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Real-World Simulations of Life with an Autonomous Vehicle Suggest Increased Mobility and Vehicle Travel

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Issue

Fully autonomous vehicles are expected to have a profound effect on travel behavior. The technology will provide convenience and better mobility for many, allowing owners to perform other tasks while traveling, summon their vehicles from a distance, and send vehicles off to complete tasks without them. These travel behaviors could lead to increases in vehicle miles traveled that will have major implications for traffic congestion and pollution.

To estimate the extent to which travel behavior will change, researchers and planners have typically relied on adjustments to existing travel simulations or on surveys asking people how they would change their behavior in a hypothetical autonomous vehicle future. Researchers at UC Berkeley and UC Davis used a new approach to understand the potential influence of autonomous vehicles on travel behavior by conducting the first naturalistic experiment mimicking the effect of autonomous vehicle ownership. Private chauffeurs were provided to 43 households in the Sacramento, California region for one or two weeks. By taking over driving duties for the household, the private chauffeurs served the household as an autonomous vehicle would. Researchers tracked household travel prior to, during, and after the week(s) with access to the chauffeur service.

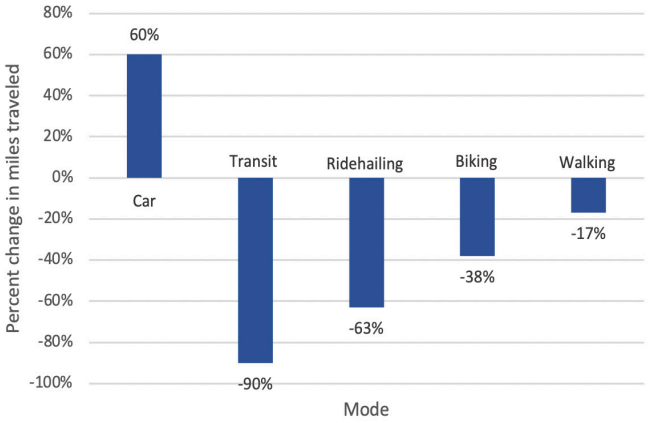


Figure 1. The percent change in households' miles traveled by various travel modes during the study period. Car travel includes travel via the provided chauffeured vehicle.

Key Research Findings

Household vehicle miles traveled substantially increased with access to the chauffeured vehicle, due in large part to zero-occupancy trips. Households participating in the study experienced a 60% increase in vehicle miles traveled. Over half of this increase was due to zero-occupancy vehicle trips in which the chauffeur, mimicking an autonomous vehicle, was sent on errands or sent home to avoid parking fees after dropping off household members or other family or friends.

Participating households became more vehicle-dominant and shifted away from other modes. The introduction of the chauffeured vehicle led to shifts away from all other travel modes; transit use experienced the largest drop (Figure 1). Households used chauffeured vehicle trips to replace transit use both for commuting and long-distance trips, such as between Sacramento and San Francisco (an approximately 90-mile distance). Households

with a chauffeured vehicle also walked, bicycled, and used ridehailing services less often, particularly if they had frequently used these modes before having access to the chauffeured vehicle.

Access to a chauffeured vehicle provided significant benefits to households with seniors and people with disabilities. Households with retirees experienced the largest increase in vehicle miles traveled (121%) of any cohort. Elderly participants and those with disabilities reported substantial lifestyle improvements from using the chauffeured vehicle, with greater freedom to travel at night, take long-distance trips, and, for those who were formerly transit dependent, travel without being tied to a fixed transit schedule.

Households that had been driving the least prior to the study experienced the greatest percent increase in vehicle miles traveled during the study period. Households that took more non-motorized and transit trips prior to gaining access to the chauffeured vehicle saw large increases in vehicle miles traveled (102%). Those households with the lowest vehicle miles traveled prior to the study observed the highest percent increase (137%). For this group, dominated by single occupancy households and the elderly, the automated vehicle fostered a more active lifestyle.

Households with access to a personal vehicle in addition to the chauffeured vehicle showed a marked shift in vehicle use. Miles traveled in the personal vehicle(s) dropped by 53% even as overall household vehicle miles traveled increased. This shift was even more pronounced in households without children whose schedules were likely more flexible. This result points to the potential for autonomous vehicle ownership to allow households to reduce the number of vehicles owned.

Policy Considerations

The study results are the first to show real-world travel behavior shifts induced by autonomous vehicles and suggest that autonomous vehicles could facilitate more car travel and a proliferation of zero-occupancy trips, which may exacerbate congestion and increase emissions (if the vehicles are not zero-emission). Regulators should consider disincentives or limits on zero-occupancy trips (and incentives to ensure these vehicles are zero-emission). These policies will be more successful if implemented proactively, *before* the adoption of autonomous vehicles becomes widespread.

The study also underscores the potential for autonomous vehicles to radically increase accessibility for some users, particularly the elderly and people with disabilities. As regulators craft legislation, incentives, and pricing programs to address the external costs mentioned above, they should also consider flexibilities or allowances for specific user groups such as seniors, low-income households, and people with disabilities that arguably have the most to gain from having access to an autonomous vehicle.

More Information

This policy brief is drawn from the report, "A Glimpse of the Future: Simulating Life with Personally-Owned Autonomous Vehicles and Their Implications on Travel-Related Behaviors," authored by Mustapha Harb and Joan Walker at the University of California, Berkeley and Jai Malik and Giovanni Circella at the University of California, Davis. The paper can be found at www.ucits.org/research-project/2018-09/. For more information about the findings presented in this brief, please contact Mustapha Harb (mrh20@berkeley.edu).

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