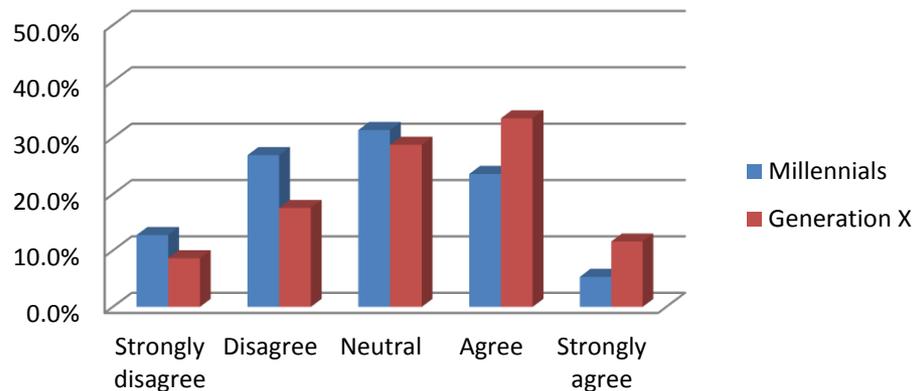
***"I'm still trying to figure out my career (e.g. what I want to do, where I'll end up)"***



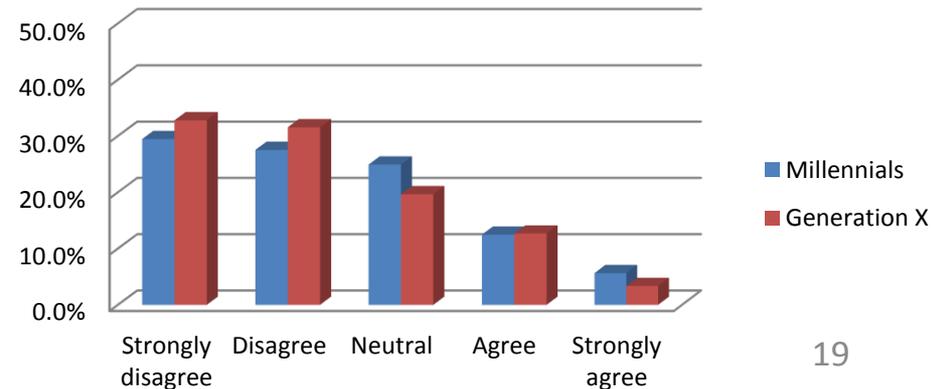
***"I prefer to live close to transit even if it means I'll have a smaller home and live in a more crowded area"***



***"I'm already well-established in my field of work"***

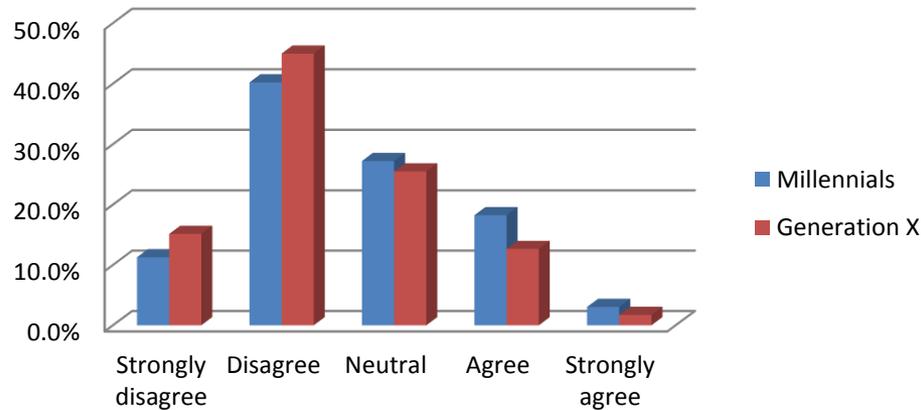


***"We should raise the price of gasoline to reduce the negative impacts on the environment"***

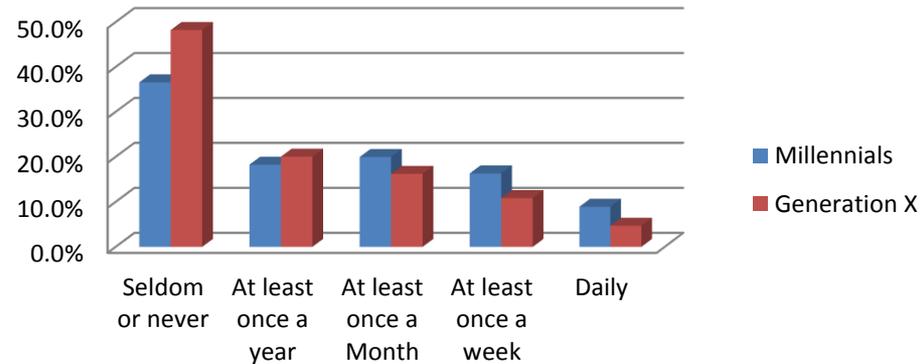


# Tech-Savvy, Smartphone-Oriented

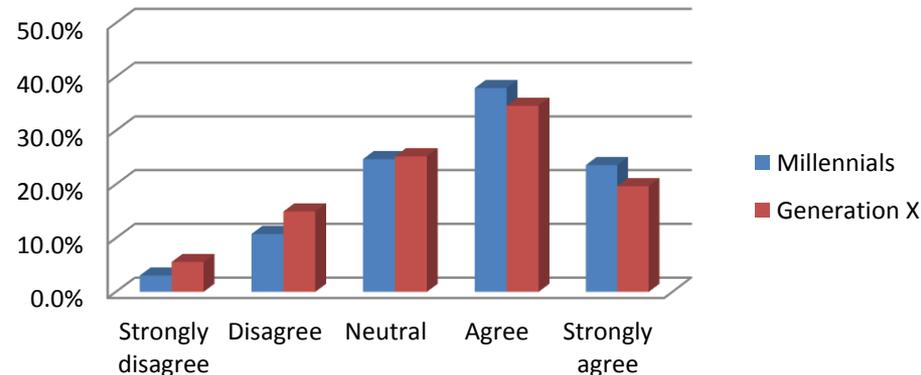
***"I avoid doing things that I know my friends would not approve"***



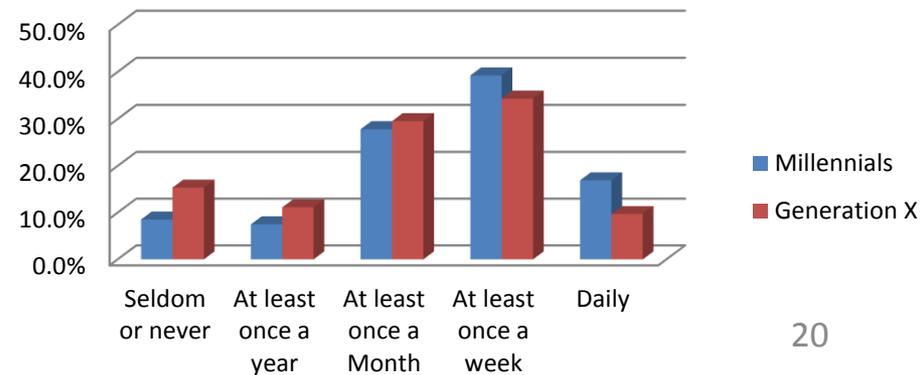
***"Use smartphone to decide which means of transportation, or combinations of multiple means, to use for a trip "***



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

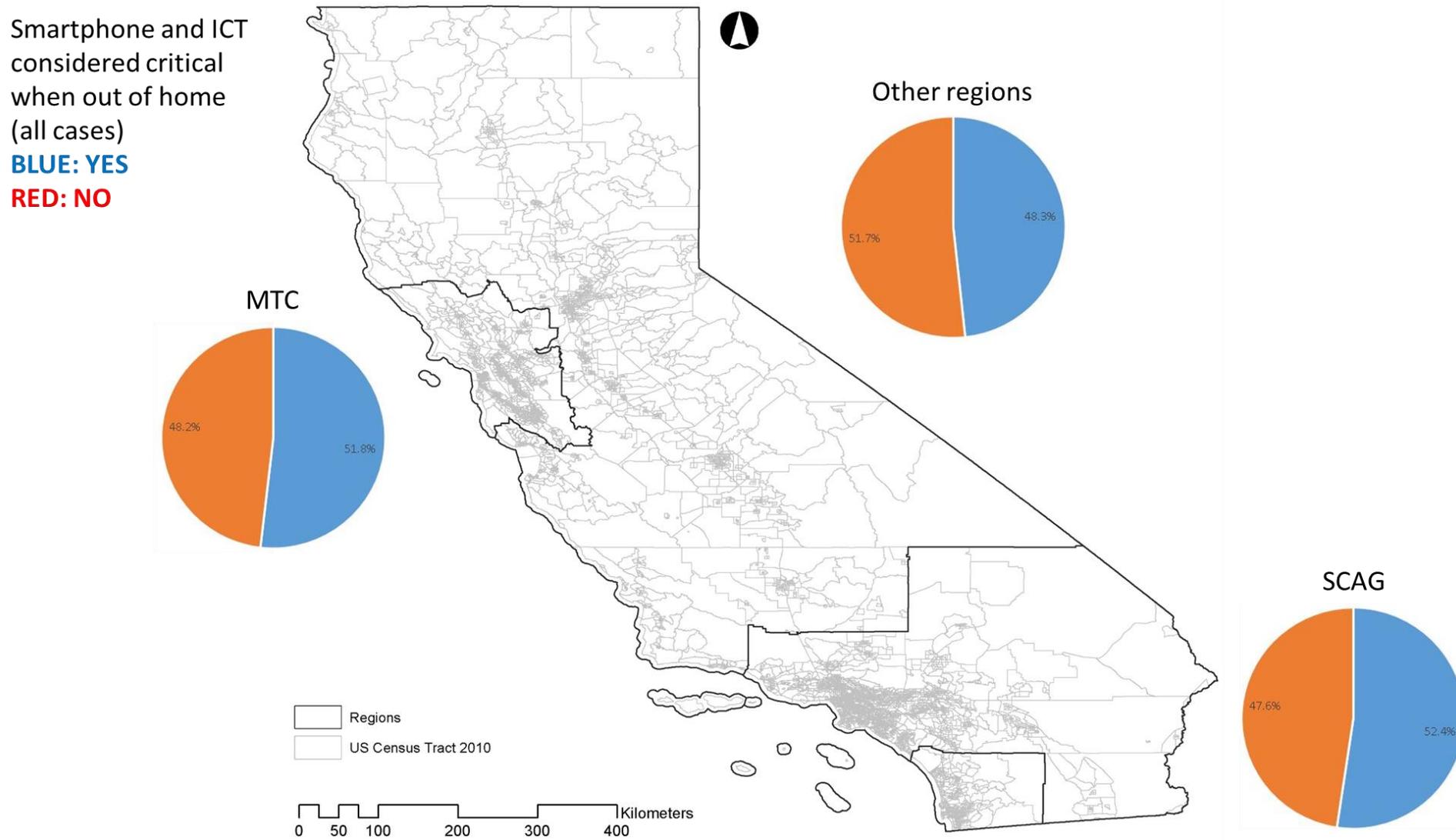


***"Use smartphone to identify possible destinations (e.g. restaurant, cafe, etc.) "***



# Smartphone and ICT

Smartphone and ICT considered critical when out of home (all cases)  
**BLUE: YES**  
**RED: NO**

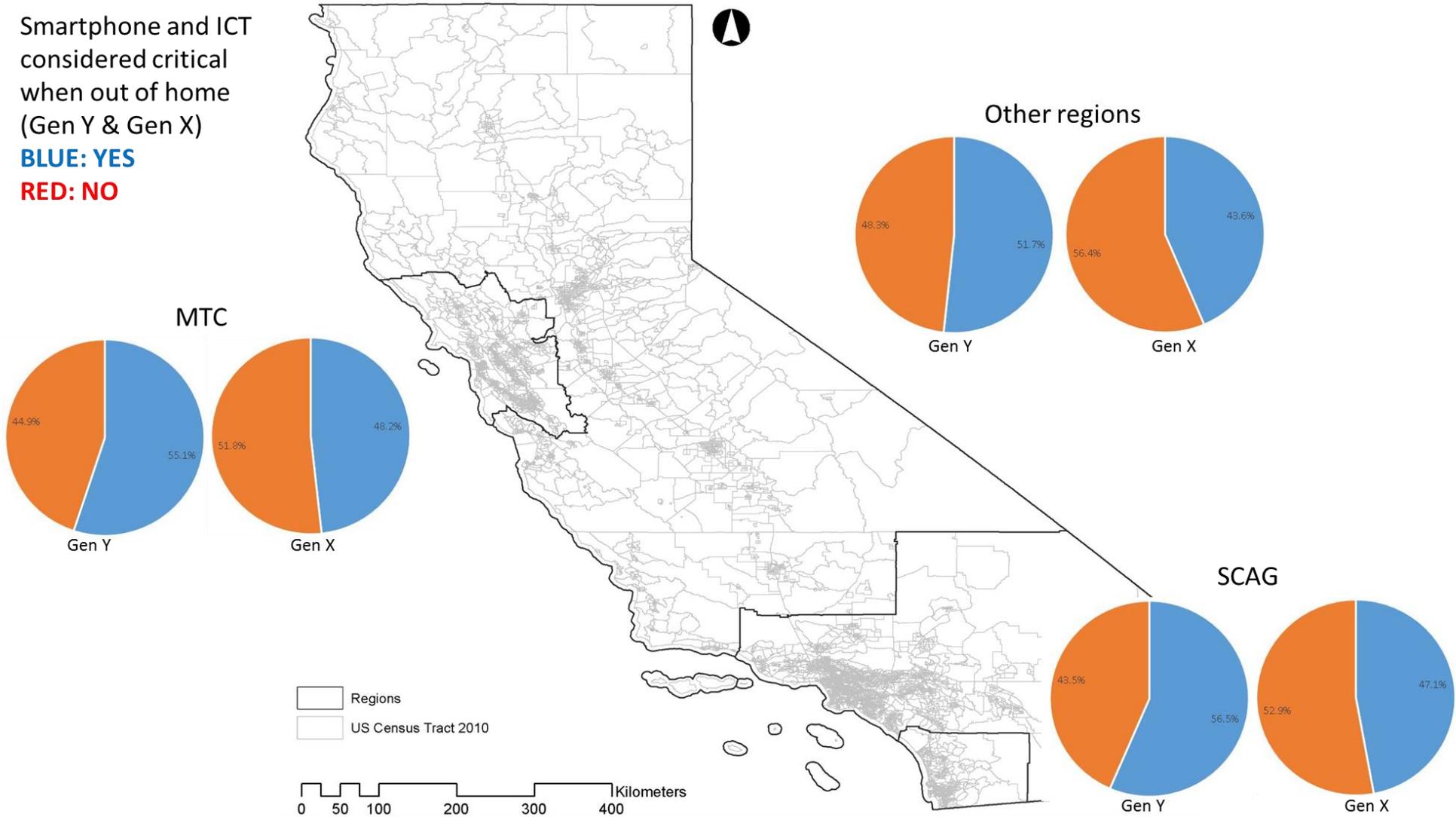


# Smartphone and ICT

Smartphone and ICT considered critical when out of home (Gen Y & Gen X)

**BLUE: YES**

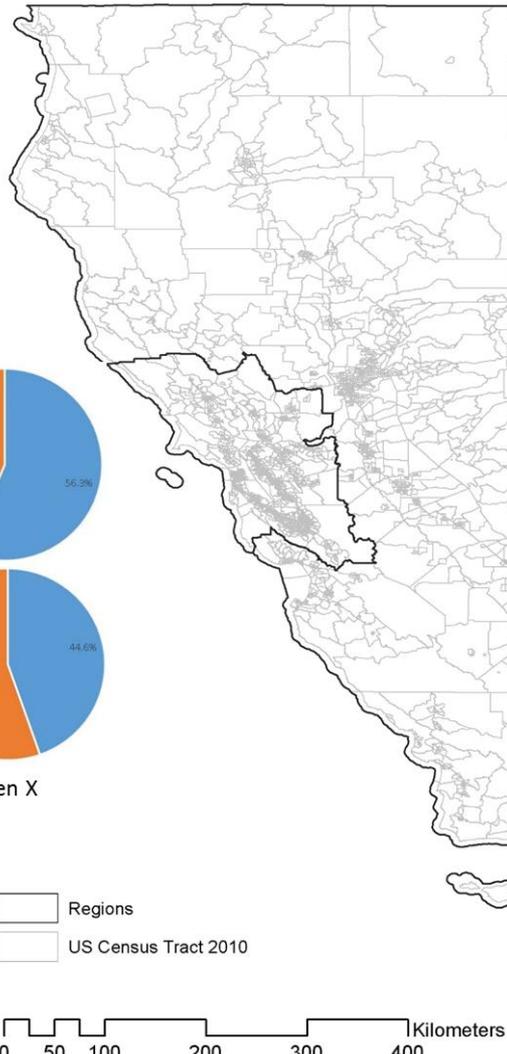
**RED: NO**



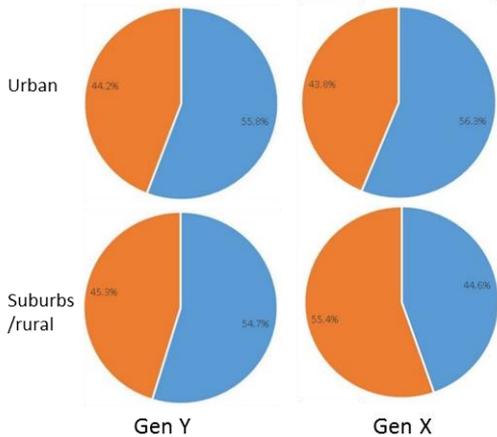
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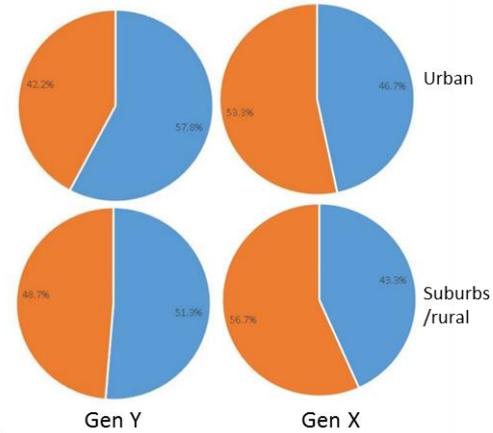
**BLUE: YES**  
**RED: NO**



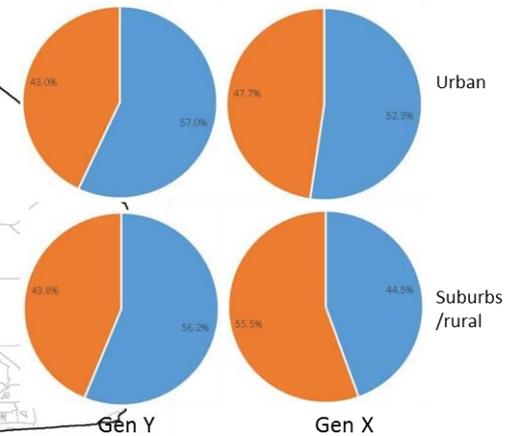
## MTC



## Other regions



## SCAG



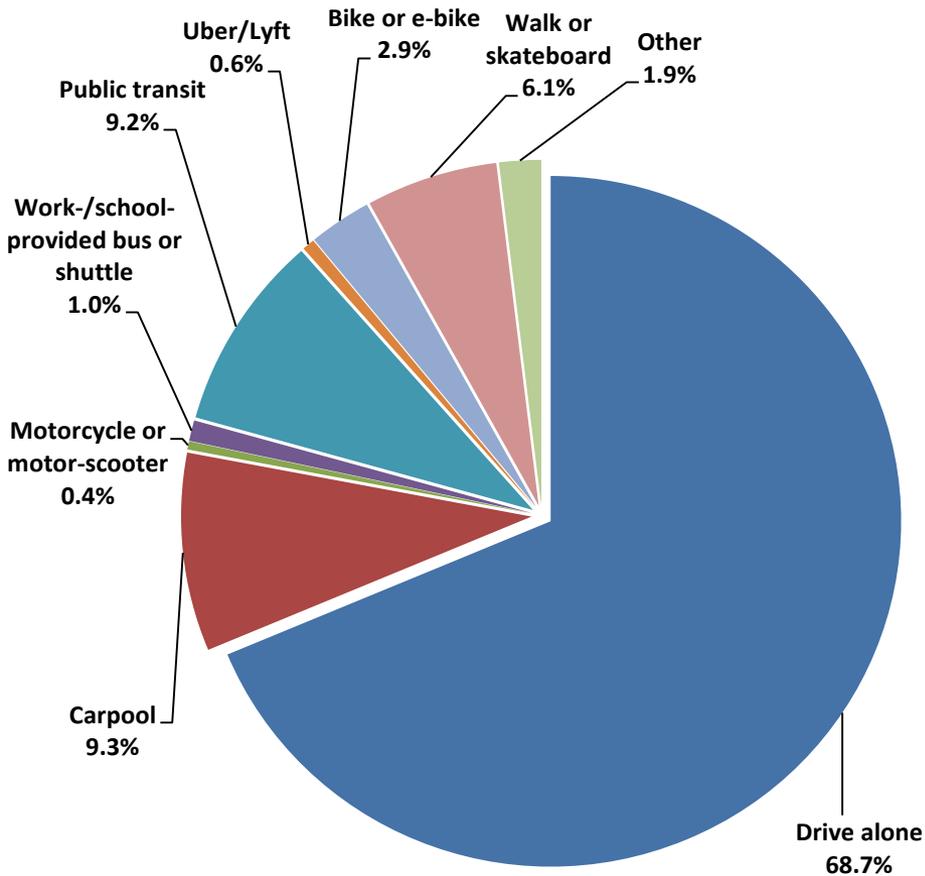
# Attitudinal Profiles

*Factor analysis: 20 attitudinal dimensions extracted from the 65 original variables, e.g.:*

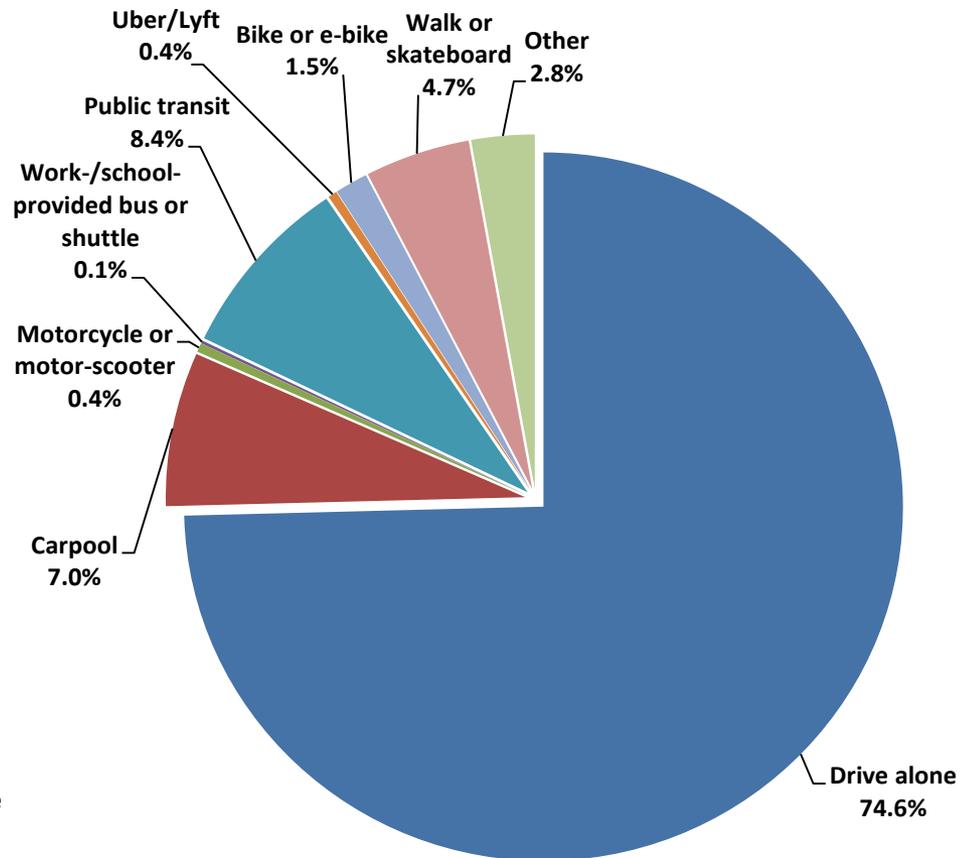
	Pro-environment	Commute causes stress	Likes ICT	No climate change
The environmental impacts of the various means of transportation affect the choices I make.	.775			
I am committed to using a less polluting means of transportation (walking, public transit, etc.) as much as possible.	.725			
To improve air quality, I am willing to pay a little more to use a hybrid or other clean-fuel vehicle.	.495			
My commute is stressful.		.776		
My commute is generally pleasant.		-.659		
Traffic congestion is a major problem for me personally.		.546		
The time I spend commuting is generally wasted time.		.511		
Getting stuck in traffic does not bother me that much.		-.318		
Having Wi-Fi and/or 3G/4G connectivity everywhere I go is essential to me.			.657	
Getting around is easier than ever with my smartphone.			.580	
I like to be among the first people to have the latest technology.			.521	
Social media (e.g. Facebook) makes my life more interesting.			.417	
Any climate change that may be occurring is part of a natural cycle.				.660
Greenhouse gases from human activities are creating major problems.				-.657
It is pointless for me to try too hard to be more environmentally friendly because I am just one person.				.365
I prefer to live in a spacious home, even if it is farther from public transportation and many places I go to.				
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 like the idea of living somewhere with large yards and lots of space between homes.				

# Most Recent Commute - Mode Choice

## Millennials



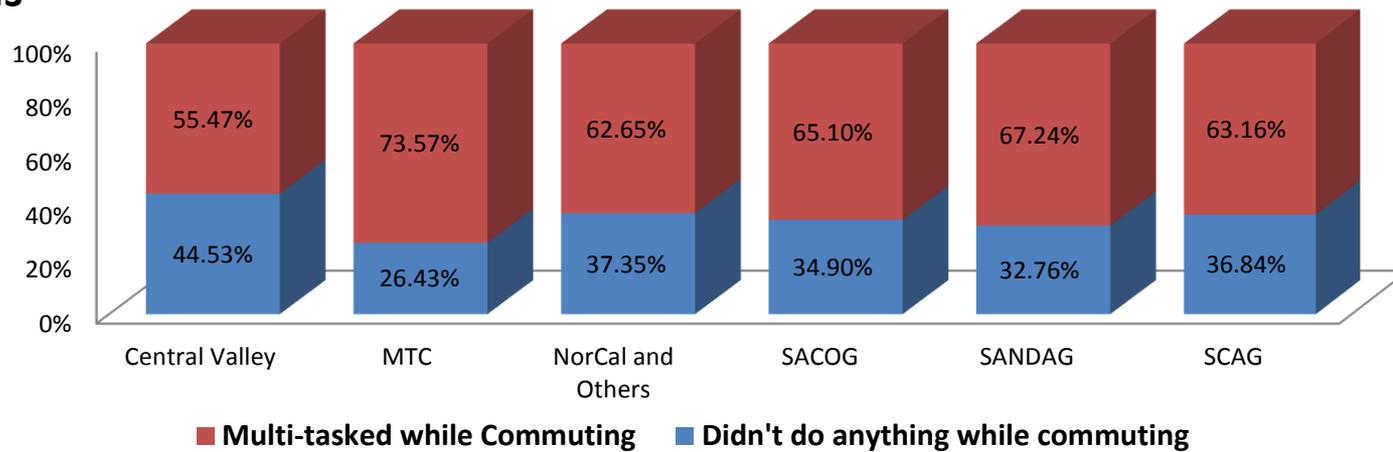
## Generation X



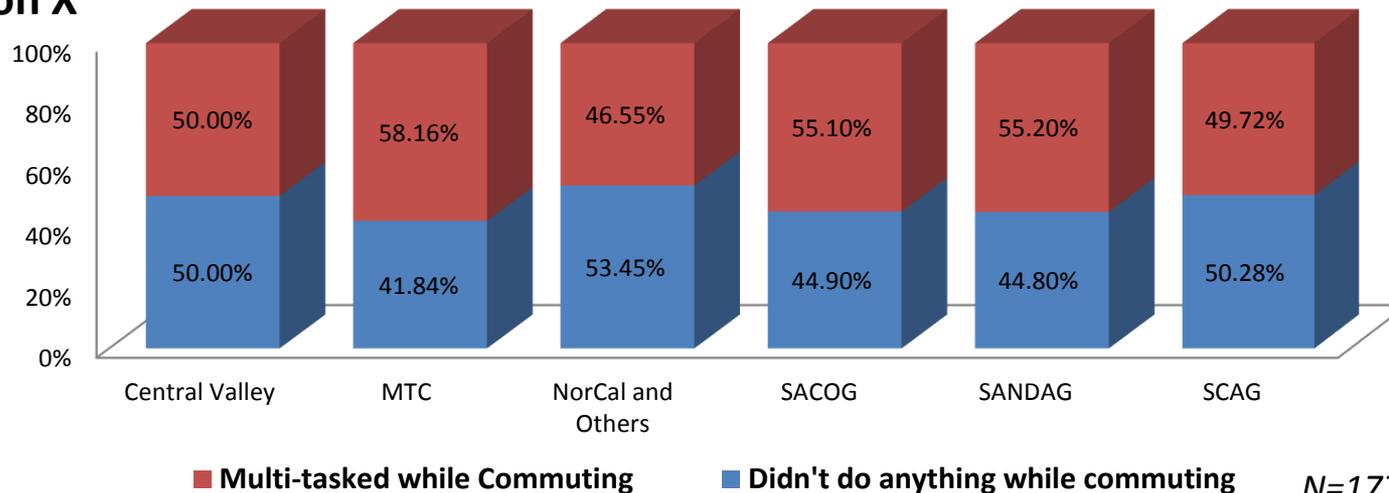
N=1776, weighted sample

# Multitasking while Traveling

## Millennials



## Generation X

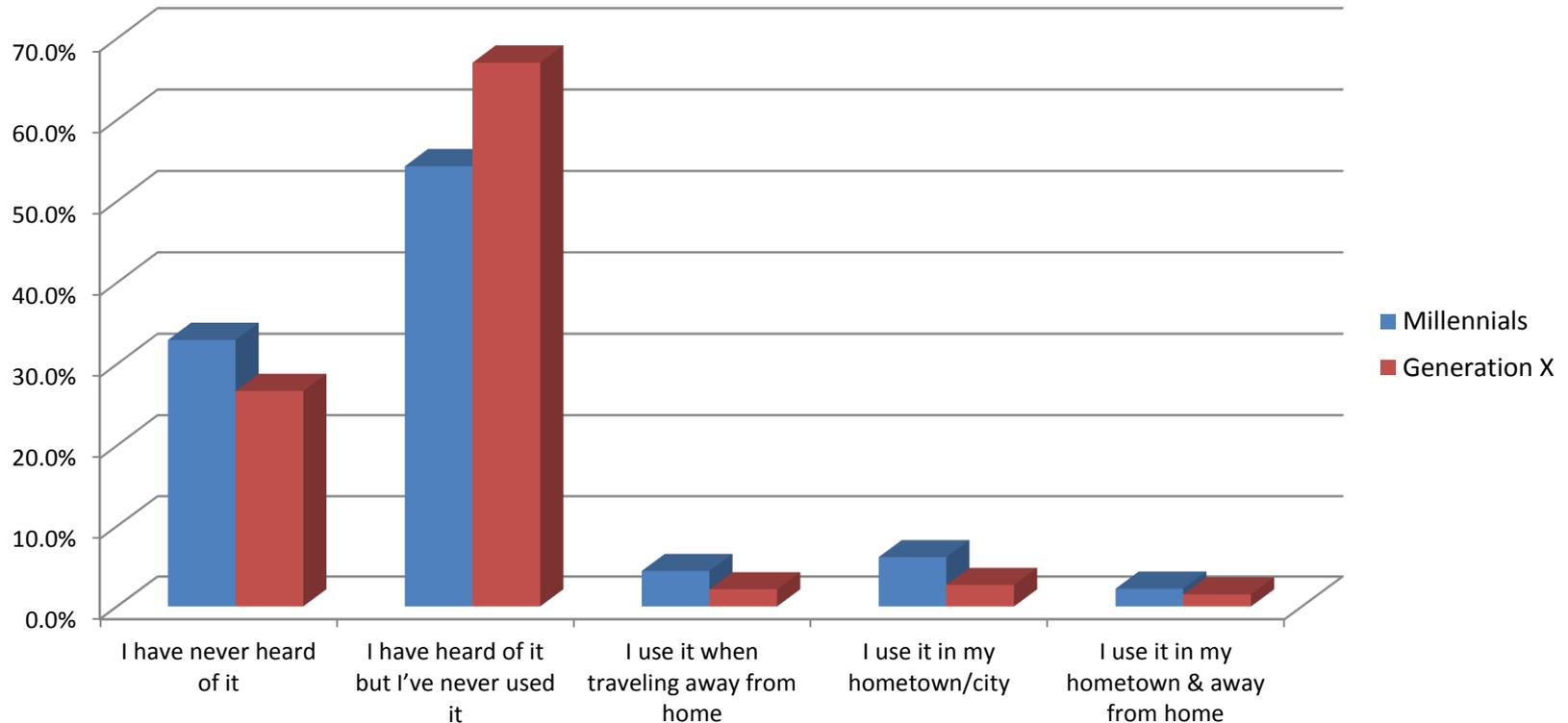


# Shared Mobility Services

Type of Services	Ownership and Operational Models
Carsharing   	<ul style="list-style-type: none"> <li>• Fleet-based or peer-to-peer</li> <li>• Round trip or one way</li> </ul>
Bikesharing   	<ul style="list-style-type: none"> <li>• Fleet-based or peer-to-peer</li> <li>• Dock-based or GPS-based</li> </ul>
Dynamic Ridesharing  	<ul style="list-style-type: none"> <li>• Private-public partnership</li> <li>• Carpooling, vanpooling, and dynamic ridesharing</li> </ul>
On-demand Ride Services   	<ul style="list-style-type: none"> <li>• Private (may be subsidized by public in future)</li> <li>• Uber X and Lyft; Uber pool and LyftLine</li> </ul>

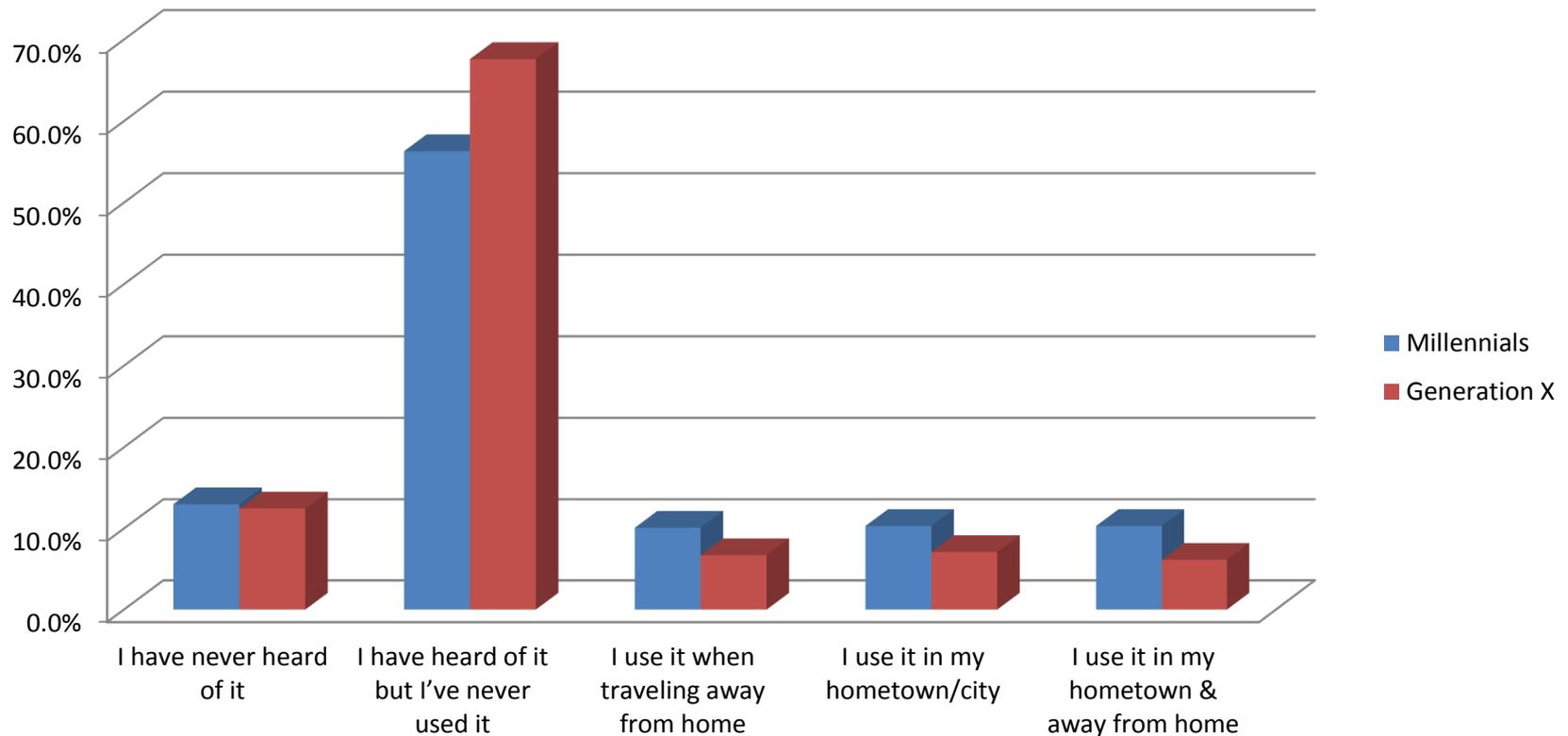
# Use of Car-Sharing

**Familiarity with and usage of car-sharing  
(e.g. Zipcar, Car2Go)**

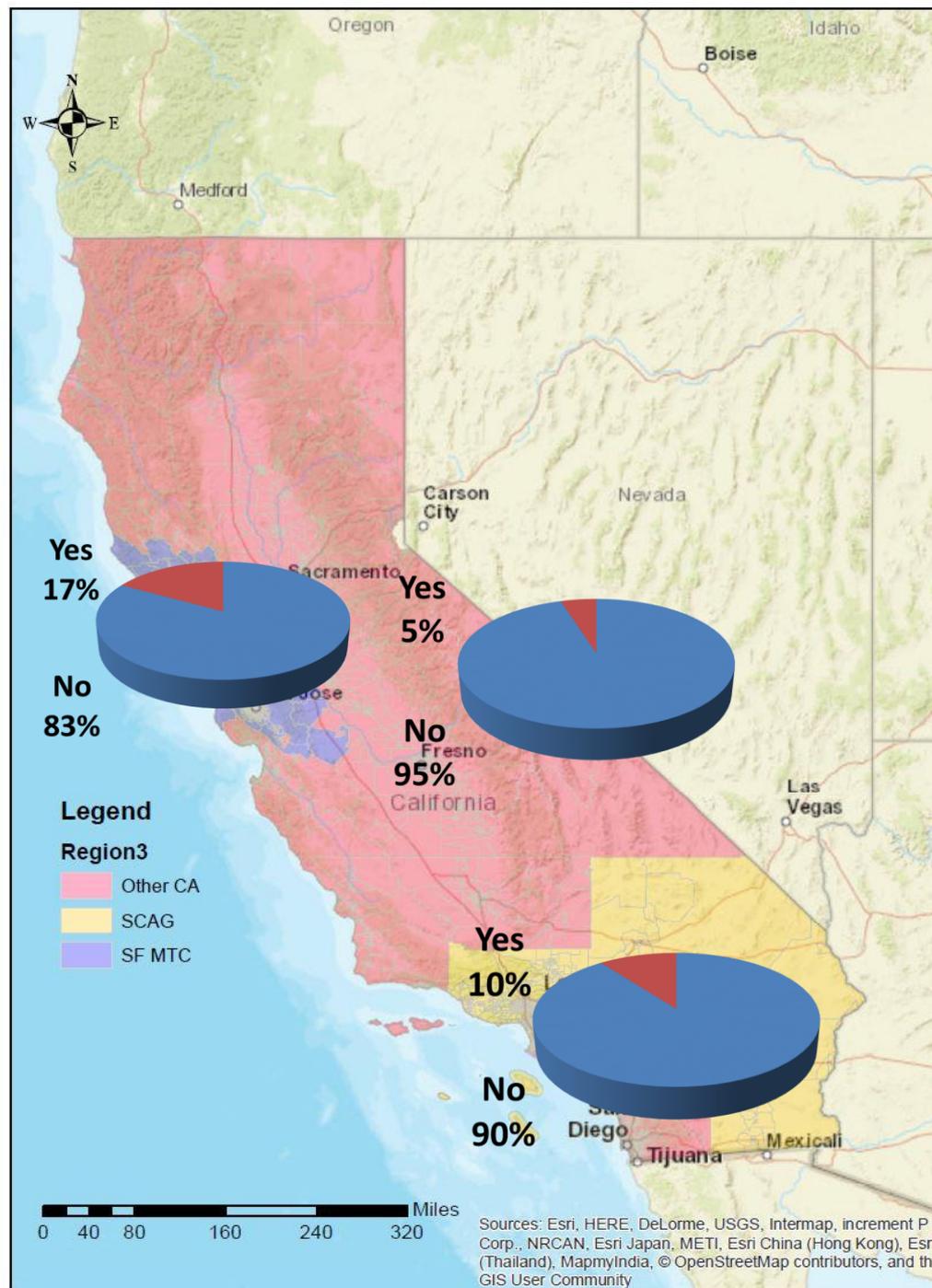


# A Uber-Friendly Generation?

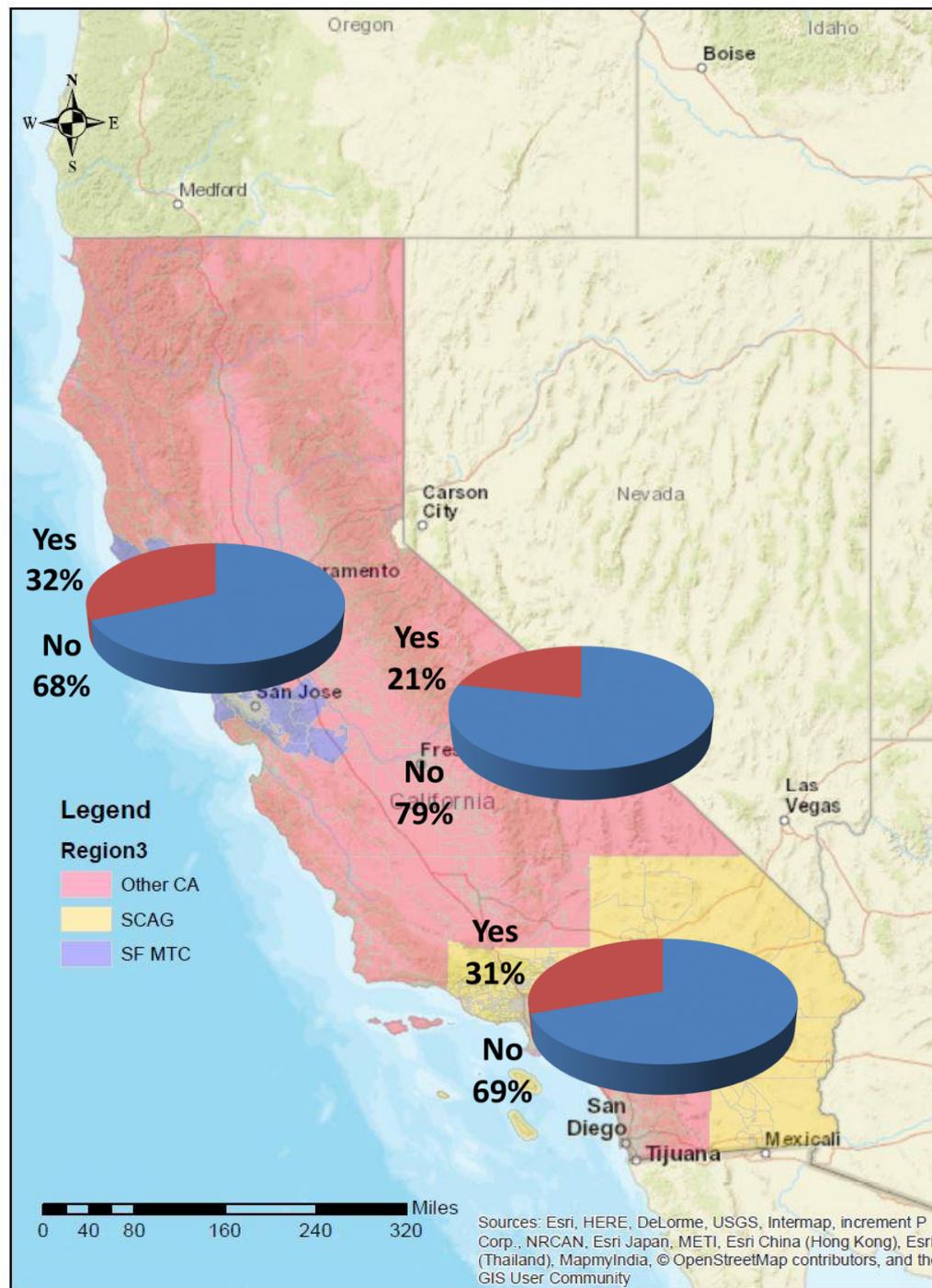
**Familiarity with and usage of on-demand ride services  
(e.g. Uber, Lyft)**



# Use of Car-Sharing

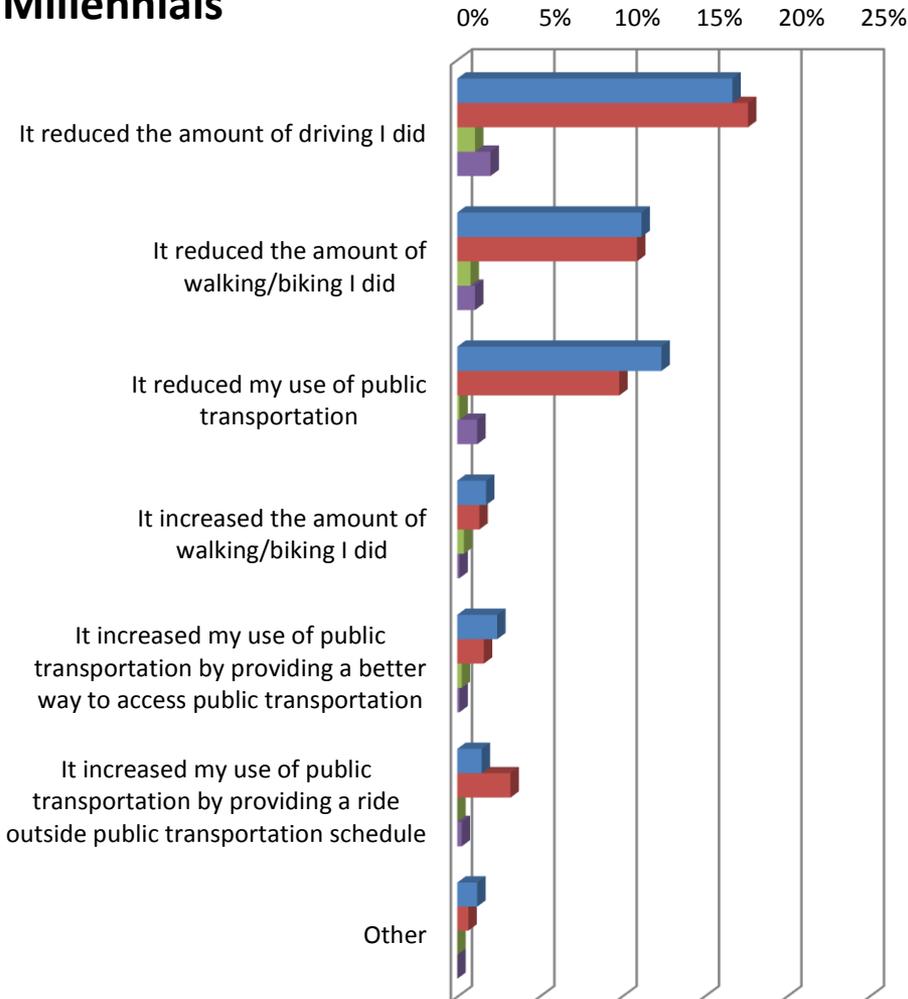


# Use of Uber/Lyft

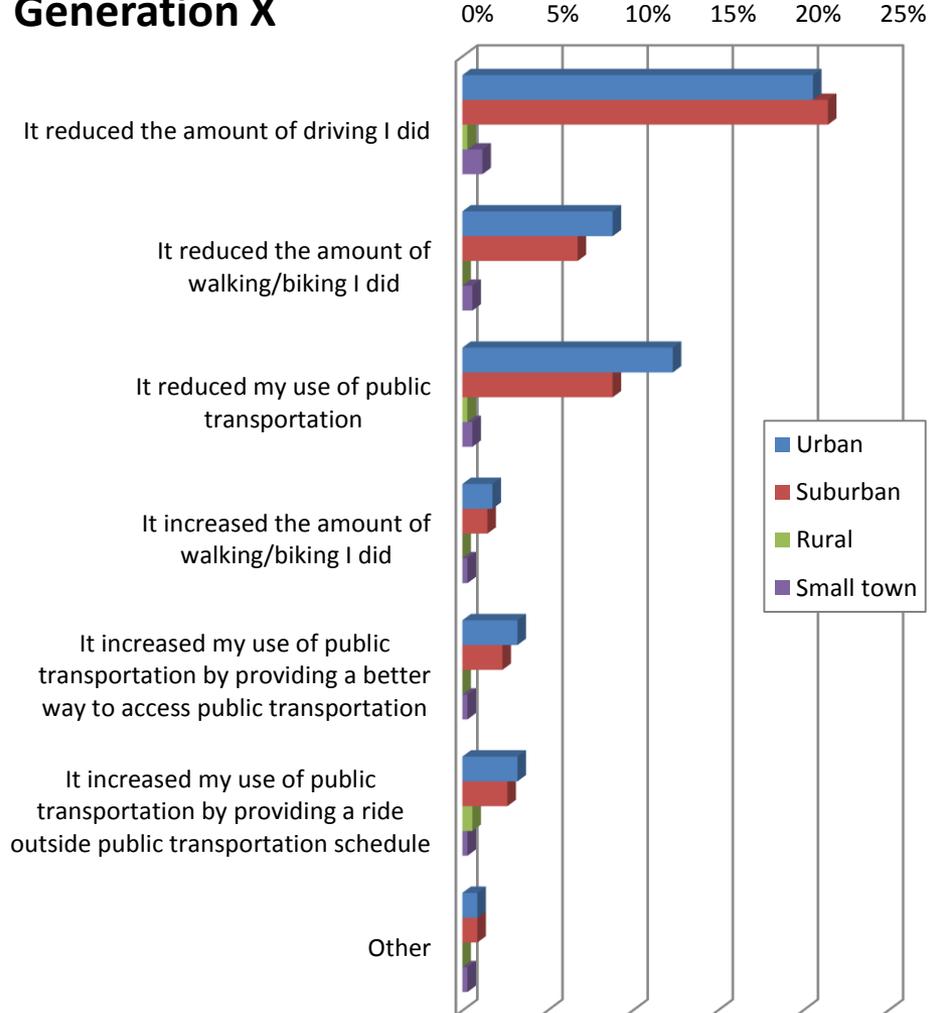


# Impact of Last Uber Trip on the Use of Other Means of Travel

## Millennials



## Generation X



N=622, weighted sample

# Preliminary Findings, and Next Steps

- Consistent with expectations, millennials are found to:
  - Drive less
  - Use ICT devices more often
  - Multitask during their commute
  - Have different personal attitudes (e.g. about the environment, technology...)
  - Adopt share mobility services more often
- How do their behaviors relate to...
  - Stage in life
  - Personal attitudes, lifestyles and living arrangements
  - Adoption of technology and mobility choices
- Relevance for planning implications, for example:
  - Will these trends continue in future years, or are mainly part of *lifecycle* effects?
  - What is the role of emerging technologies/shared mobility services?
  - How are behavioral patterns affected by geographic location?

# What Affects an Individual's VMT?

Estimated coefficients of Ln(VMT+1) model (WLS estimation, N=2345):

	Millennials	Generation X
<i>Constant</i>	-5.995***	2.620***
<i>Presence of Children in the HH</i>	0.264***	0.366***
<i>Age of respondent</i>	0.612***	-
<i>Age^2</i>	-0.010***	-
<i>Individual Income 40-60K</i>	0.457***	0.442***
<i>Individual Income 60-80K</i>	0.343**	0.662***
<i>Individual Income 80-100K</i>	0.706***	0.746***
<i>Individual Income 100K or more</i>	0.361*	0.718***
<i>#Cars per HH Drivers</i>	-	0.492***
<i>Can Telecommute</i>	-	-0.316***
<i>Full time student</i>	0.651***	-
<i>Part time Employee</i>	0.958***	0.537***
<i>Full time Employee</i>	1.271***	0.897***
<i>Two Jobs</i>	0.579***	1.022***
<b>Adj R-square</b>	<b>0.165</b>	<b>0.206</b>

**Note: Draft model – please do not cite**

# What Affects an Individual's VMT? (2)

Same model, with addition of land use and attitudinal variables (WLS estimation, N=2345):

	Millennials	Generation X
<i>Constant</i>	-4.629***	3.062***
<i>Presence of Children in the HH</i>	0.193**	0.283***
<i>Age of respondent</i>	0.534***	-
<i>Age^2</i>	-0.009***	-
<i>Individual Income 40-60K</i>	0.388***	0.413***
<i>Individual Income 60-80K</i>	0.320**	0.596***
<i>Individual Income 80-100K</i>	0.643***	0.527***
<i>Individual Income 100K or more</i>	0.375**	0.635***
<i>#Cars per HH Drivers</i>	-	0.268***
<i>Can Telecommute</i>	-	-0.249**
<i>Full time student</i>	0.654***	-
<i>Part time Employee</i>	0.962***	0.450***
<i>Full time Employee</i>	1.416***	0.818***
<i>Two Jobs</i>	0.600***	0.761***
<i>Gross population density</i>	-0.006**	-0.010***
<i>Use Zipcar</i>	-	-0.389**

**Note: Draft model – please do not cite**

**(continues...)**

# What Affects an Individual's VMT? (3)

	Millennials	Generation X
(...continues)		
<i>Factor Score: Anti Government Regulation</i>	0.135***	-
<i>Factor Score: Pro-Suburban</i>	0.161***	-
<i>Factor Score: Fine with No Car</i>	-0.140***	-0.310***
<i>Factor Score: Car as a Tool</i>	-0.139***	-
<i>Factor Score: Too Busy</i>	0.301***	0.344***
<i>Factor Score: Commute Stress</i>	0.201***	0.180***
<i>"The air quality of the region where I live concerns me"</i>	-0.137***	-0.115***
Adj R-square	0.242	0.320

**Note: Draft model – please do not cite**

# Research Question 1

What are the **relationships among travel behavior, personal preferences, adoption of technology and residential location** of millennials?

Estimation of frequency models for the use of various means of travel, segmented respectively for millennials and Gen Xers.

- What are the main factors affecting the adoption of modes alternative to cars?
- What is the impact of the adoption of **on-demand ride services** (Uber/Lyft) on the use of other modes?
- What is the impact of living arrangements vs. personal preferences?

How do **level of education, income** and **geographic location** relate to millennials' choices?

# Research Question 2

Are the dominant trends of millennials' travel **permanent** or **temporary** (e.g. effect of a transition in life stages)?

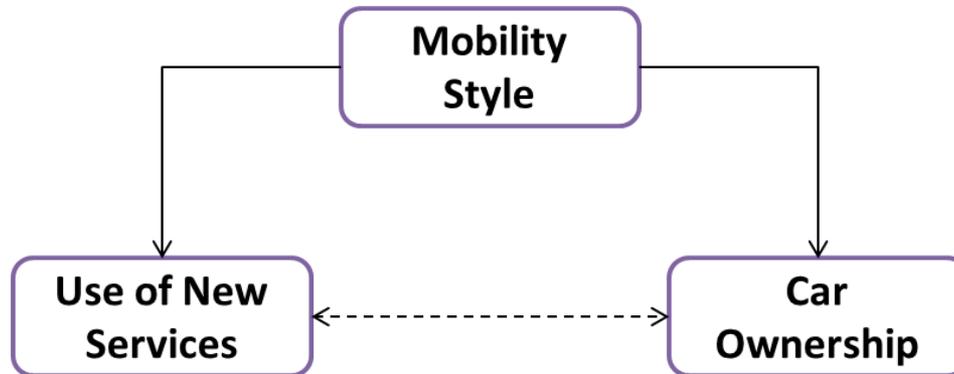
Estimation of a VMT model, which controls for sociodemographics, personal attitudes, lifestyles, and geographic location.

- What is the impact of stage of life (e.g. being married, presence of children) on the travel behavior of millennials?
- What is the impact of personal attitudes and preferences?
- How does the place where somebody grew up affect travel behavior?
- What is the impact of major life events (new job, relocation to city, moving out of parents' place, moving in with partner, etc.)?

**Not possible to fully analyze these issues using NHTS, or other currently available travel survey data.**

# Research Question 3

How does the adoption of **shared mobility** affect other components of **travel behavior** and **vehicle ownership**?



Jointly model the adoption of shared mobility and vehicle ownership (or self-reported desired level of vehicle ownership), while controlling for the impacts of attitudes, commute and non-commute patterns, adoption of technology and social media, residential self-selection, household, individual and built environment characteristics.

Estimation of *bivariate ordered Probit*, *recursive Probit*, or *latent-class structural equation models*.

# Research Question 4

How many millennials match the stereotype of *urbanite/socialite* common in the media?

Cluster or latent class analysis to analyze different profiles of people (socialite/urbanite vs. others)

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?

# 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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Project Report Available at:  
[ncst.ucdavis.edu](http://ncst.ucdavis.edu)

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Thank you for your attention!



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