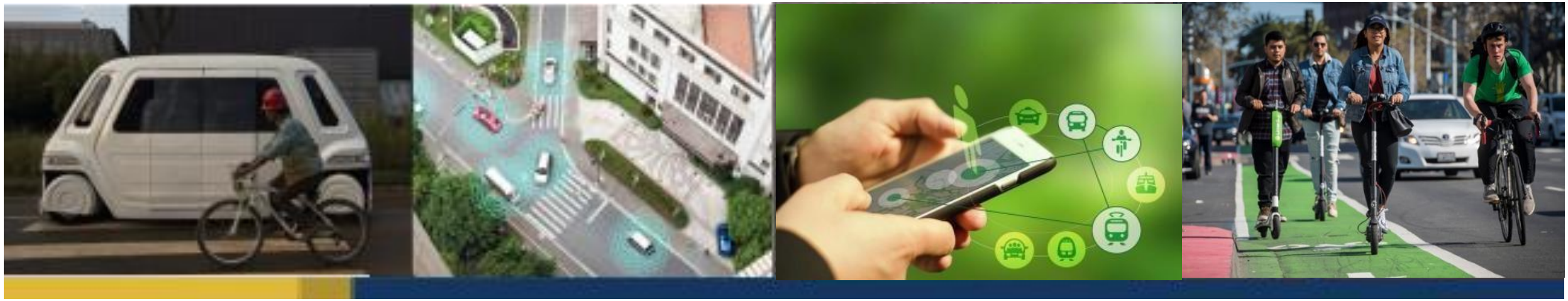


The Adoption of Shared Mobility in California and Its Impacts on the Use of Other Travel Modes

October 23, 2019

Dr. Giovanni Circella

Director, 3 Revolutions Future Mobility Program

Institute of Transportation Studies, University of California, Davis

gcircella@ucdavis.edu

Twitter: **@CircellaG**

LinkedIn: **@giovannicircella**

UCDAVIS INSTITUTE OF TRANSPORTATION STUDIES

National Center for Sustainable Transportation

3 REVOLUTIONS SHARED·AUTOMATED·ELECTRIC

UCDAVIS
INSTITUTE OF TRANSPORTATION STUDIES

3 REVOLUTIONS
SHARED · AUTOMATED · ELECTRIC

3 REVOLUTIONS
SHARED · AUTOMATED · ELECTRIC

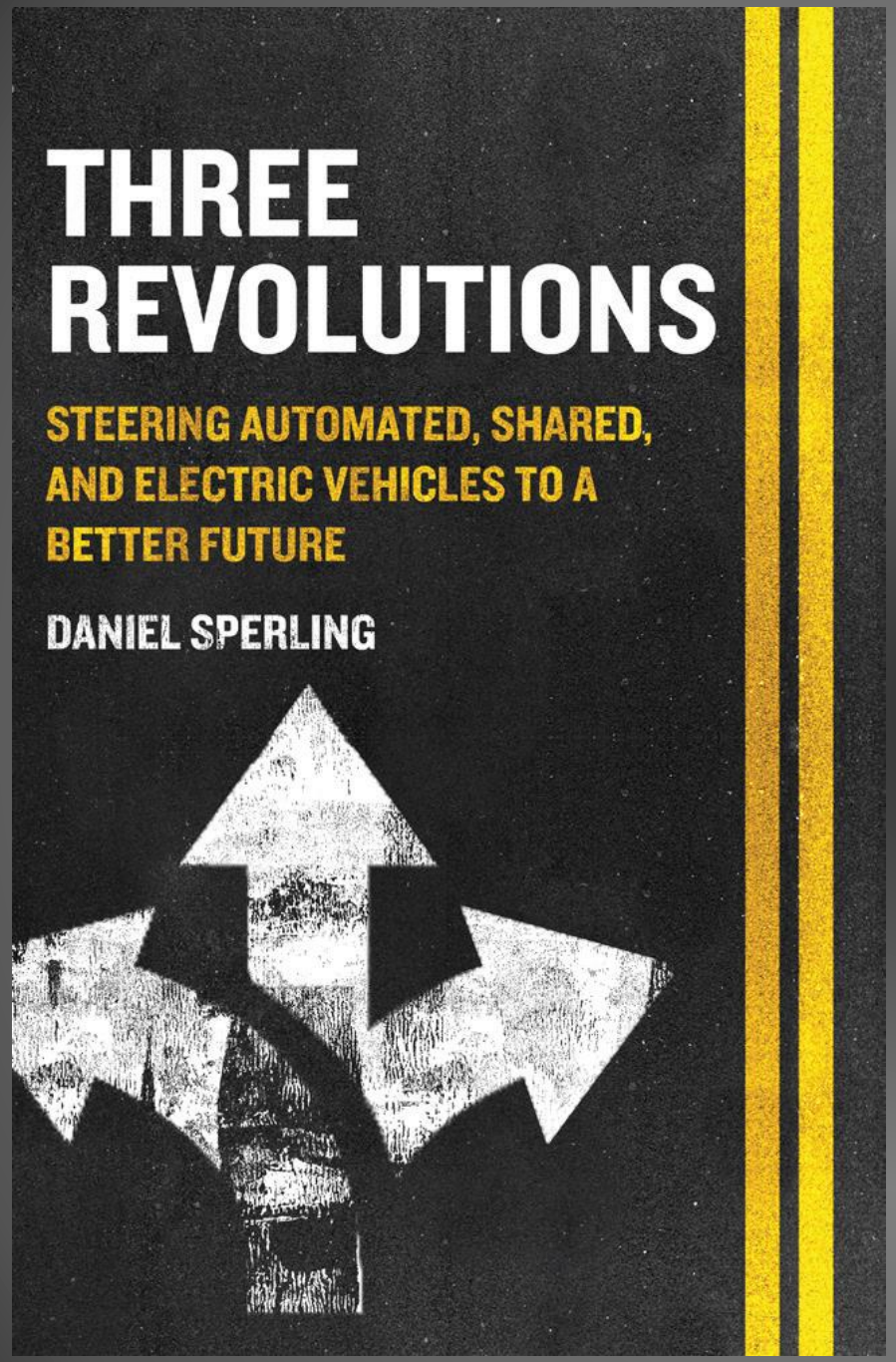
Shared mobility, **electrification** and **autonomous vehicles** are bringing big changes in:

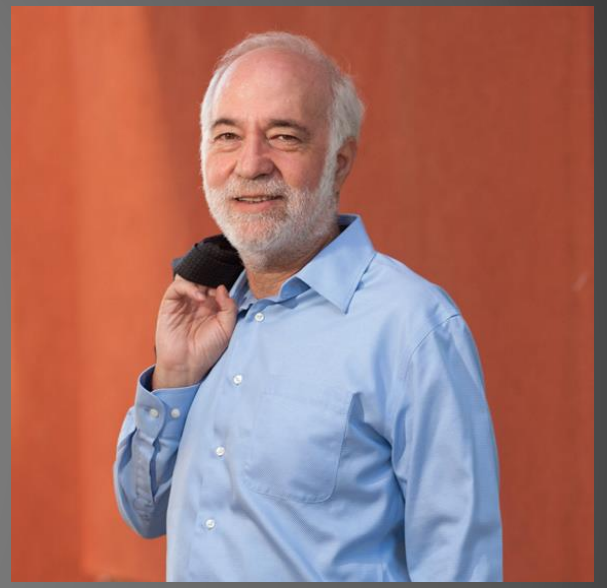
- *Transportation supply*
- *Transportation demand*

Need for rigorous research and impartial policy analysis to understand the impacts of these revolutions, and guide industry investments and government decision-making.

BMW · DAIMLER · Bay Area Air Quality Management District · VOLVO · lyft · EPA United States Environmental Protection Agency · PG&E Pacific Gas and Electric Company

Ford · Caltrans · UBER · HONDA · NISSAN · faurecia · ClimateWorks Foundation





Sperling, Daniel. *Three Revolutions: Steering Automated, Shared, and Electric Vehicles to a Better Future*. Island Press, 2018.

https://islandpress.org/books/three-revolutions

Future Mobility:

"Heaven" or "Hell" ?

- ✓ Cars are all electric
- ✓ Energy mix is clean
- ✓ Increased capacity of transportation
- ✓ Better livability in cities
- ✓ Integration with public transit
- ✓ Everybody shares intelligent vehicles

vs.

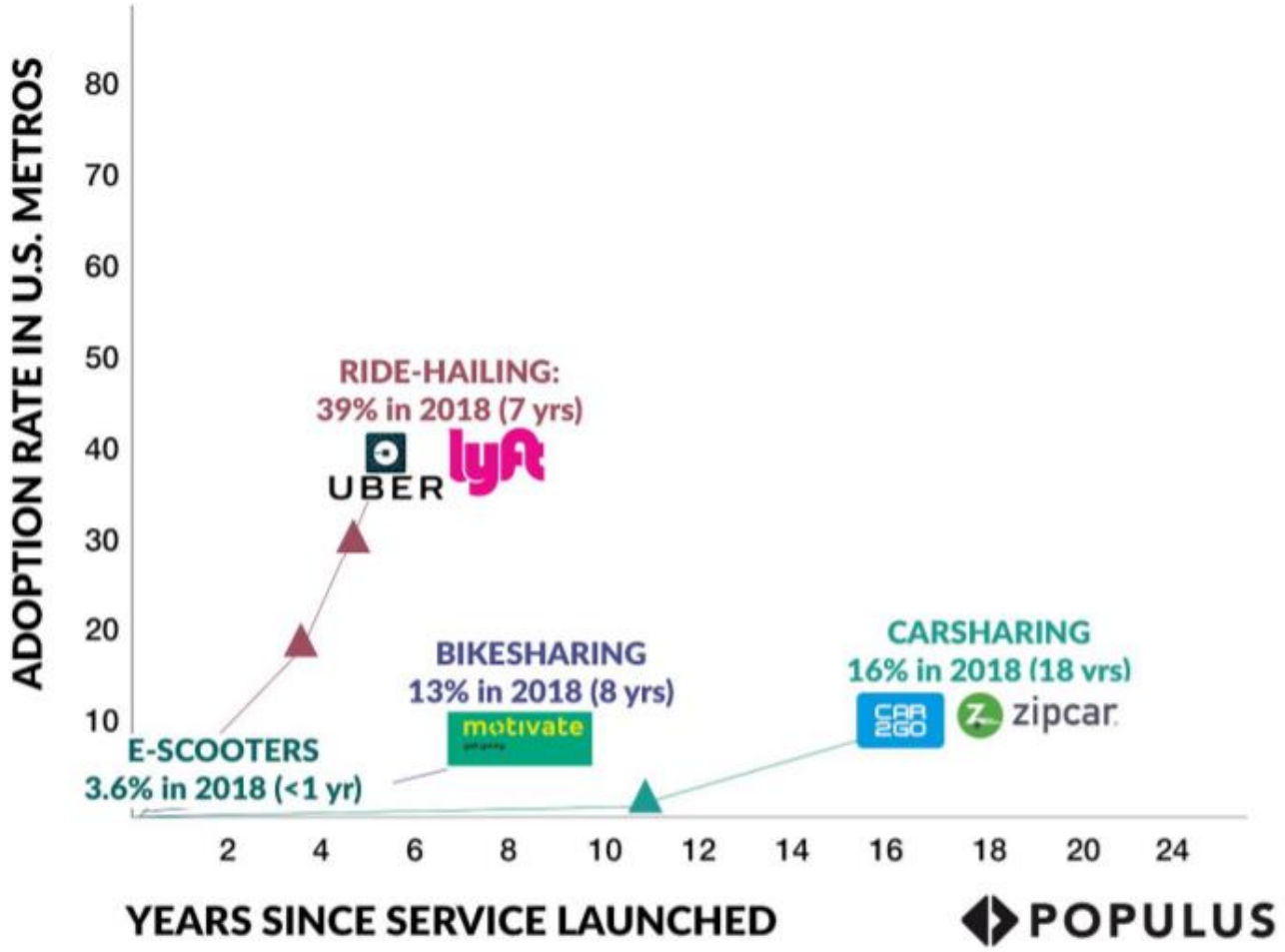
- ✓ Increased congestion
- ✓ Electricity produced with coal
- ✓ Increased travel demand
- ✓ More car-dependence of society
- ✓ Reduced role of transit
- ✓ "Ghost" vehicles traveling on streets

"People won’t have as many vehicles because they’ll share one and own one."

Jim Hackett, Ford CEO

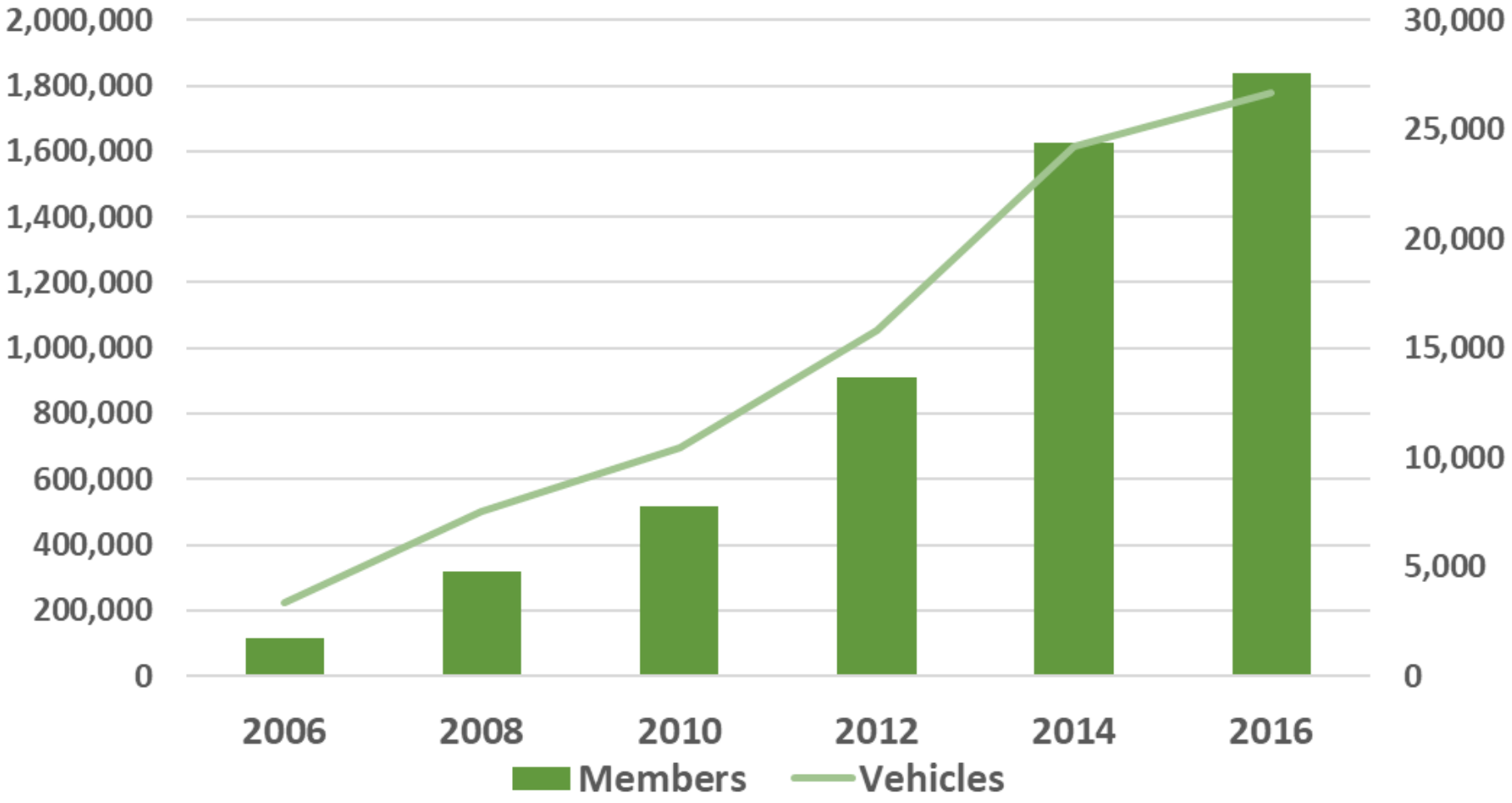
How are these transportation “revolutions” affecting vehicle ownership and travel behaviors?

Adoption of Shared Mobility Services Over Time



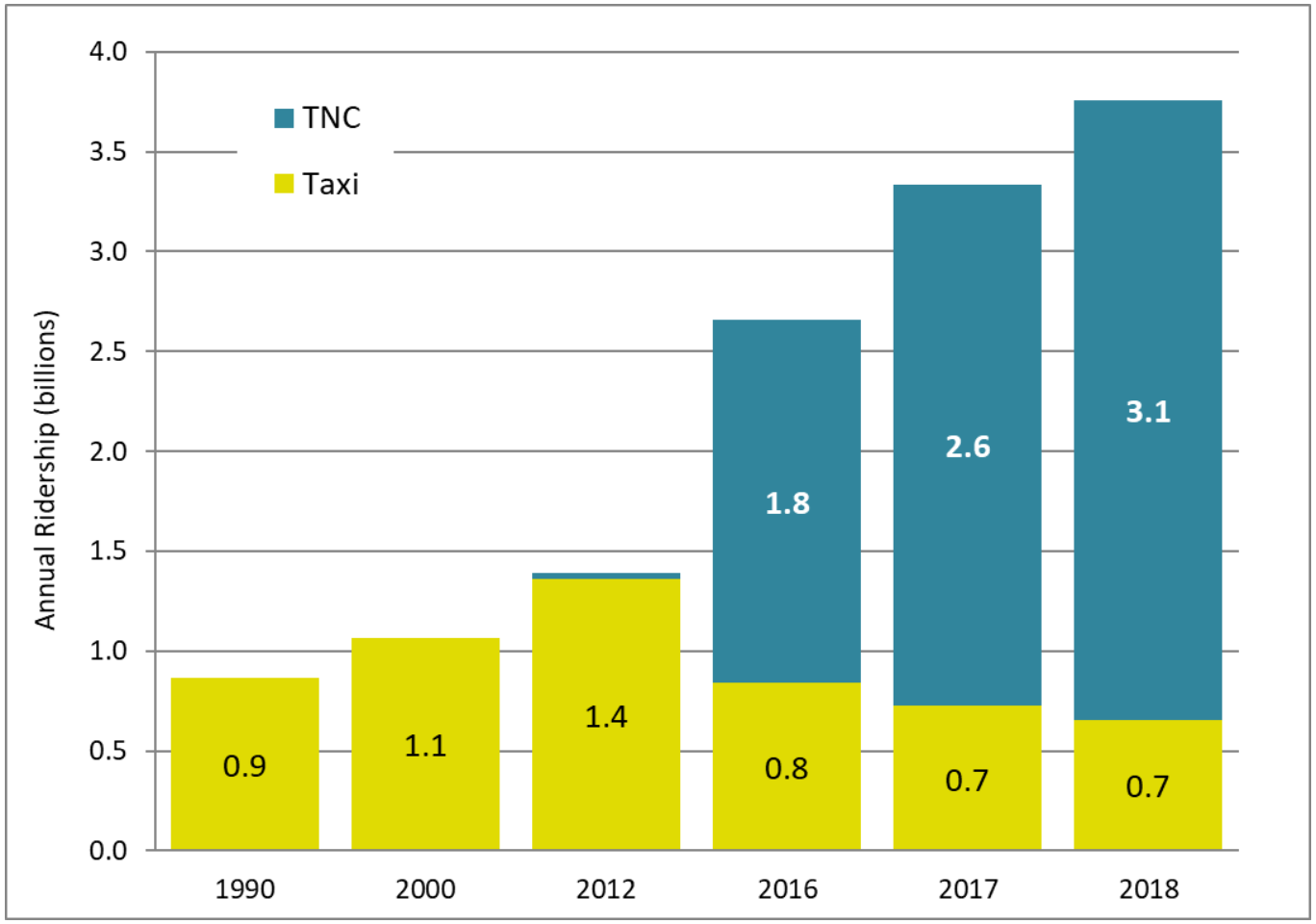
Source: Populus (2018); Data sources: Populus Groundtruth (2018), Clewlow & Mishra (2017), Clewlow (2016)

Carsharing in North America



Source: Shaheen, S., Cohen, A., & Jaffee, M. (2018). Innovative mobility: Carsharing outlook.

Uber/Lyft ridership is growing quickly…



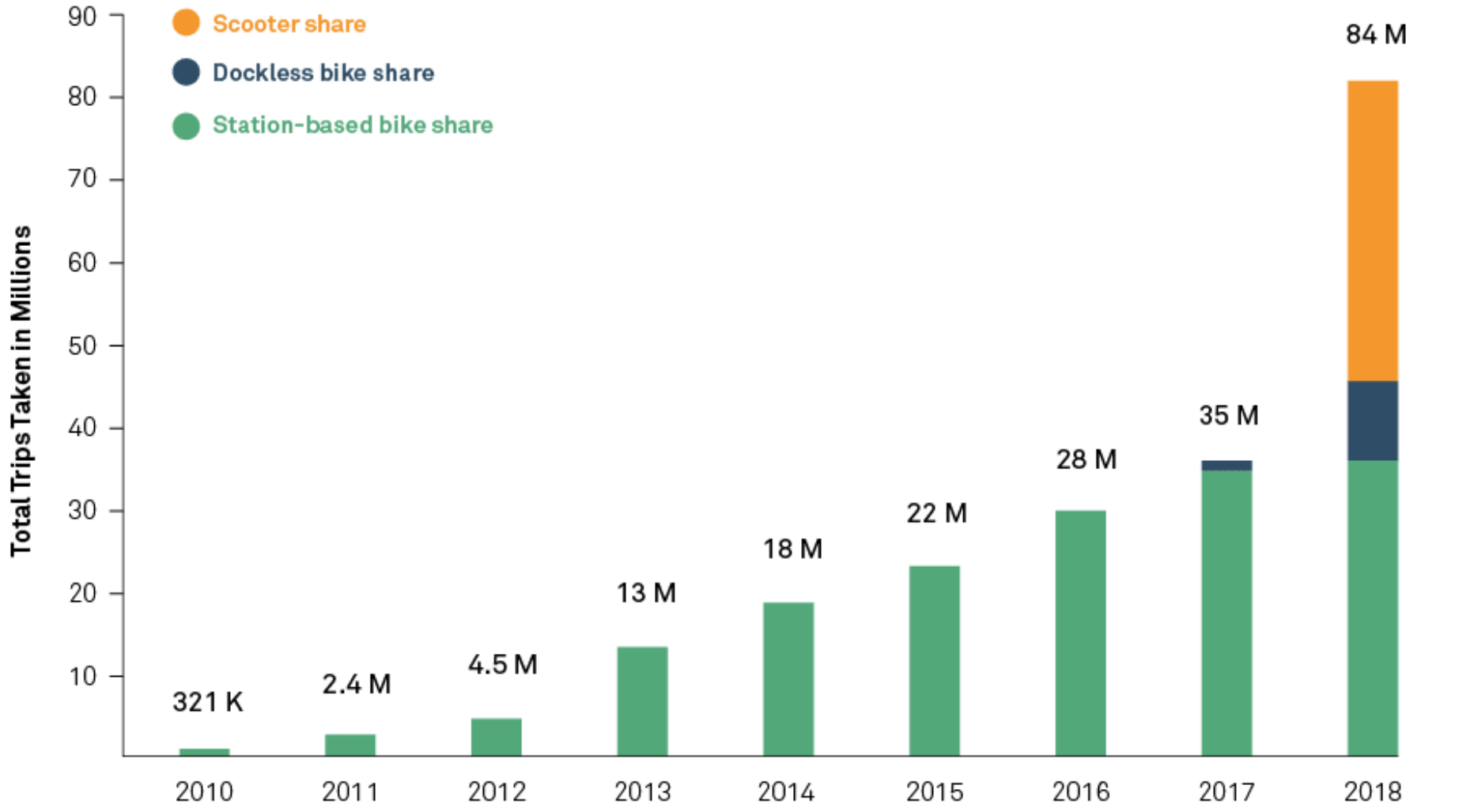
2018 Ridership (estimates):

- Local bus 4.7 billion
- Urban rail 4.2 billion
- Taxi/TNC 3.8 billion

(Annual rate)

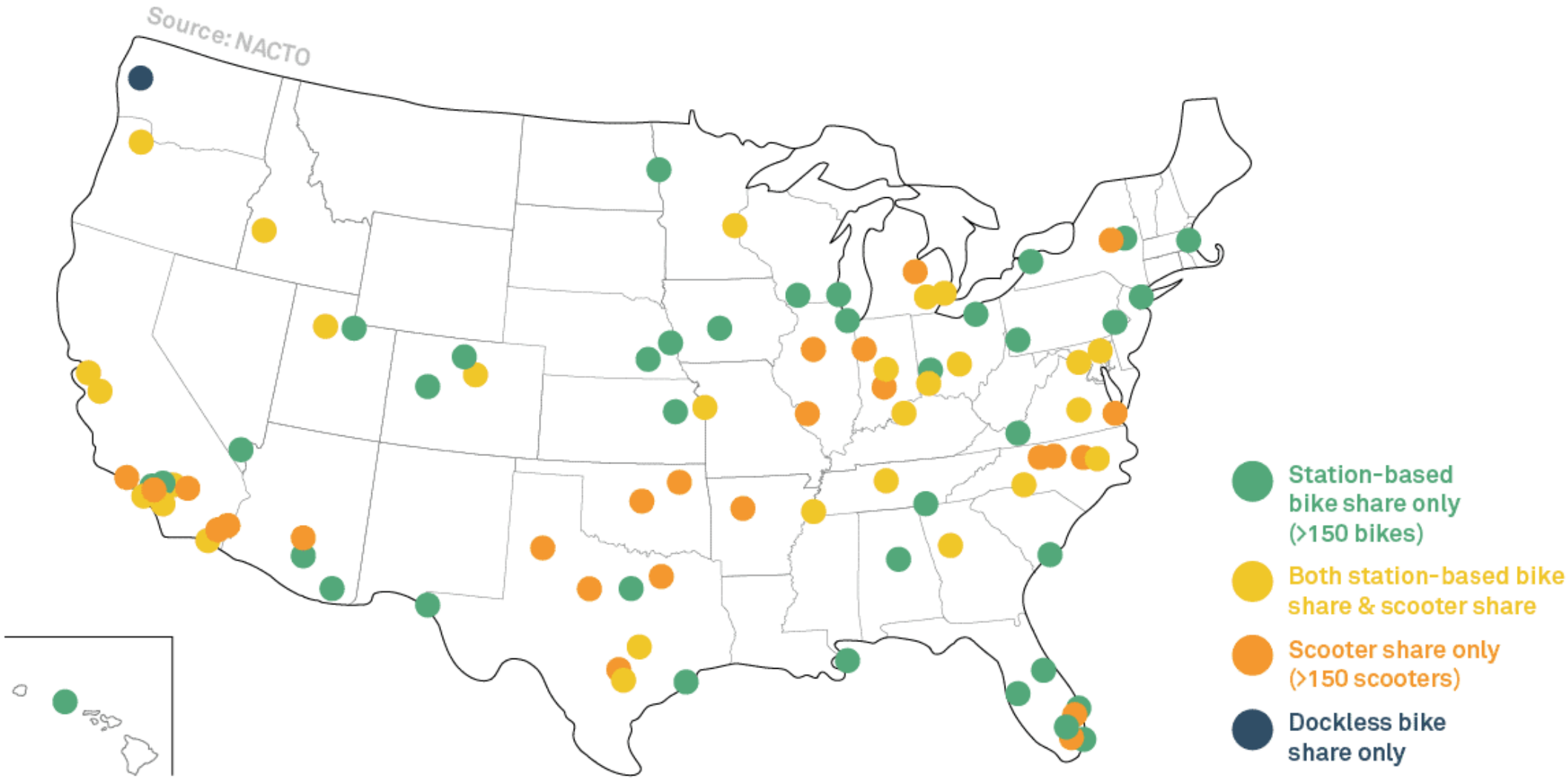
Source: The New Automobility: Lyft, Uber and the Future of American Cities, Schaller Consulting, July 2018. Revised January 2019.

From *Bike Share* to *Shared Micromobility*



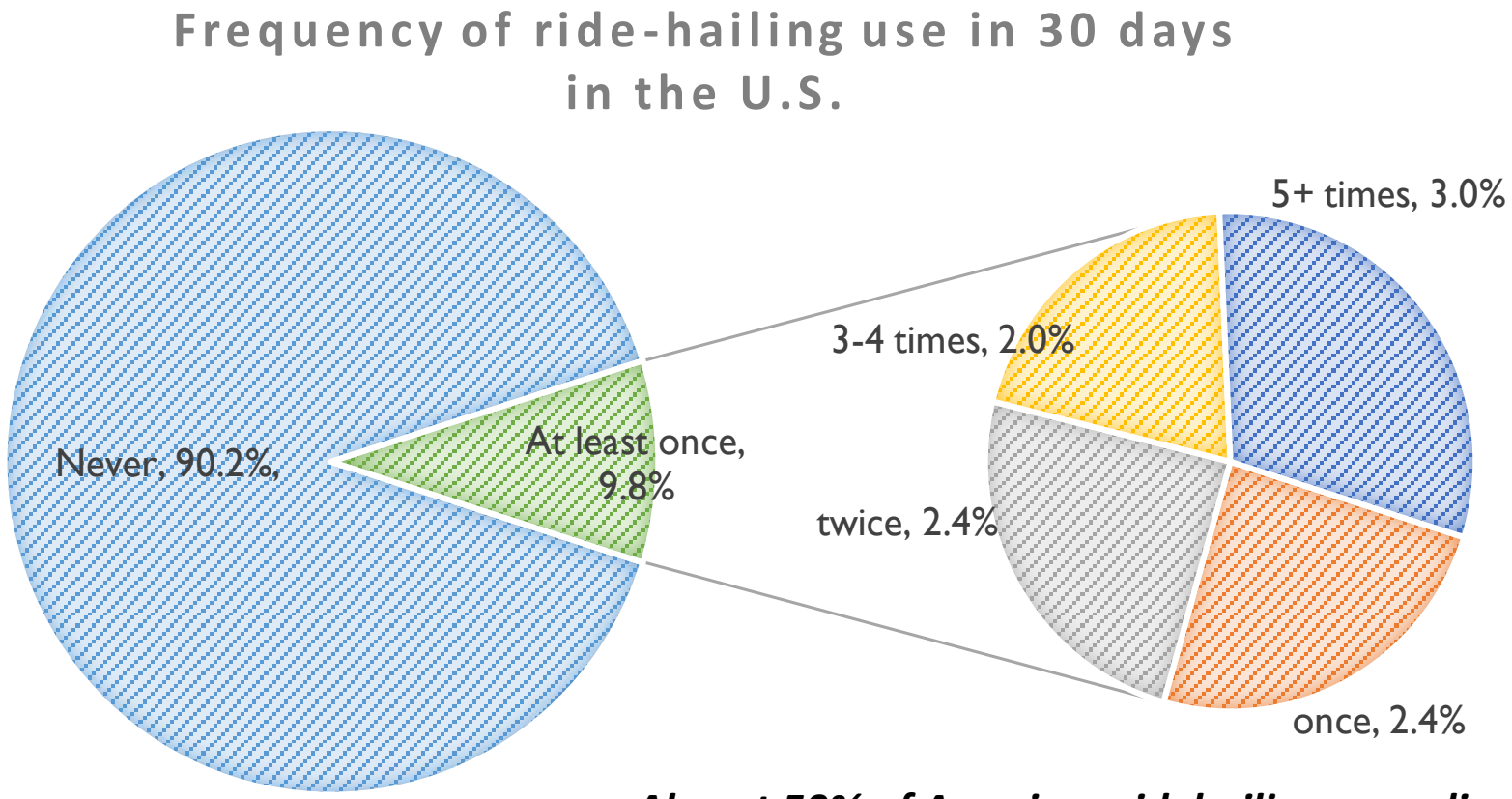
Source: NACTO

Shared Micromobility across the U.S. in 2018



Ridehailing Users in the U.S.: Insights from 2017 NHTS Data

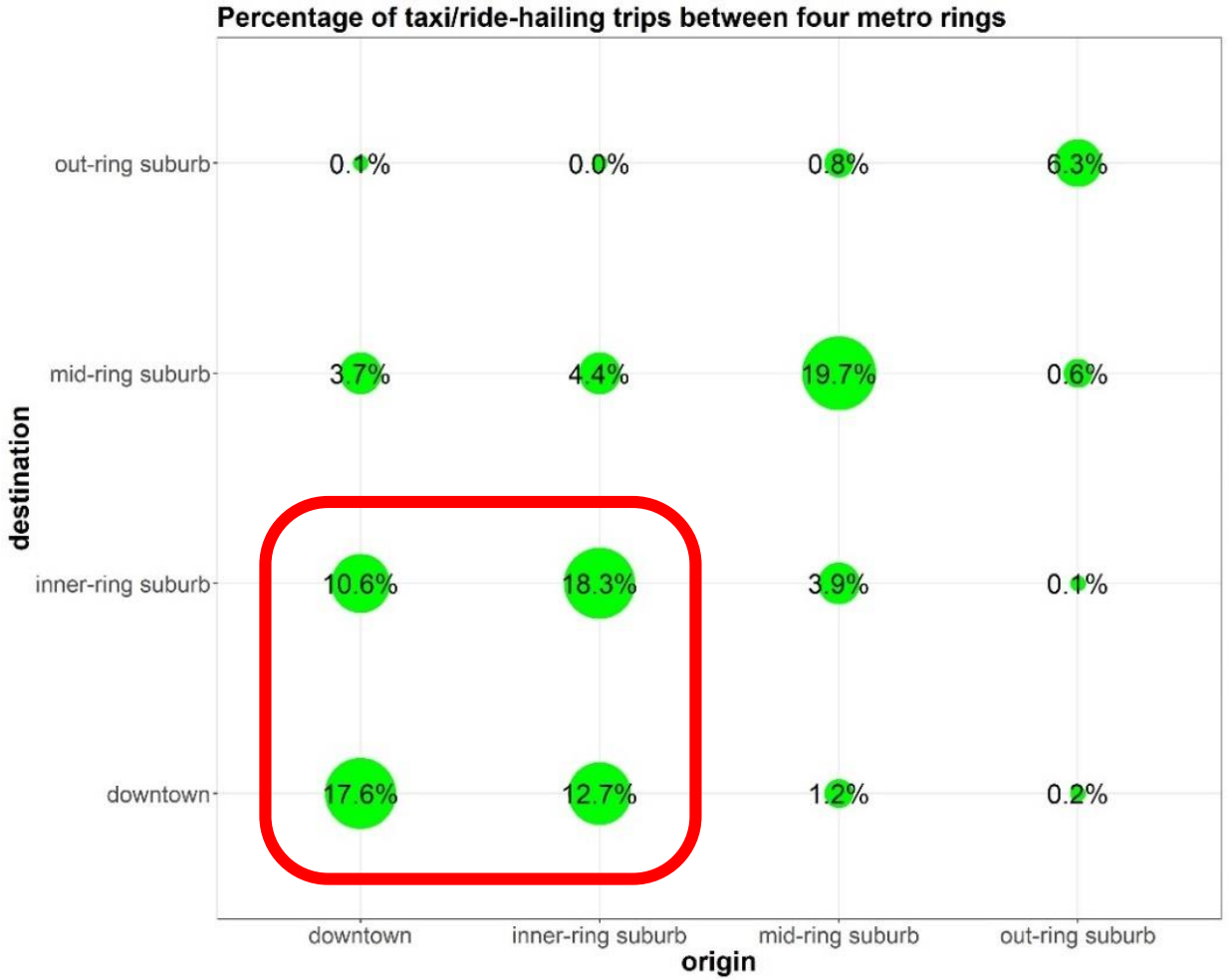
Only ***10% of U.S. residents*** (aged 16+) reported to have used ridehailing in the past 30 days

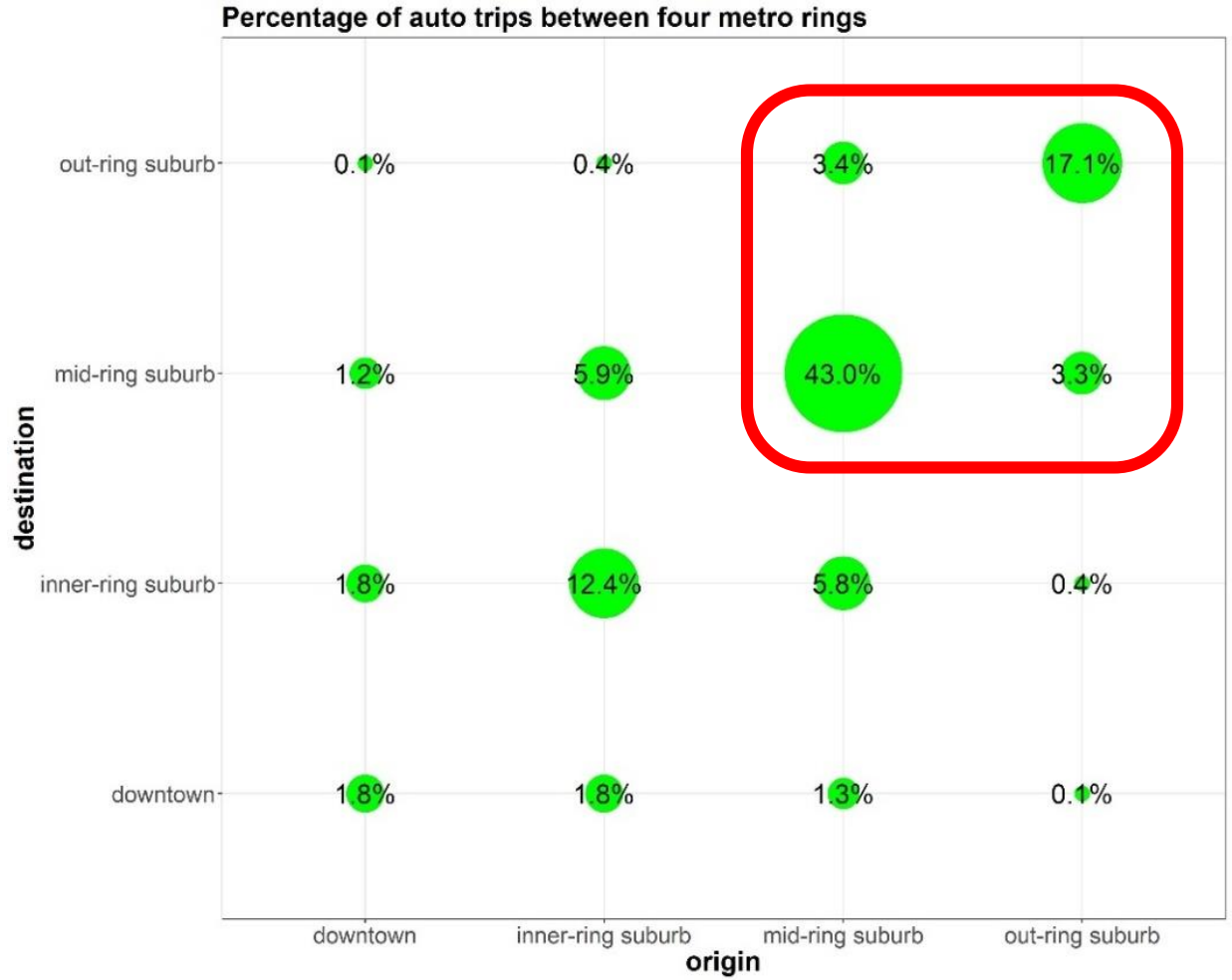


Almost 50% of American ridehailing users live in five states:
California (20%), New York (9.2%), Florida (7.2%), Texas (6.4%), Illinois (5.9%)

Source: Hongwei Dong, using 2017 NHTS data

Spatial Distribution of Taxi/Ridehailing Trips

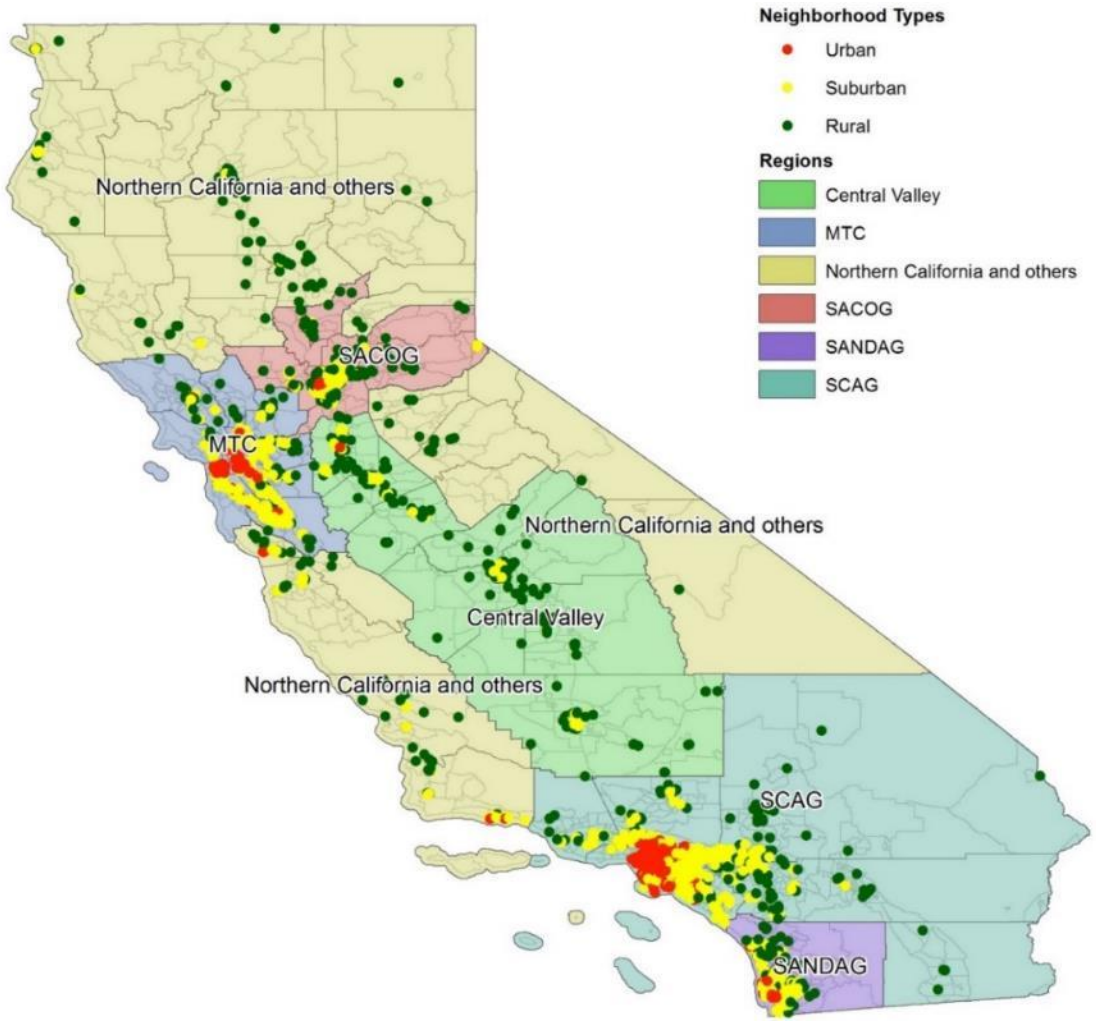




Source: Hongwei Dong, using 2017 NHTS data

California Panel Study of Emerging Transportation Trends

- Statewide longitudinal study with ***rotating panel***
- 2015 survey: ***Millennials*** (18-34) and ***Generation X*** (35-50)
- 2018 survey: ***All age groups***
- Quota sampling by ***geographic region*** and ***neighborhood type***
- Focus on changing lifestyles, adoption of shared mobility and attitudes towards AVs



Timeline of the Project

2015

Opinion panel

Generation X
Millennials

N = 2,400

2018

Opinion panel, paper survey

Baby Boomers (and older)
Generation X
Millennials
Post-Millennials

N = ~ 4,500
(Version in Spanish is also offered)

2021

(same method…)

2018 | 2019 | 2020 | 2021

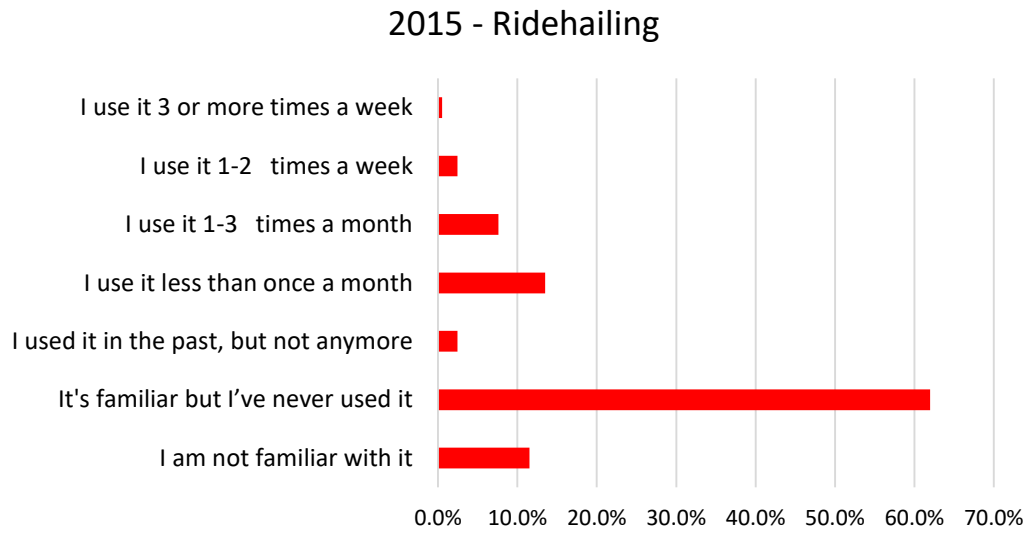
Annual updates…

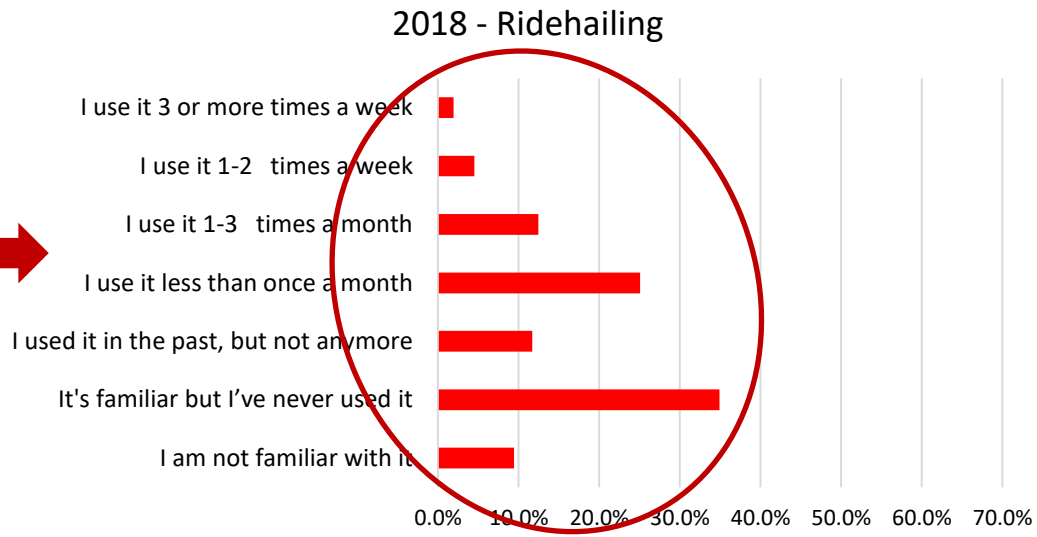
Changes in the Use of Shared Mobility

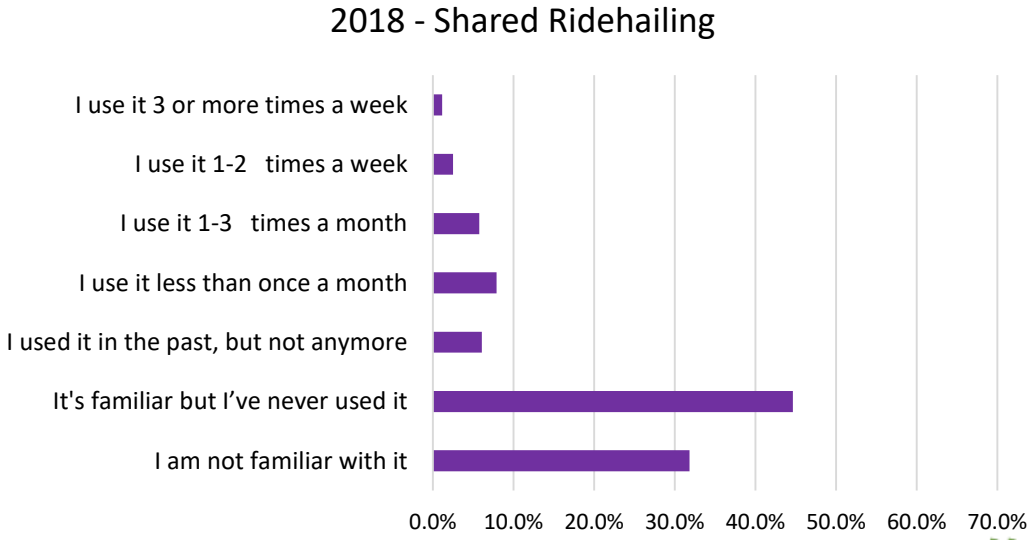
Changes from 2015 to 2018:

- *Carsharing* use little changed over the past few years
- Sharp increase in *ridehailing* use
- *Shared ridehailing* (e.g. UberPOOL) now a common presence in big cities
- Appearance of micromobility (*dockless bikesharing* and *e-scooter sharing*)

Adoption of Shared Mobility: 2015-2018





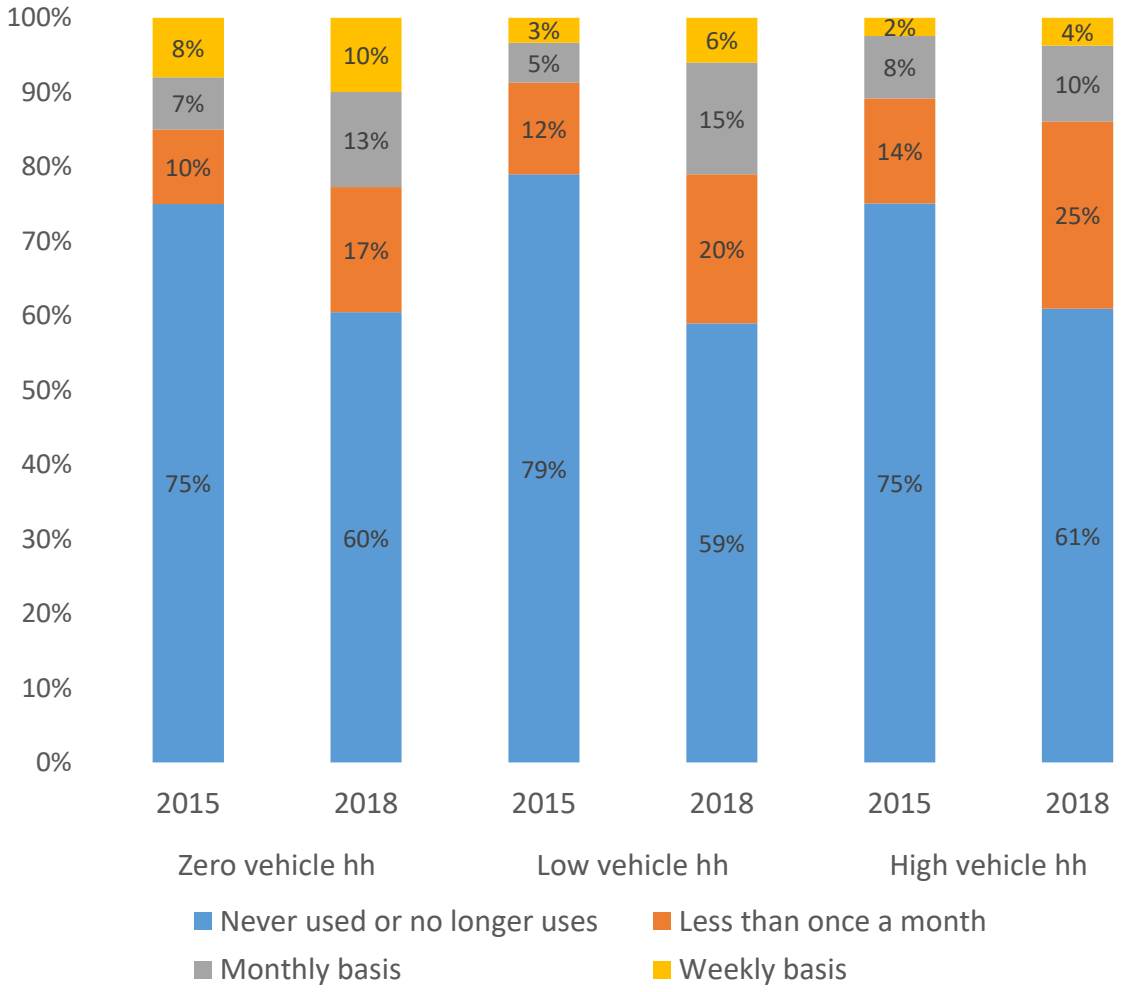


For more details:

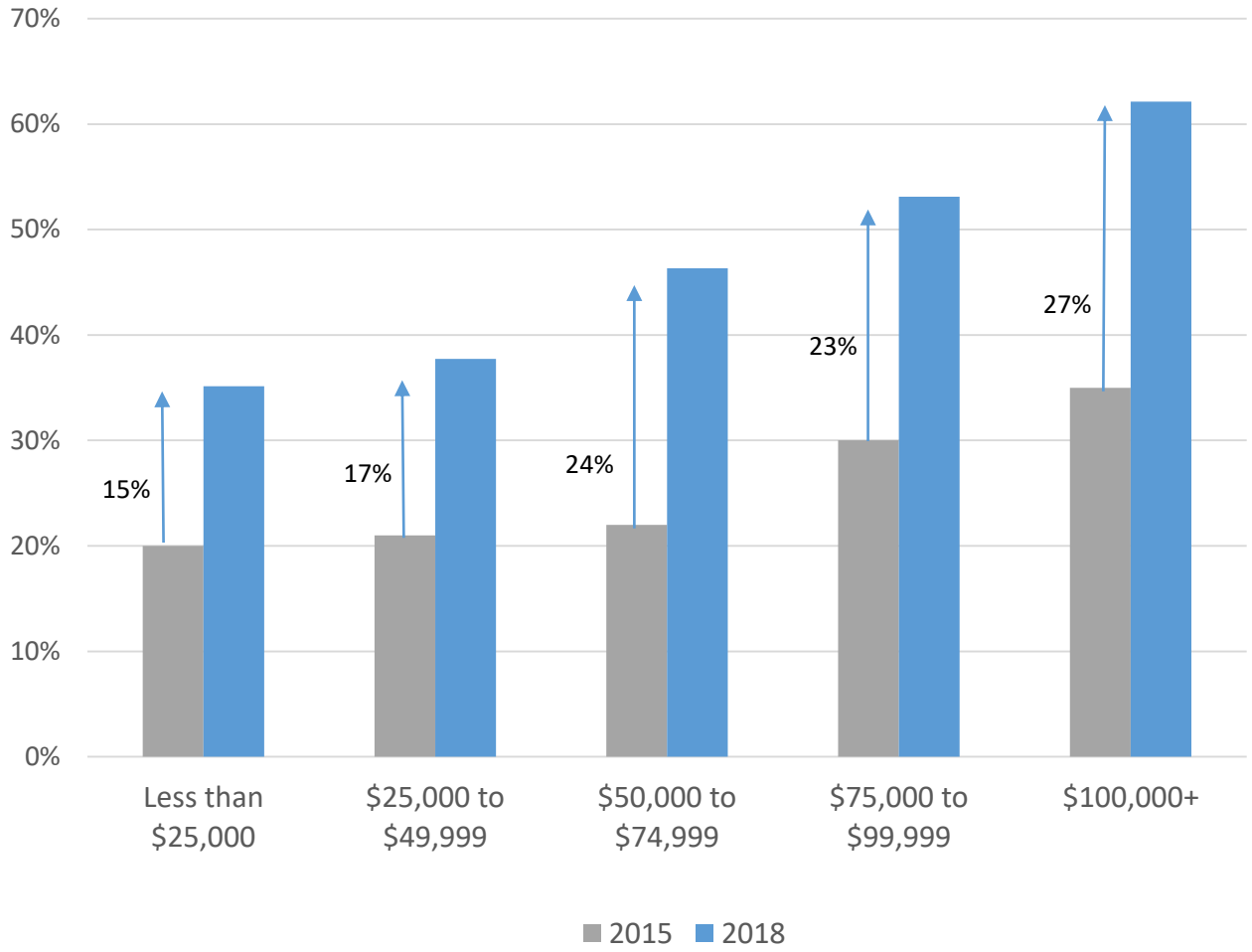
Circella, G., G. Matson, F. Alemi and S. L. Handy (2019) "Panel Study of Emerging Transportation Technologies and Trends in California: Phase 2 Data Collection", Project Report, National Center for Sustainable Transportation. University of California, Davis, January 2019; available at https://escholarship.org/uc/item/35x894mg

Changes by Vehicle Ownership and Income Groups

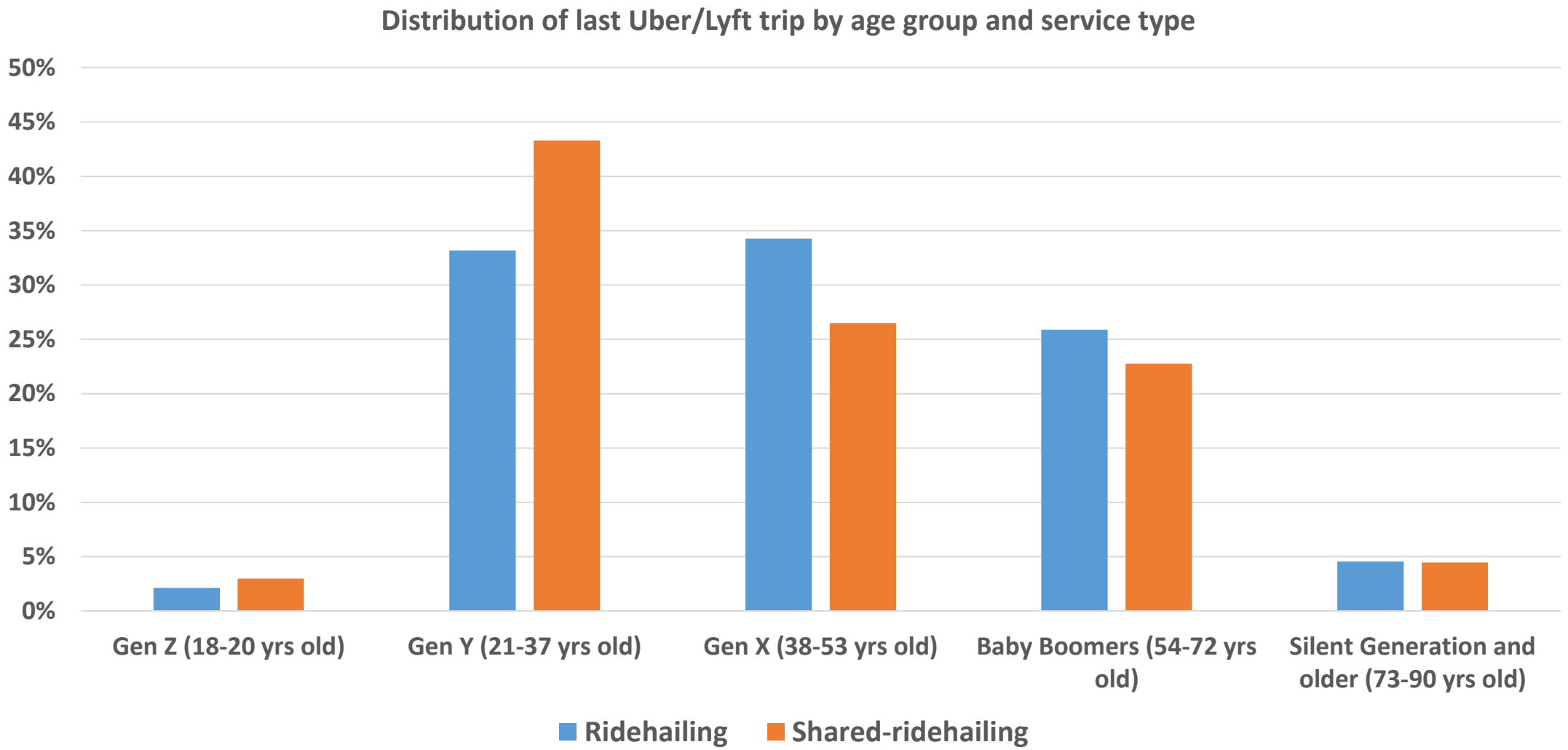
Use of ridehailing by vehicle ownership



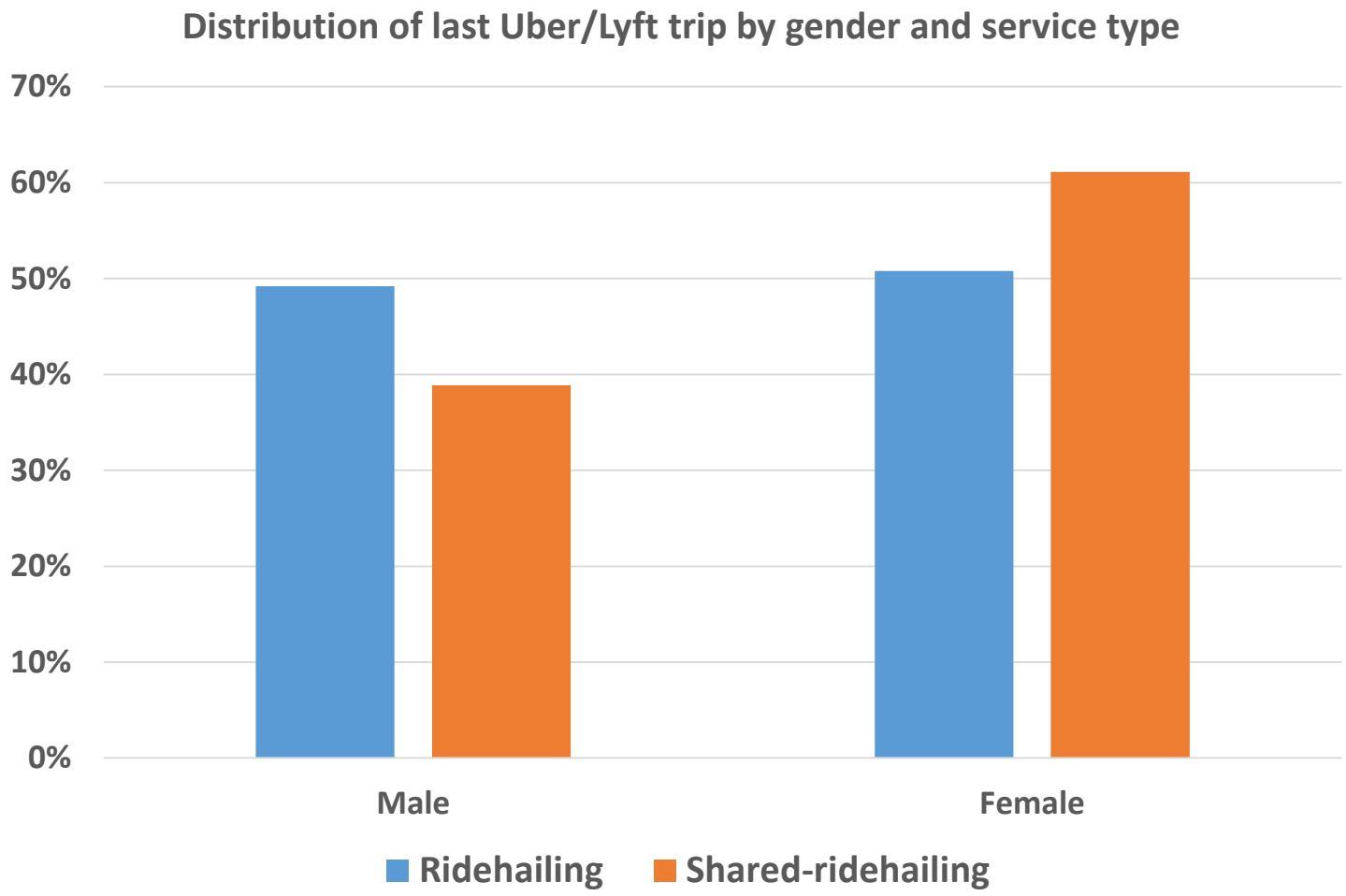
Adoption of ridehailing by household income



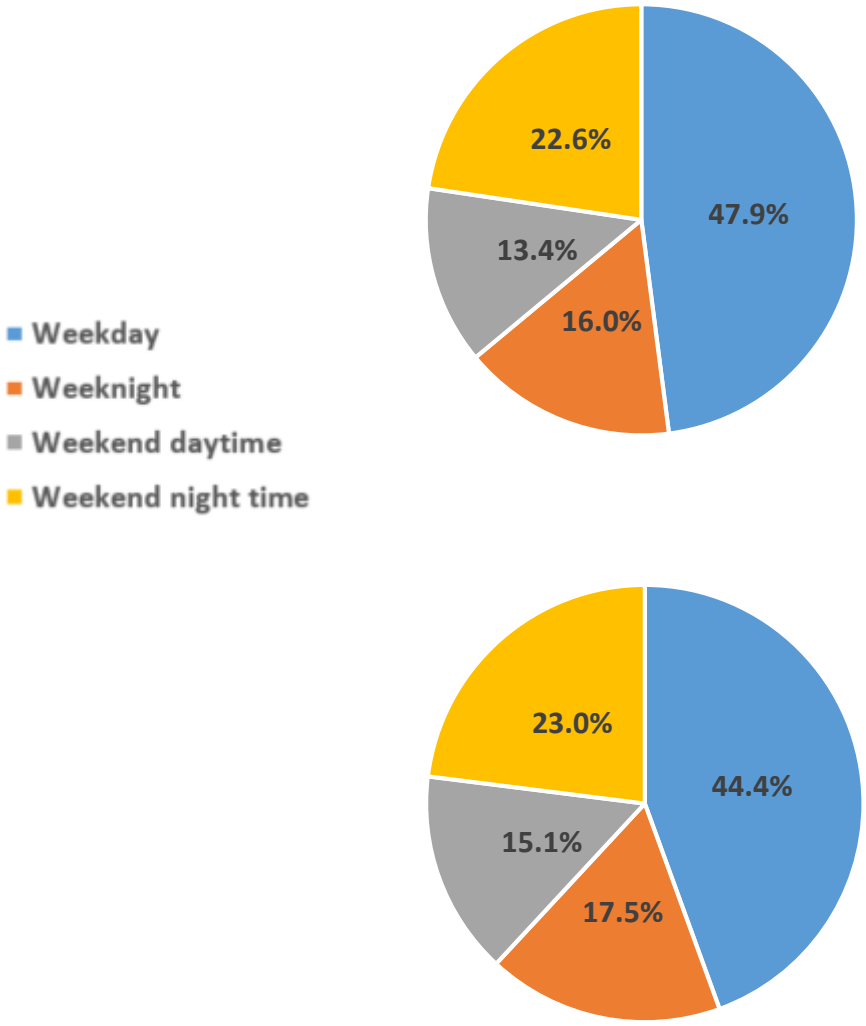
Ridehailing *vs.* Shared Ridehailing



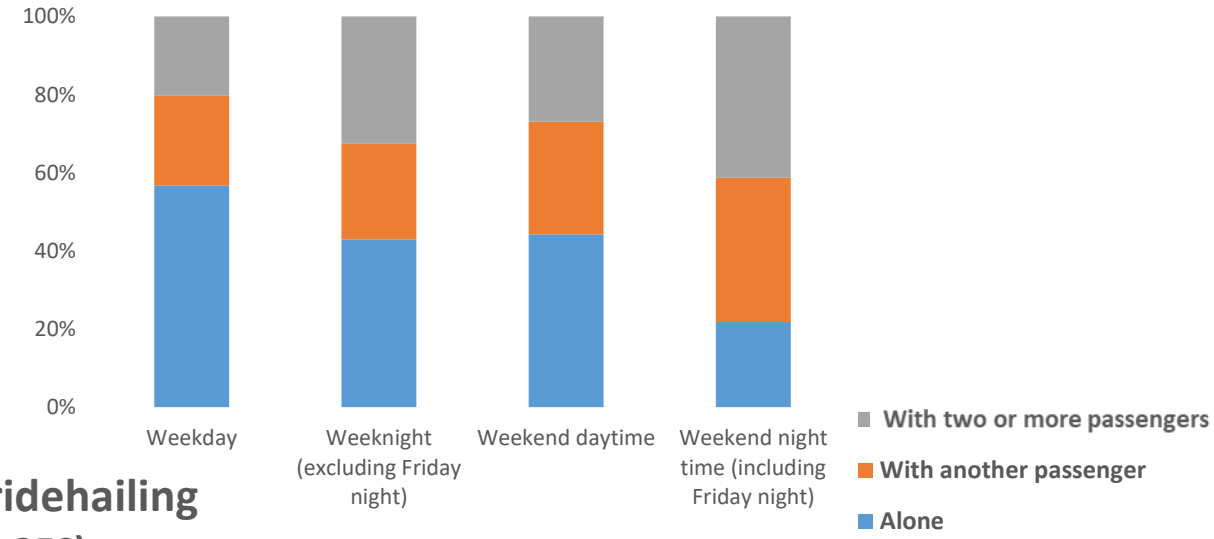
Ridehailing *vs.* Shared Ridehailing (2)



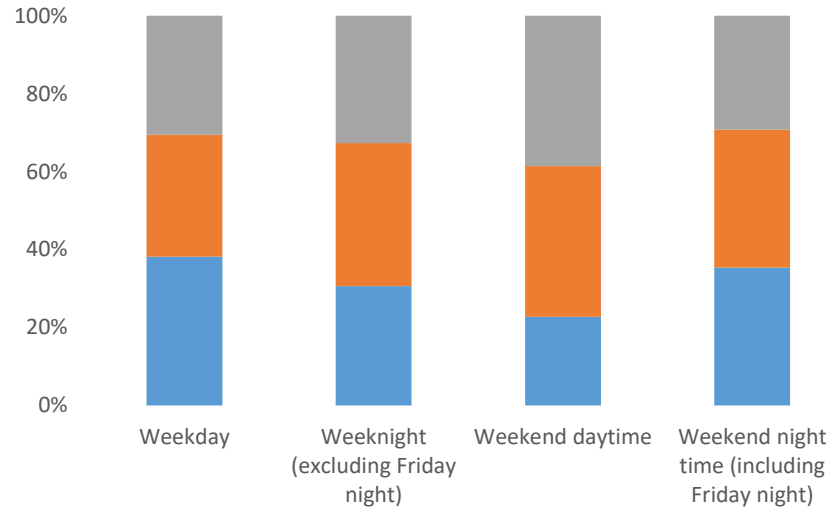
Time of Day and Occupancy



Ridehailing (*N=1607*)



Shared ridehailing (*N=253*)



"Not all users behave the same way"

Latent-class adoption model to investigate differences in the use of ridehailing:

Adoption Rate: 47%

- *Higher-educated independent millennials* who live *in more central areas* and in households *without kids*
- The adoption rate significantly increases as the *rates of technology adoption* and *frequency of long-distance leisure travel by plane* increase.

Adoption Rate: 27%

- *Most affluent* individuals, predominantly *dependent millennials* or *older Gen Xers,* who live with their *families*.
- Technology adoption rate, household income, and frequency of non-car business long-distance trips affect the adoption.

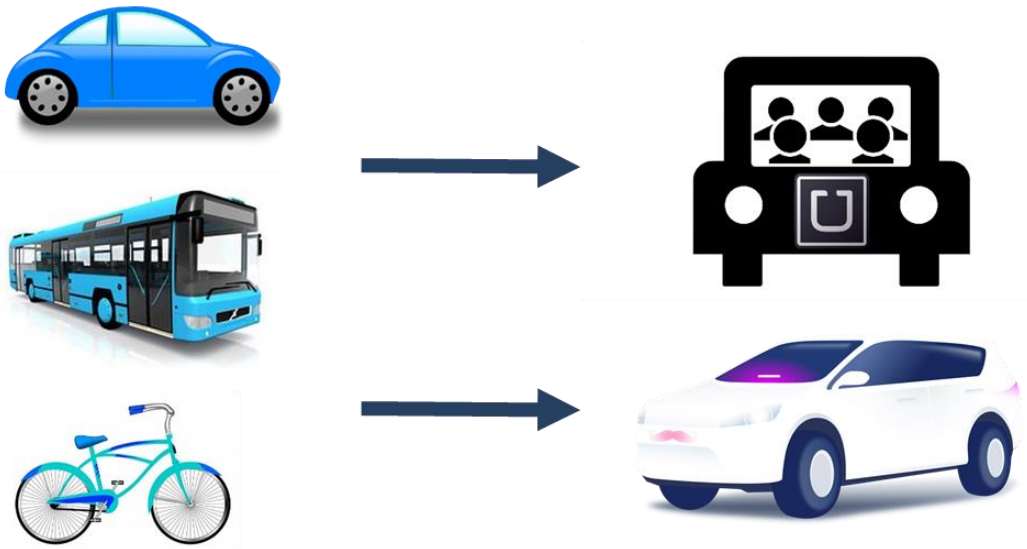
Adoption Rate: 5%

- *least affluent* and *less educated* individuals, who live in *rural* neighborhoods and *do not work nor study*.
- Adoption rate is affected by the characteristics of the *built environment*, including *transit accessibility* and *land-use mix*.

For more details:

Alemi, F., G. Circella, S. L. Handy and P. L. Mokhtarian (2018) "Exploring the Latent Constructs behind the Use of Ridehailing in California", Journal of Choice Modelling, 29, 47-62.

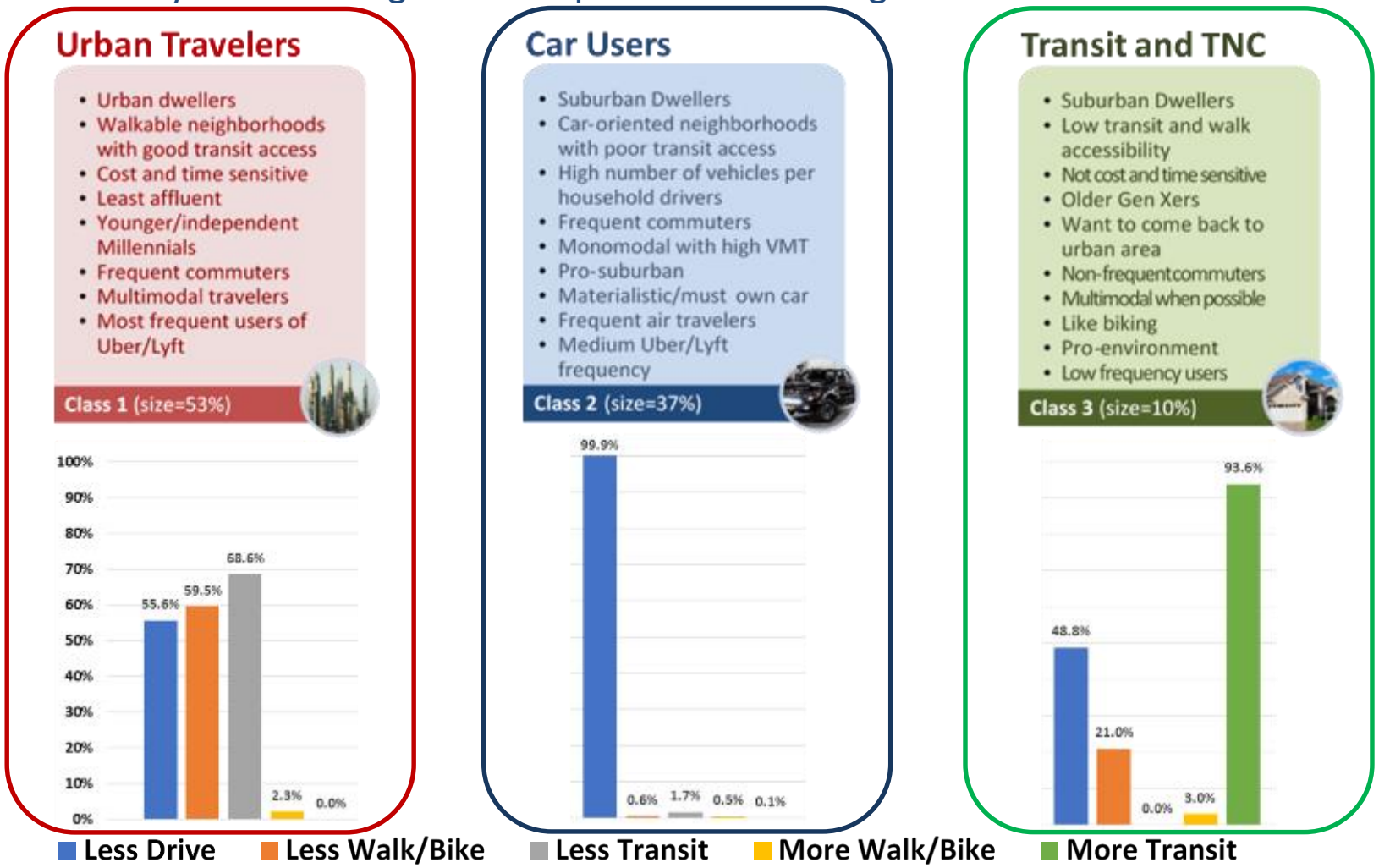
How does the use of ridehailing affect the use of other modes?



…what replaces what?

Impacts on Other Travel Modes for Various Groups of Users

Latent-class analysis to investigate the impacts of ridehailing on other travel modes:

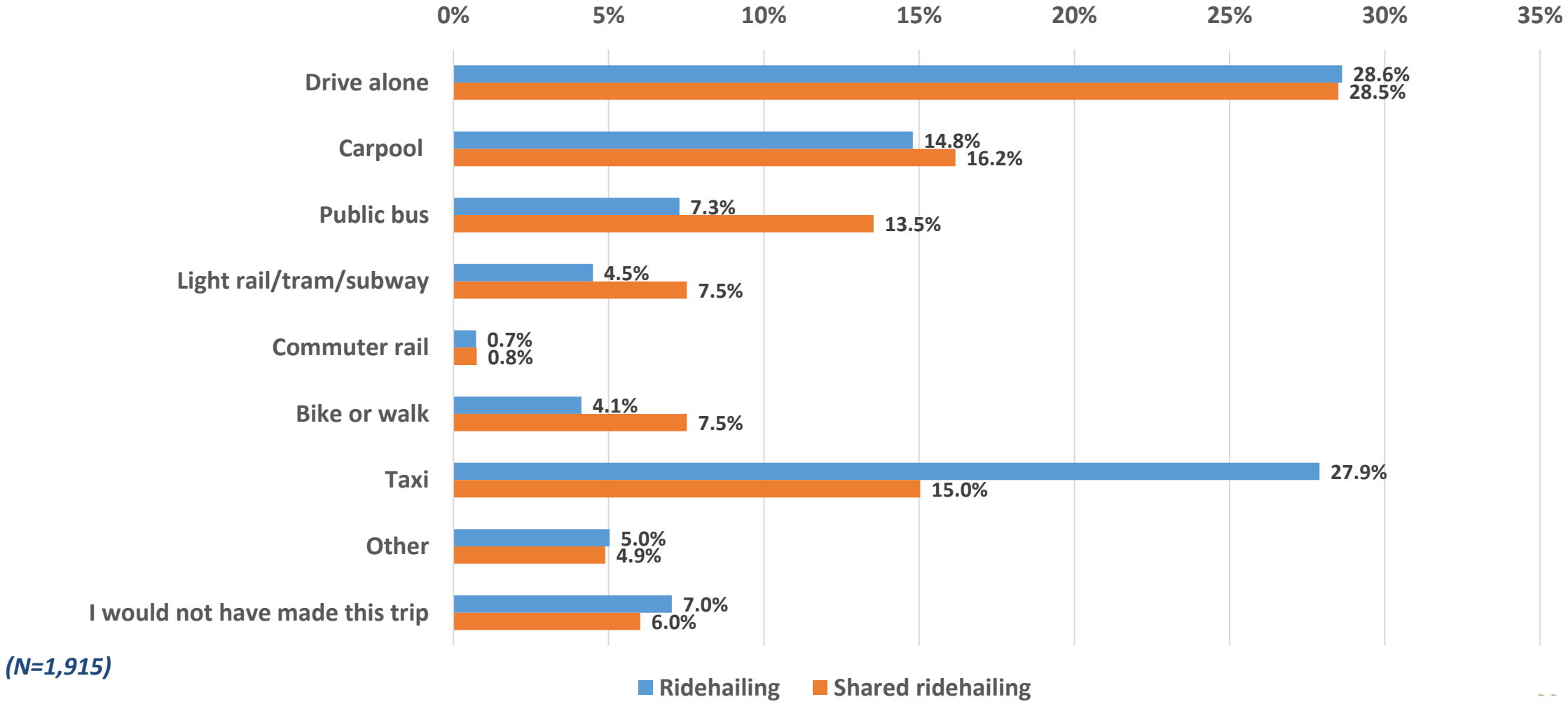


For more details:

Circella, G. and F. Alemi (2018) "Transport Policy in the Era of Shared Mobility and Other Disruptive Transportation Technologies", in Advances in Transport Policy and Planning, Volume 1, edited by Yoram Shiftan and Maria Kamargianni, Chapter 5, 119-144, Elsevier.

“Not all on-demand mobility services are created equal”…

Impact of ridehailing on use of other modes - *“What Would You Have Done if Ridehailing Was Not Available?”*



(N=1,915)

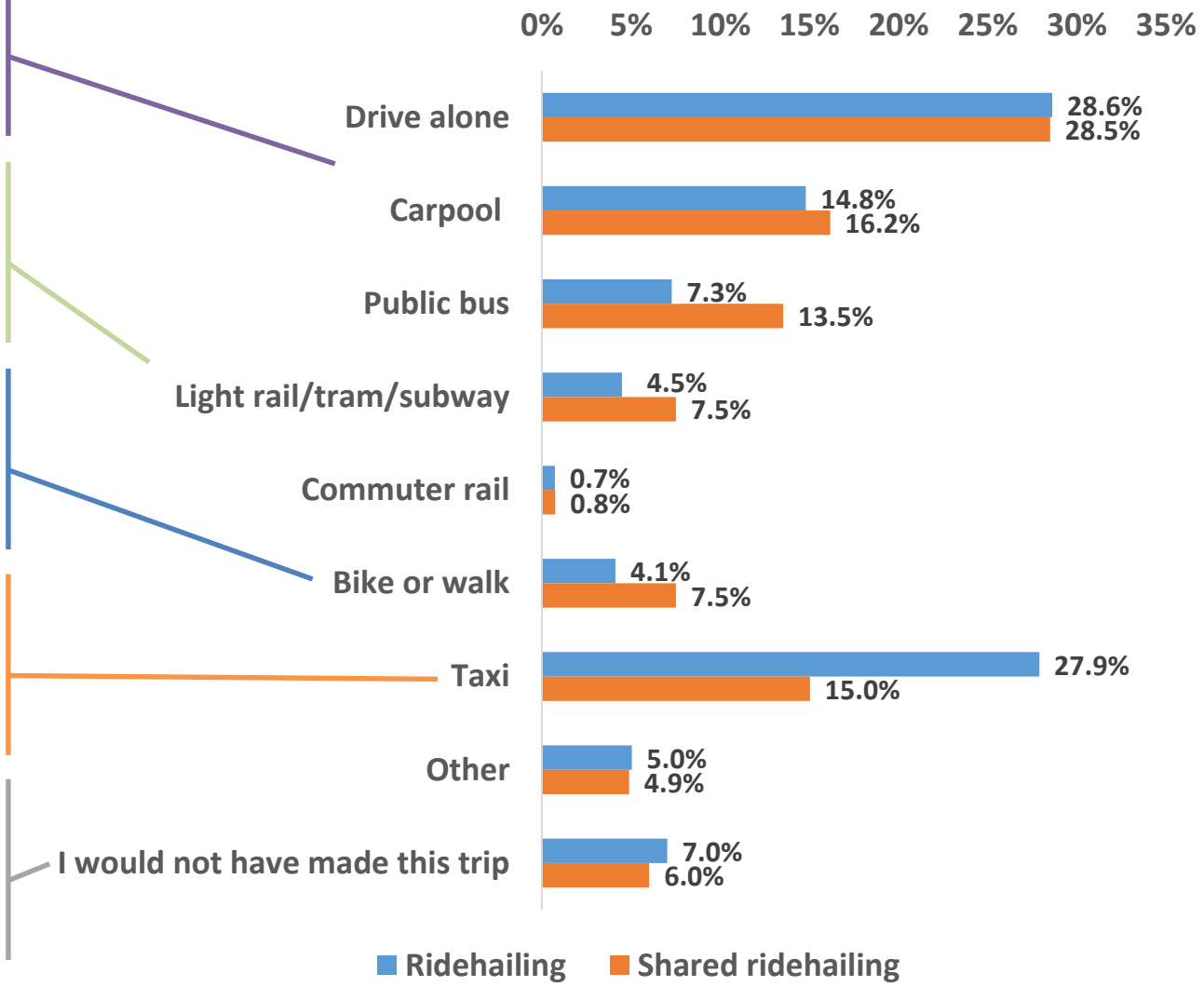
For more details:

Circella, G., G. Matson, F. Alemi and S. L. Handy (2019) “Panel Study of Emerging Transportation Technologies and Trends in California: Phase 2 Data Collection”, Project Report, National Center for Sustainable Transportation. University of California, Davis, January 2019; available at https://escholarship.org/uc/item/35x894mq

“Not all on-demand mobility services are created equal”…

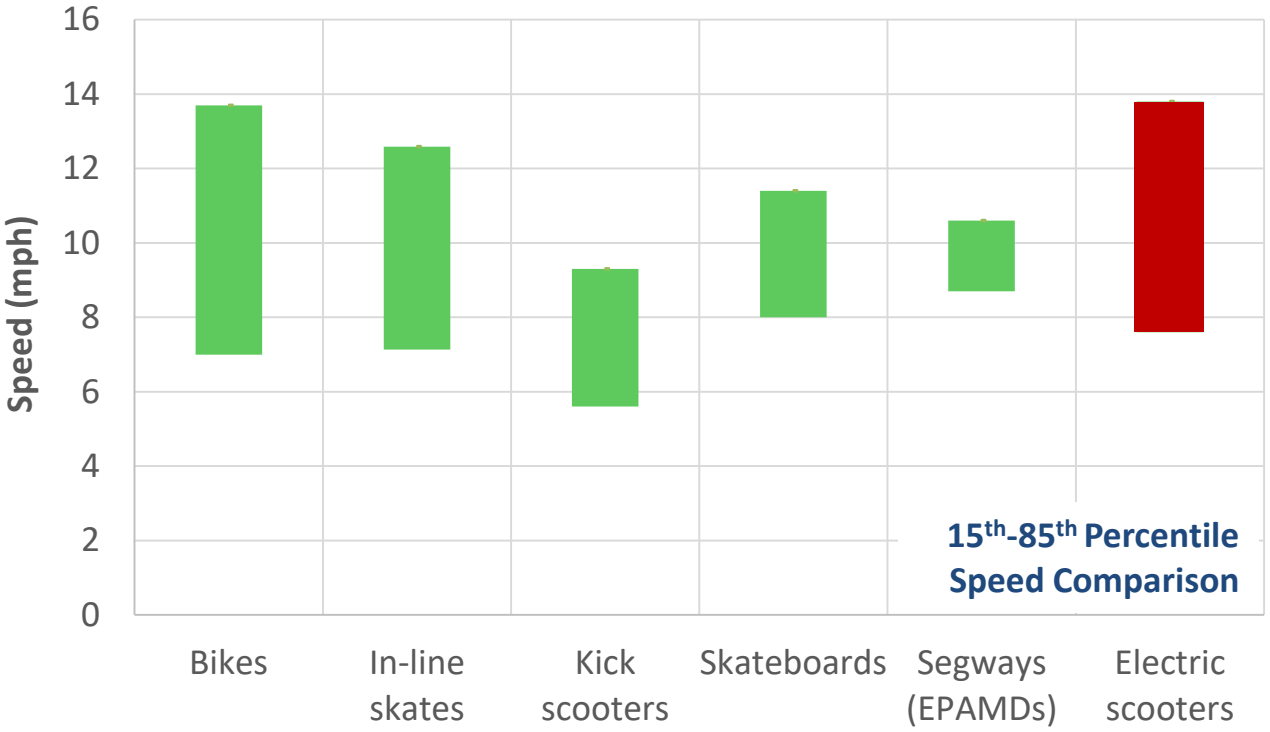
Who does that?	And for what type of trips?
• Higher and medium income • Higher-vehicle-owning HHs • Households with kid(s)	• Longer trips • Trips without company • Shopping and social trips
• Lower-income individuals • Students and workers • Multimodal (users of public transit and active modes)	• Trips during the daytime
• Lower-income individuals • Zero-vehicle households • Workers	• Trips during the daytime • Very short trips
• Higher-income individuals • Older generations	• Trips to/from Airports • Trips with others
• Lower-income individuals • Unemployed • Zero-vehicle households	• Trips without company • Shopping and social trips • Medium distance

Impact of ridehailing on use of other modes - *“What Would You Have Done if Ridehailing Was Not Available?”*



How are micromobility options changing travel behaviors?

E-scooters largely similar in speed to bicycles…



Can share bike lane infrastructure!

Source: Pernia, Lu, and Birriel (2000); FHWA (2004); Fang and Handy (2017); Fang (2018)

"Not all trips are created equal"…

Where do trips happen?

Which trips could be made by…

Active Modes
(Walking/Bicycling)

High-Occupancy Modes
(Public Transit/Pooling)

Interest in the adoption of new mobility options, micromobility, MaaS, future with automation…

New Nationwide Study: “The Pulse of the Nation on 3R”

- New nationwide study
- Annual data collection
- N = 3,500-4,000 participants
- 2019 cities:
  - San Francisco
  - Los Angeles
  - Sacramento
  - Washington DC
  - Boston
  - Seattle
  - Salt Lake City
  - Kansas City

Study on New Mobility Trends in Southern US Cities

Interest in studying new mobility trends in rapidly growing cities in predominantly car-dependent southern US States

TOMNET Project with cooperation of ASU, Georgia Tech, UT Austin and USF

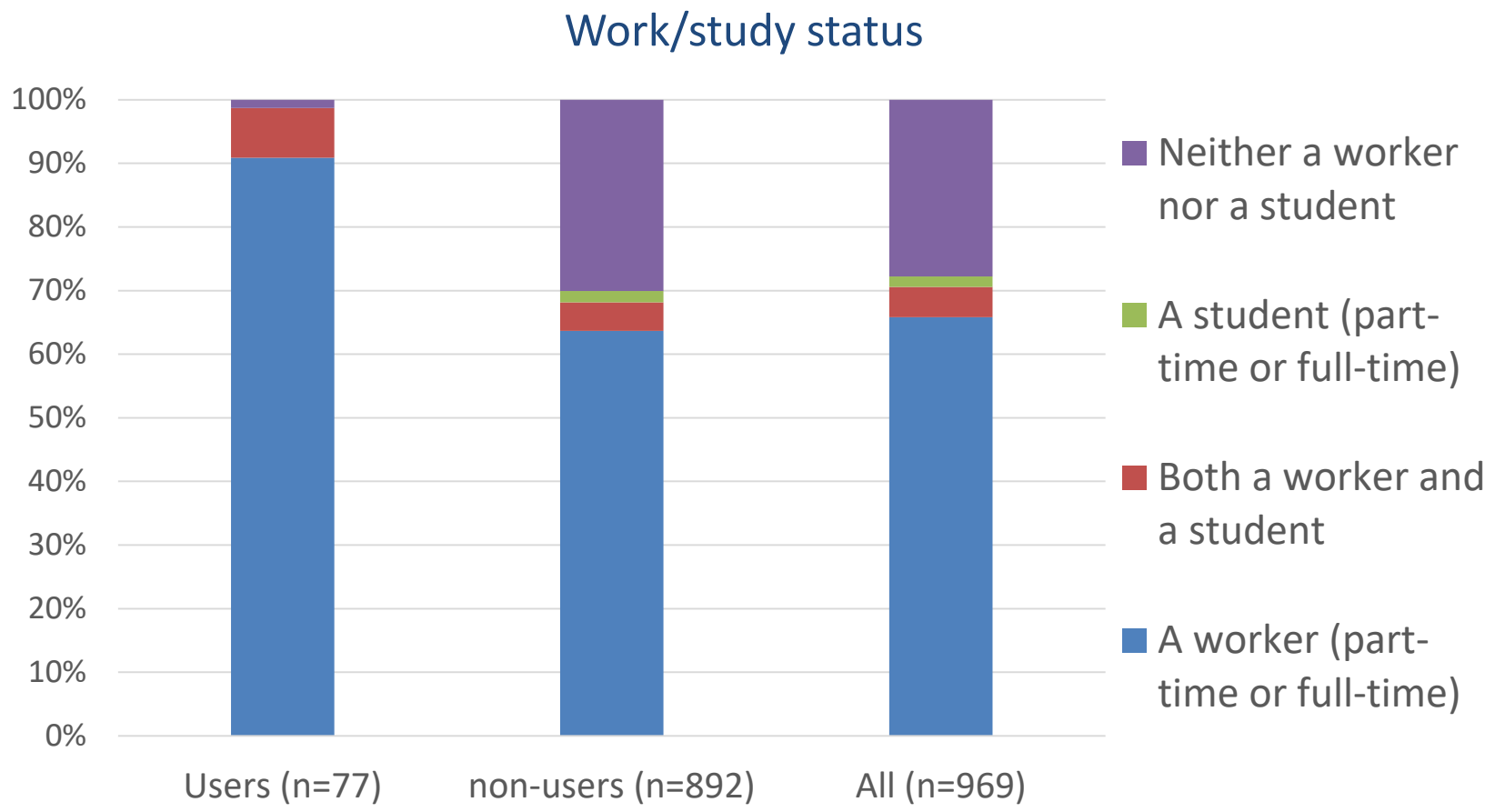
Phoenix, AZ

Atlanta, GA

Austin, TX

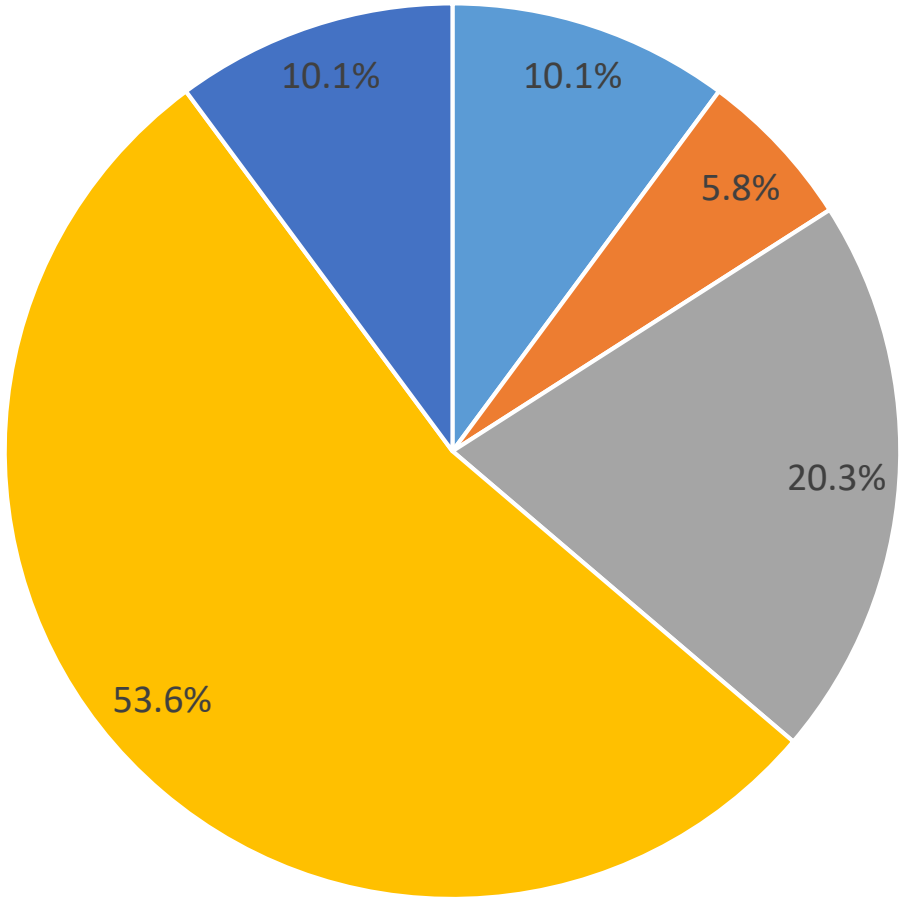
Tampa, FL

Micromobility Users



2019 Atlanta sample, N=969

E-scooter Trips – Primary Trip Purpose

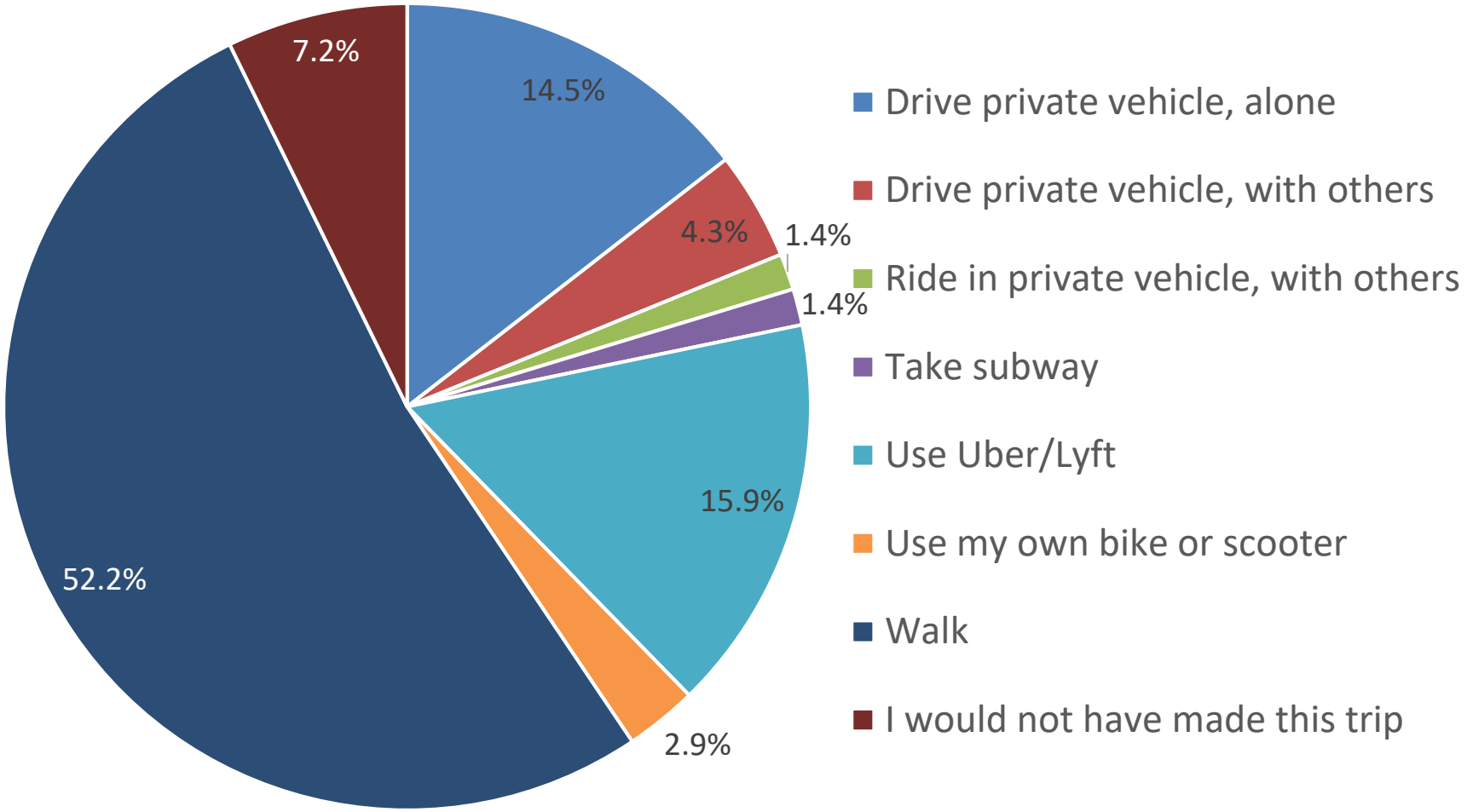


2019 Atlanta sample, active users, N=77

UCDAVIS INSTITUTE OF TRANSPORTATION STUDIES

3 REVOLUTIONS SHARED·AUTOMATED·ELECTRIC

E-scooter Trips – Impacts on Other Modes



2019 Atlanta sample, active users, N=77

Some Conclusions…

- Shared mobility options are getting rapidly adopted in California (and other places), even if they still account for a relatively small ***mode share***
- Users predominantly include young, well-educated ***urban residents***
- Use of Uber/Lyft often replaces use of ***private vehicles*** and ***taxis***, but to a certain extent also use of ***public transit*** and ***active modes***
- ***Pooling*** is (in theory) a good option – but (in practice) it often strongly competes with non-car modes in denser urban cores
- Medium-term impacts on car ownership are largely unclear: how many users might give up private ***vehicle ownership***?

Next Steps…

- Longitudinal analysis of ***changes in vehicle ownership*** associated with adoption of shared mobility
- ***Mobility as a Service (MaaS)*** likely to affect future car ownership
  - *Under what conditions individuals prefer to access a vehicle when needed rather than owning one?*
  - *To date, only a minority (mainly in urban areas) seems interested in not owning a vehicle and accessing a suite of mobility services when needed*
- New study examining willingness to join ***MaaS***
- New study focusing on ***airport*** access

Policy Implications

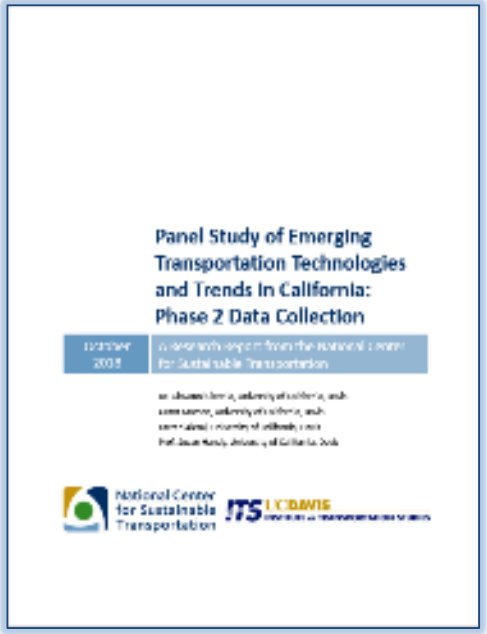
- Need to focus on human beings and not cars
- Future of mobility will depend on how the market is regulated (and priced)
- TNC drivers' activity already compatible with EV range and performance (but need to remove barriers!)
- Need for behavioral nudge to support shift towards increased sustainability
- Land use and *pricing* will be key factors to promote more sustainable choices
- Micromobility provides critical mass for *bicycling* infrastructure
- Potential of MaaS to modify relationships with private vehicle ownership

March 2018 Report: *https://escholarship.org/uc/item/1kq5d07p*

Travel Behavior and Society (2018) Paper: https://doi.org/10.1016/j.tbs.2018.06.002

Journal of Choice Modeling (2018) Paper: https://doi.org/10.1016/j.jocm.2018.08.003

Book Chapter (2018): *Advances in Transport Policy and Planning, Vol. 1, Elsevier, 2018.* https://doi.org/10.1016/bs.atpp.2018.08.001



January 2019 Report: *https://escholarship.org/uc/item/31v7z2vf#main*

Additional references to papers from this project:

- Alemi, F., G. Circella, P. L. Mokhtarian and S. L. Handy (2019) "What Drives the Use of Ridehailing in California? Ordered Probit Models of the Usage Frequency of Uber and Lyft", *Transportation Research Part C*, 102, 233-248.
- Circella, G. F. Alemi, R. Berliner, K. Tiedeman, Y. Lee, L. Fulton, S. Handy and P. Mokhtarian (2017) "Multimodal Behavior of Millennials: Exploring Differences in Travel Choices Between Young Adults and Gen-Xers in California", Presented at the Transportation Research Board 96th Annual Meeting, Washington DC, January 2017, TRB Paper #17-06827; Submitted for publication in the *Journal of Transport Geography*.
- Berliner, R. and G. Circella (2017) "Californian Millennials Drive Smaller Cars: Estimating Vehicle Type Choice of Millennials", Presented at the Transportation Research Board 96th Annual Meeting, Washington DC, January 2017, TRB Paper #17-06744.
- Alemi, F., G. Circella and D. Sperling (2018) "Limitations to the Adoption of Uber and Lyft in California and Impacts on the Use of Other Travel Modes", Presented at the Transportation Research Board 97th Annual Meeting, Washington DC, January 2018, TRB Paper #18-06713.
- Berliner, R., L. Aultman-Hall and G. Circella (2018) "Exploring the Self-reported Long-distance Travel Frequency of Adult Californians", Presented at the Transportation Research Board 97th Annual Meeting, Washington DC, January 2018, TRB Paper #18-05960; Accepted for publication in Transportation Research Record, Journal of the Transportation Research Board (*forthcoming*).
- Circella, G., F. Alemi and P. Mokhtarian (2017) "Exploring the Impact of Shared Mobility on California Millennials and Older Adults' Travel Patterns", Presented at the 2017 International Choice Modeling Conference, Cape Town (South Africa), April 2017.

UCDAVIS INSTITUTE OF TRANSPORTATION STUDIES

For more info, visit 3rev.ucdavis.edu

3 REVOLUTIONS SHARED·AUTOMATED·ELECTRIC

Research Program

https://3rev.ucdavis.edu/research-program

Behavioral Studies, Surveys and Experiments

California Panel Study of Emerging Transportation Trends

This research will expand the current statewide panel study to investigate emerging trends in travel behavior, vehicle ownership, adoption of shared mobility and propensities towards the use of AVs.

Travel Demand Modeling and Simulation Projects

Modeling Emissions Impacts of Automated Vehicle (AV) Deployment in California under Various Ownership Models

This project evaluates potential future scenarios of

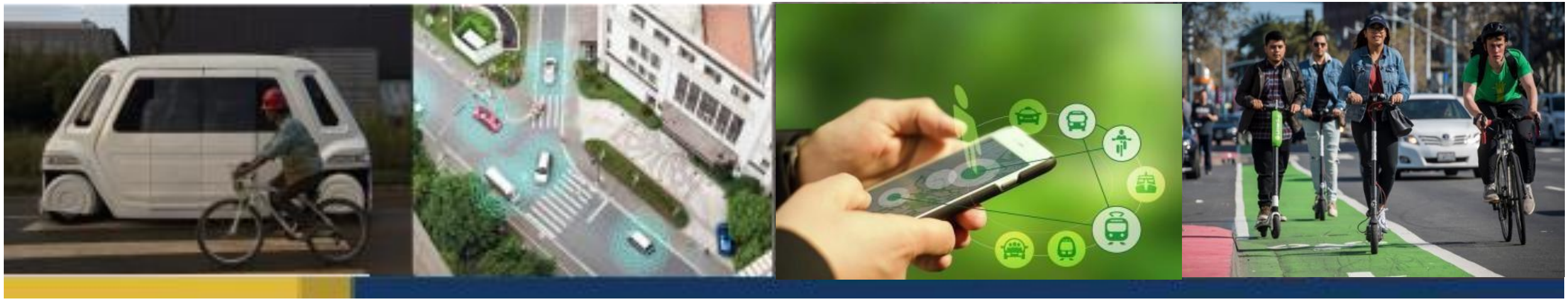
Environmental, Economic, Equity Impacts and Policy Analysis

3 Revolutions and Smart Cities: Exploring Future Potentials and Impacts on the Energy System

This research explores the impacts of the changes in the mobility ecosystem and travel demand provided by future potentials of a smarter city and

Acknowledgements

- Farzad Alemi
- Yongsung Lee
- Grant Matson
- Ali Etezady
- Rosaria Berliner
- Pat Mokhtarian
- Susan Handy
- Lew Fulton
- Dan Sperling
- Kate Tiedeman
- Tho Le
- Kailai Wang
- Jai Malik
- Melinda Matyas



Any questions? Please contact:

Dr. Giovanni Circella

Director, 3 Revolutions Future Mobility Program

Institute of Transportation Studies, University of California, Davis

Email: gcircella@ucdavis.edu | Twitter: @CircellaG

UCDAVIS INSTITUTE OF TRANSPORTATION STUDIES

3 REVOLUTIONS SHARED·AUTOMATED·ELECTRIC