The Future of Automation Policy: From California to DC

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Future Mobility:
"Heaven" or "Hell" ?

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

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

The future will largely be shaped by the policies that are developed today…

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How can we model the impacts of vehicle automation?
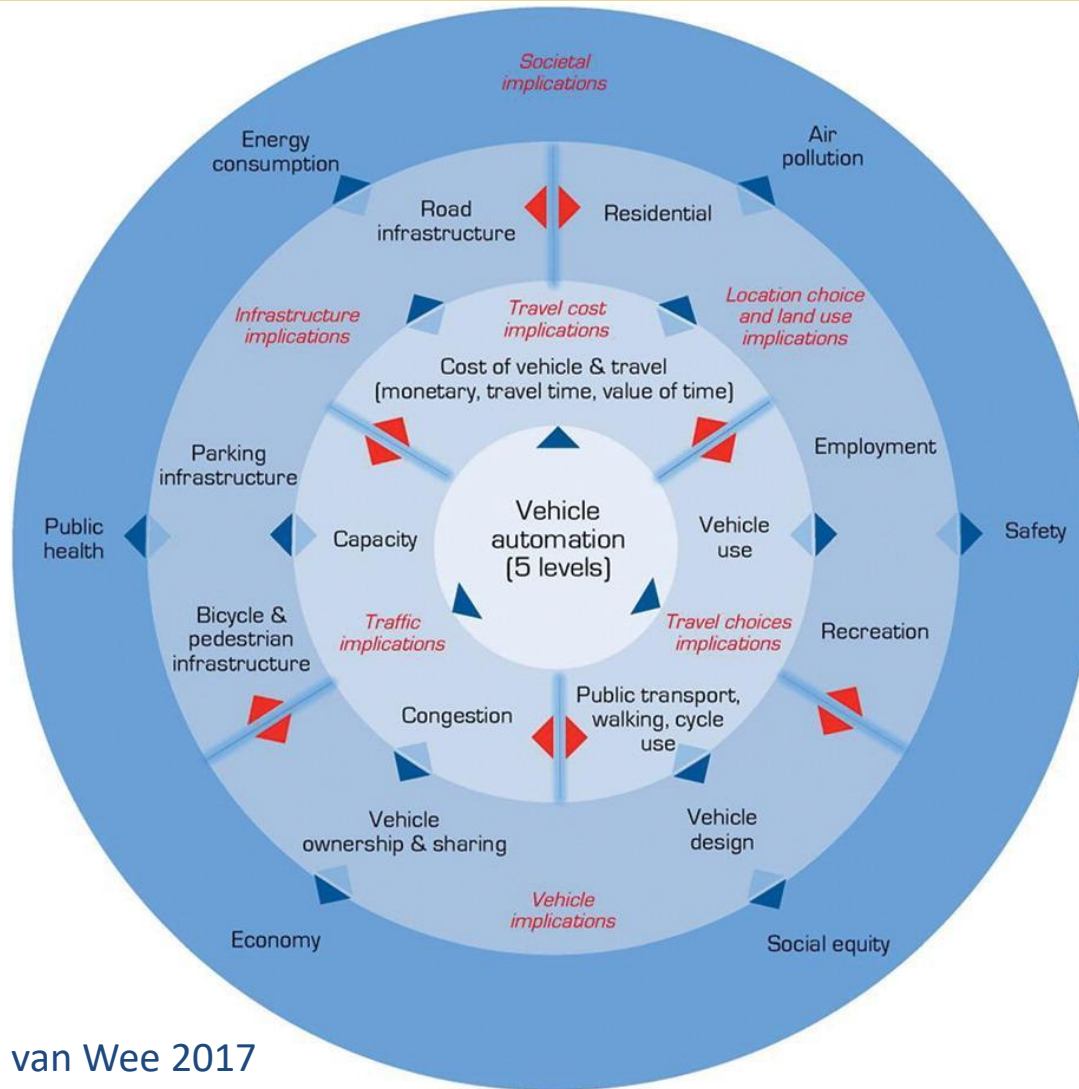
Many **sources of uncertainty** to consider, including:

- Land use
- Travel demand
- Trip length
- Auto ownership
- Mode choice

- Parking
- Auto occupancy
- Value of travel time
- Zero-occupancy vehicles

Source: Milakis, van Arem, van Wee 2017

Predicting Travel Implications

- Rich travel behavior literature:
  - Pricing, multitasking, parking, sharing vehicles and rides, mode choice, safety, etc…

- Approaches:
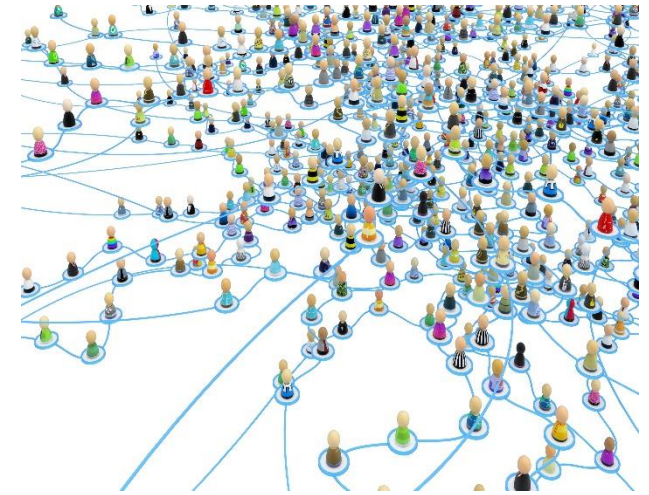
Driving simulators and controlled testbeds

Stated preference surveys

Microsimulations and agent-based model scenarios

US DOE, Volpe center (August 19, 2014)

The Apopka voice (July 26, 2016)

ISI Foundation & ISI Global Science Foundation (April 20, 2016)

Naturalistic Experiment: How could privately-owned fully autonomous vehicles impact travel behavior and activity patterns?

- **FUTURE OF INTEREST:** a fully autonomous vehicle

Don't have to drive the car ✓
Full multitasking ✓
No parking worries ✓
Can send on errands ✓

SCENARIO
- *Status quo infrastructure and policies.*
- *Private vehicle ownership.*

- **SIMULATION OF FUTURE:** a personal driver

- *Subjects use their own household vehicles.*
- *We provide the chauffeur to the household for free.*
- *Chauffeur stays with the car whether in use or not.*

For more details:
Harb, M., Y. Xiao, G. Circella, P. L. Mokhtarian and J. Walker (2018) "Projecting Travelers into a World of Self-driving Vehicles: Estimating Travel Behavior Implications Via a Naturalistic Experiment", Transportation, 45 (6), 1671–1685.

Sacramento Experiment 2019/2020

Following a pilot in San Francisco (Harb et al., 2018), we conducted a larger study in partnership with the Sacramento Area Council of Governments (SACOG):
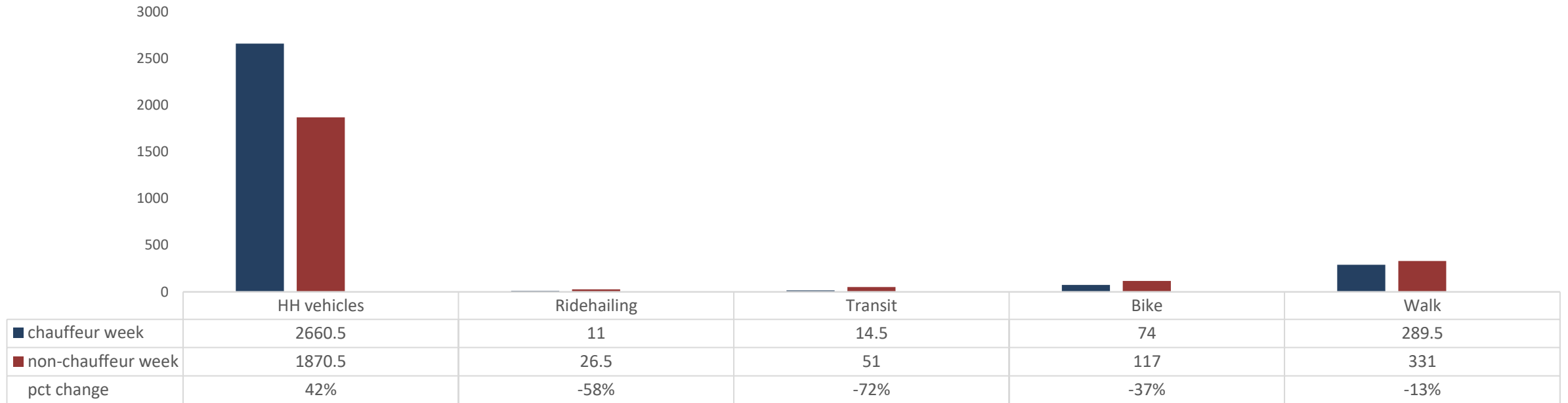
- 43 households recruited from the 2018 SACOG household travel survey

- Stratified by vehicle miles traveled (VMT) level

- Within each group, selected a diverse sample by:
    - Household structure
    - Income
    - Modal preferences
    - Mobility barriers
    - Residential location

- Tracked all household vehicles and adult members

- Recorded a richer dataset through the rMove smartphone app

- Fairly representative sample, except females, higher income, and higher education are overrepresented

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Finding 1: Increase in VMT and changes in activity patterns

- **More auto travel**
  - 60% increase in VMT
  - 47% of increased VMT were ghost trips (ZOV trips)
  - 7% of increased VMT were friends and family trips
- **Change in activity patterns**
  - 40% increase in # of vehicle trips
  - 25% in system-wide trips via all modes
  - 75% increase in # of longer trips (over 20 miles)
  - 20% increase in # of evening trips (after 6 pm)
  - 14% increase in average trip length

Finding 2: Participants shift away from transit, ridehailing, biking and walking

Number of trips by mode and week type

	HH vehicles	Ridehailing	Transit	Bike	Walk
■ chauffeur week	2660.5	11	14.5	74	289.5
■ non-chauffeur week	1870.5	26.5	51	117	331
pct change	42%	-58%	-72%	-37%	-13%

■ chauffeur week ■ non-chauffeur week

- *"I currently work in downtown where it is expensive to park, so once it [the AV] drops me off I would send to go park somewhere on the outskirts of town where it can find free parking for the day, and then it would pick me up and take me home"*

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Finding 3: AVs particularly benefit the elderly and individuals with mobility barriers

- Elderly had the highest percent increase in VMT (120%)

- 74% increase in evening trips

- 270% increase in trips longer than 50 miles

- Main advantages of the service:
  - Safety
  - Ability to explore new places
  - Traveling at night

- HH that includes a member with a disability that prevents them from driving had 700% increase in VMT

- Went from being a captive transit rider (virtually zero VMT) to having 350 vehicle miles

- Cut their commute time by half

- Traveled 156 miles for social activities during an average chauffeur week compared to 74 miles for an average non-chauffeur week

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Study Limitations

Resource limitations
- Sample size
- Relatively short treatment/adjustment time (1 week)
- 60 hour chauffeur limit
- Novelty effect

Context limitations
- Private ownership model, not shared
- "Automation" is provided for free (but the household does pay for other car travel costs)

Technology limitations
- Human driver, not robot

Quotes From Exit Interviews/Surveys:

- "I love the chauffeur service. I've already gone to two places I would never have driven to on my own and it's been wonderful."

- "one time I used the chauffeur, I took a nap, I made sure they knew where we were going and then I feel a sleep. That is how I would use the car."

- "Many errands and chores that I would otherwise avoid doing would become so much easier or altogether automated by my car."

- **"My life will improve, and stress levels will go down once self-driving cars become the norm."**

- *"If I'm any indication, Americans will get fatter!"*

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Some Policy Implications

- Self-driving cars will change how we travel.

- Privately-owned AVs could sharply increase overall VMT.

- It is important to identify and evaluate the tradeoffs between enhancing quality of life versus environmental and social cost of the additional travel.

- The future cannot be stopped, but it can be improved…

  - *Need for policies to maximize the societal benefits and minimize the negative externalities*

Strategies to Support VMT and GHG Containment Goals

1. Deploy driverless vehicles as shared use vehicles, rather than privately owned
2. Ensure widespread carpooling
3. Deploy driverless vehicles with zero tailpipe emissions
4. Take advantage of opportunities to introduce pricing
5. Increase line haul transit use rather than replacing it
6. Ensure driverless vehicles are not larger or more energy consumptive
7. Program vehicle behavior to improve livability, safety and comfort on surface streets

For more details, please visit: https://3rev.ucdavis.edu/policy-brief/keeping-vehicle-use-and-greenhouse-gas-emissions-check-driverless-vehicle-world

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