

Framing Document: Directing Innovations to the Public Interest

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In November 2016, the Institute of Transportation Studies at the University of California, Davis (ITS-Davis) convened leading academic, government, private industry, and public interest stakeholders to explore science-based policies that could steer the three transportation revolutions- shared mobility, electrification, and autonomous vehicles, toward the public interest. The resulting conversations led to the launch of the 3 Revolutions Policy Initiative. This framing document aims to summarize the mission and objectives of the policy Initiative.

After many decades of little innovation in passenger travel, three transportation revolutions—shared mobility, electrification and autonomous vehicles—are about to transform our cities, lifestyles and much more.

Many of these innovations will lead to positive changes. We can envision a dream scenario where people have plentiful, accessible and affordable mobility options. They travel safely, use their travel time productively, and have more free time. In this dream scenario the air is cleaner and communities are vibrant and well connected. But we could also envision a nightmare scenario, with much more vehicle use, greenhouse gas emissions and sprawl. Growing mobility inequities could make many low-income people stuck in traffic while wealthier riders enjoy faster travel times. In this nightmare scenario more people are more car-dependent, and spend more time to get around.

Our government policies, together with decisions by business, travelers, and civil society, will largely determine whether we head toward the dreamy or nightmarish future.

The three revolutions, embraced by powerful stakeholders and motivated innovators, have the potential to stimulate sweeping changes in passenger travel, overcome the resistance of incumbent industries, and provide a faster, scalable, and more profitable path toward societal goals. The dream scenario however, is not guaranteed. Unmanaged, some of these same innovations could exacerbate environmental quality, equity, and livability.

Our Transportation Future

3 Revolutions Dream

If policymakers and businesses effectively manage the transition to maximize cost savings and environmental benefits, these types of benefits may occur:

- Inexpensive on-demand robot cars and shared electric bicycles become widely available.
- Ridesharing costs plunge as a result of matching of passengers and car size
- More productive multi-tasking while traveling and fewer wasted hours spent ferrying kids around or running errands.
- Less searching for parking and less space devoted to parking at homes, along curbs, and at parking lots and garages.
- Better access to healthcare, retail services, education, and work for mobility disadvantaged.
- Cleaner air and more livable communities.

3 Revolutions Nightmare

If government is unprepared for the revolutions and allows companies to rush gasoline-powered autonomous cars to market, then the following may occur:

- Only wealthiest people buy autonomous cars, enjoying their enhanced freedom, flexibility and productivity.
- Conventional cars owners experience worsening congestion as they compete with more intensively used, and often empty, autonomous cars waiting for their owners.
- Those without driver's licenses, autonomous cars, or smartphones continue to be marginalized as the divide widens between mobility haves and have-nots.
- More urban sprawl as people opt for long commutes.
- Air pollutant and greenhouse gas emissions rise as vehicle usage increases.

The 3 Revolutions Conference & Policy briefs

The opportunities are enormous and exhilarating, while the risks are daunting. Equally daunting are the unknowns. That's why the Institute of Transportation Studies at UC Davis (ITS-Davis) recently convened academics, policymakers, industry and public interest groups to review the latest science, and to explore policies and strategies that governments and others could implement to steer innovation and deployment toward the public interest.

ITS-Davis used the Three Revolutions Conference to launch a new national outreach and engagement program to inform public discourse on the three transportation revolutions, and to connect researchers with policymakers.

Conference attendees, experts and leaders from across the United States and Europe drafted a series of policy briefs that set forth a range of policy concepts, recommendations and research needs. Some of the three revolutions policy briefs are more prescriptive, offering recommendations from the authors based on a foundation of established, ongoing research. Some of the policy briefs raise more questions than answers,

due to a lack of available data or research to draw from. In these cases authors introduced policy concepts that can be used to spur further research and engagement.

The variety and depth of the issues raised in the policy briefs reflect a rapid pace of change—and great uncertainty at this early stage of our revolutions. Some briefs represent consensus opinions among the larger community of transportation professionals, others reflect the opinions of the authors and contributors. All the policy briefs are offered with the shared desire to foster an understanding of how we can make our dream scenario a reality.

What's driving the three revolutions?

For the first time in a century, mobility is on the cusp of not just one transformation, but several. One transformation is the roll-out of new mobility services by Lyft, Uber, and others. In only a few years, this new mobility industry has gained admiration from travelers and the attention of governments and investors around the world. Uber has already surpassed the valuation of 107-year-old General Motors. These new mobility services include ride pooling, car sharing and bike sharing, and an expanding array of micro-transit services that use vans and small buses on flexible routes with flexible schedules.¹

Millennials are playing a leading role in embracing these new mobility services, as well as many other elements of the sharing economy. A comprehensive survey conducted by the National Center for Sustainable Transportation at UC Davis finds millennials use the internet and smartphone apps to identify places to go and how to get there more frequently than older generations. Millennials report “travel multitasking,” using their devices while they travel, and using mobility services at a higher rate than older generations. The survey also finds millennials drive 18% fewer vehicle miles on average.²

Other transformations involve vehicles. Automakers are investing in longer range and lower cost electric-drive vehicles, including plug-in hybrid, battery and fuel cell electric vehicles. More than 30 models are now available in the United States. Even more are available elsewhere, especially in China. Every major automaker is planning to expand their offerings, motivated by battery and fuel cell costs that are dropping faster than almost anyone anticipated. Lithium-ion battery pack costs dropped from about \$1,300 per kilowatt-hour in 2006 to \$400 in 2014,³ and are well on their way to another 50 percent drop by 2020. Recognizing their large potential air quality, energy, and climate benefits, nations around the world are implementing aggressive policies in support of electric vehicles.

In addition, vehicle manufacturers, technology companies, and mobility service providers are competing to load more automated and information technologies into cars. Several automotive and mobility companies have announced plans to place autonomous vehicles on the road by 2021, though usually with caveats. Many automation technologies are already standard in upscale vehicles, including automated emergency braking, lane-detection sensors, and adaptive cruise control. And some cars already are nearly self-driving, mostly on limited-access highways and in low-speed urban demonstration projects.

A variety of existing policies support these revolutions. These include first-last mile subsidies to travelers to help them get to and from existing public transit or complete short local trips. Rebates and tax credits are now offered for electric car purchases. California's Zero Emission Vehicle mandate will push research and development of vehicle technology in the right direction. Federal guidelines for automated vehicles, and autonomous vehicle

tests and demonstrations are occurring in a number of states. As the three revolutions gain traction, increasing consumer, business, and political interest will likely accelerate the speed of transformation.

A hard to predict future

Each transportation revolution offers distinct benefits. But the greatest benefits will result from synergies between the three. When the revolutions are partnered, the result is low-cost, low-carbon, equitable transportation. But how and when this integration occurs is uncertain.

Will synergies happen naturally through the workings of the marketplace, or will it require a combination of market forces and government guidance?⁴ Is the vision compelling enough to transcend shortsighted choices by businesses, government and individuals?

More specifically, what changes in behavior and policy are needed? Will travelers be willing to cede vehicle control to a robot?^{5 6} Or to give up private ownership? Will people be comfortable sharing rides with strangers? How will hacking and privacy concerns be resolved—or not? Will data be shared with governments to facilitate efficient planning and oversight? How might these new services and technologies integrate with existing public transit service to provide greater access to more people? How do we ensure that these revolutions don't exacerbate inequities in our society, creating benefits for rich people but not others?

How do we ensure increased access by those unable to drive? How can these new services and technologies complement bicycling and walking to improve health and livability? How do we build confidence in the safety of these new technologies? How do we mitigate likely job losses by drivers? What new tax and road use policies are needed to account for changes in vehicle ownership and the inevitable drop in fuel tax revenues?

All these uncertainties paralyze local planning.⁷ Risk-averse public agencies need to experiment with new platforms, business models, and services.⁸

Ongoing and new research will help answer these questions and many more. The policy briefs offered by UC Davis conference participants delve into the details and discourse around these issues.

Anticipating and informing the revolutions

Private industry is investing billions in technology and service platforms. Academia is cultivating research centers and programs to understand and inform decision making. Public interest groups are building expertise to advocate for solutions that promote the most sustainable, equitable outcomes. And private foundations are developing philanthropic strategies to help guide the revolution toward the public interest.

Because the pace of change could prove to be rapid, we all must be adaptable. Government policy, at the intersection of the many competing and complementary interests, must evolve quickly in response to technology and service innovations, stakeholder input, and growing societal knowledge and experience. Working together, we can develop policies and strategies that steer these transformative innovations toward the public interest and our dream of a bright transportation future.

Additional reading

[Shared Mobility Innovation for Livable Cities](#), International Transport Forum-OECD, May 2016

[Autonomous taxis could greatly reduce greenhouse gas emissions of U.S. light-duty vehicles](#), Nature Climate Change, Jeffery Greenblatt and Samveg Saxena, July 2015

[Peak Car Ownership: The market opportunity of electric automated mobility services](#), Rocky Mountain Institute, Jonathan Walker and Charlie Johnson, 2016

[An Integrated Perspective on the Future of Mobility](#), Bloomberg New Energy Finance and McKinsey & Company, October 2016

[Smart City Challenge Lessons Learned](#), U.S. Department of Transportation, 2016

[ReProgramming Mobility Literature Review](#), Andrew Mondschein, New York University's Rudin Center for Transportation Policy and Management, August 2014

References

1. Shared Use Mobility Center, "Shared Use Mobility Reference Guide," (2015)
2. Giovanni Circella, Lew Fulton, Farzad Alemi, Rosaria M. Berliner, Kate Tiedeman, Patricia L. Mokhtarian, Susan Handy, "What Affects Millennials' Mobility? PART I: Investigating the Environmental Concerns, Lifestyles, Mobility-Related Attitudes and Adoption of Technology of Young Adults in California," National Center for Sustainable Transportation, (May 2016)
3. Björn Nykvist and Måns Nilsson, "Rapidly falling costs of battery packs for electric vehicles," Nature Climate Change 5, 329–332 (2015)
4. Boyd Cohen, and Jan Kietzmann, "Ride On! Mobility Business Models for the Sharing Economy," Organization and Environment, Vol. 27(3) 279–296 (2014)
5. M. Kyriakidis, R. Happee, J.C.F. de Winter, "Public opinion on automated driving: Results of an international questionnaire among 5,000 respondents." Transportation Research Part F 32 127–140 (2015)
6. Dale Richards, Alex Stedmon, "To delegate or not to delegate: A review of control frameworks for autonomous cars," Applied Ergonomics 53 383–388 (2016)
7. Erick Guerra, "Planning for Cars That Drive Themselves: Metropolitan Planning Organizations, Regional Transportation Plans, and Autonomous Vehicles," Journal of Planning Education and Research; 1–15, (2015)
8. Bryant Cannon and Hannah Chung, "A Framework for Designing Co-Regulation Models Well-Adapted to Technology-Facilitated Sharing Economies," Santa Clara High Technology Law Journal, Volume 31, Issue 1, Article 2. (2015) Available at: <http://digitalcommons.law.scu.edu/chtlj/vol31/iss1/>