Unintended Consequences: What Else Should We be Thinking About?

2017 Florida Automated Vehicle Conference
Tuesday, November 14, 2017 • Steven E. Polzin, PhD.
Perhaps the Most Transformational Period in Transportation Since the Development of Personal Vehicles

Demographics
Economics
Technology
Governance
Culture/values
Key Issues

• The Nature of the Uncertainties
• Key Behavioral Issues Underlie the Consequences of AV/CAV
• Rare Events not Everyday Challenges May Govern Progress
• Miscellaneous Consequences We Haven’t Thought Much About
• Impact on Transportation Planning
Disclaimer: We Aren’t Very Good at Prediction

“Dial-a-bus call stations could be installed at convenient intervals throughout a suburban area.”

Source: Tomorrow’s Transportation, New Systems for the Future, 1968

- Weather/Climate
- Next election
- Hot toys for Christmas
- Box office success
- Hot stocks
- Pace of technology deployment
Very smart people have very different opinions on the future of transportation – and we haven’t challenged them to rationalize their timelines.
The New York Times

Navy Returns to Compasses and Pencils to Help Avoid Collisions at Sea

By ERIC SCHMITT  SEPT. 27, 2017

Forbes

10 Million Self-Driving Cars Will Hit The Road By 2020 -- Here’s How To Profit

Olivier Garret, CONTRIBUTOR, MAR 3, 2017

Conservative Prediction: 10 Million Self-Driving Cars by 2020

As I said above, my research leads me to believe that there will be 10 million self-driving cars on the road by 2020, with one in four cars being self-driving by 2030.

https://www.forbes.com/sites/oliviergarret/2017/03/03/10-million-self-driving-cars-will-hit-the-road-by-2020-heres-how-to-profit/#7ae6e3397e50

Pushback/Uncertainty on Fast Deployment and Transformational Impacts Is Intensifying

- “Something to Call My Own” Thinking Highways, Bern Grush and Blair Schlecter, August 2017.

- “The Road Ahead for Connected Vehicles”, Knowledge@Warton, July 28, 2017.

  When can cities see fully unconstrained driverless vehicles? “That may not be achieved in 100 years,” Bishop said.

  Achieving the ability to handle 90% of driving situations may happen relatively soon; being able to deal safely with 99% is exponentially more difficult and getting to 99.9% effectiveness is currently out of reach, said MacDuffie.

Three Factors Influence Consequences

- Uncertainty on Consequences
- Uncertainty on Timing
Impacts of Technology are Highly Dependent on Three Key Decisions

- Vehicle Ownership
- Live/Work Location Choices
- Shared Travel/Occupancy
Ownership Not Just a Mobility Decision

Functional transportation

Transportation plus?
<table>
<thead>
<tr>
<th>Cost Component</th>
<th>Cost Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fully Amortized Auto Operating Cost</td>
<td>$0.54/ mi.</td>
</tr>
<tr>
<td>Maintenance and Operation</td>
<td>$0.19</td>
</tr>
<tr>
<td>Out of Pocket</td>
<td>$0.14</td>
</tr>
<tr>
<td>BLS Consumer Expenditure Survey</td>
<td>$0.44/ vmt</td>
</tr>
<tr>
<td></td>
<td>$0.26/ pmt</td>
</tr>
<tr>
<td>Transit fares</td>
<td>~ $0.26/mi</td>
</tr>
<tr>
<td>TNC</td>
<td>~$1.00-2.00/mi</td>
</tr>
<tr>
<td>(sequentially shared vehicle, not concurrently shared ride)</td>
<td></td>
</tr>
<tr>
<td>Automated Vehicle (shared ride)</td>
<td>~&lt;$0.20-?????</td>
</tr>
</tbody>
</table>

Source: IRS

Auto owners “feel” $0.14 per mile costs in mode choice decision.
Envisioned Cost Structures Imply Possible New Institutional Roles Governing/Providing Mobility
Willingness to Rely on a Mobility Service?

Evacuations
Fires, storms, volcanos, Tsunami, power plant failures, damn failures, chemical spills, etc.
Independence is a Prerequisite to Freedom?

Are American’s willing to relinquish vehicle ownership?

And if so to Whom?
Key Decisions

- Live/Work
- Location
- Choices
Land Use Impacts

Drive till you qualify becomes nap till you qualify?

More house and less garage?
Without having to own and park a car I can afford the urban lifestyle.

After a day at the office and a nap on the ride home I can enjoy the great outdoors.
Key Decisions

Sharing vehicles sequentially versus sharing vehicles concurrently.
Rare Events not Everyday Challenges May Govern Deployment

• The business model for Mobility as a Service is generally based on routine conditions.

• The logistics analysis for shared automated vehicles is based on typical conditions. Typically dense urban environments, average trip tables, and single provider service scenarios.

• What if rare events drive fleet size and logistics capabilities.
Automated Vehicles in Emergency Evacuations

• Fleet size - will emergency evacuation drive peak fleet size?
• Prioritization and logistics - jurisdictional or other considerations?
• Range - Refuel/recharging?
• Operation in unique situations - shoulder running, reversed lanes, debris covered or flooded roadways?
• Traveler discretion on evacuation decision and timing?
Emergency Response
• Fuel/power availability post emergency?
• Ability to operate in non routine conditions: no signals, on road debris, no signage, roadside debris piles, covered lane markings, deviations out of lane, etc.
Energy Efficiency of Automation?

• “Autonomous Overhead”—the significant amount of electrical power required for data processing alone.
• The 1.5 kW to 2.75 kW needed just to process the increasing deluge of incoming and in-vehicle data—generated from on-board sensor arrays, from other vehicles, the infrastructure and the cloud—is “the dirty little secret” of autonomous vehicle engineering, Thomas told the audience at SAE’s 2017 High-Efficiency Engines Symposium in Detroit on April 3.
Disruptions in Healthcare and Legal Professions

In 2010 Accidents resulted in $23.4 billion in medical cost of a total 2.6 trillion in medical spending in 2010 - 0.9% (The Economic and Societal Impact Of Motor Vehicle Crashes, 2010 (Revised), U.S. Department of Transportation, National Highway Traffic Safety Administration; Health Care Costs: A Primer, The Henry J Kaiser Family Foundation, May 2012.)
Impacts on Government Revenues and Costs

TECHTANK
Autonomous vehicles will have tremendous impacts on government revenue

Kevin C. Desouza and Kena Fedorschak Tuesday, July 7, 2015

DOT chief: Electric, driverless cars could dry up road funds

BY GARY D. ROBERTSON
Associated Press
OCTOBER 02, 2017 6:11 PM

RALEIGH, N.C. — North Carolina generates half of its $3.7 billion in state transportation money by taxing motor fuels, a revenue engine that could begin puttering out as soon as four years from now, the state’s transportation chief told lawmakers on Monday.

The future of travel is just around the corner, Transportation Secretary Jim Trogdon said, and North Carolina needs to act swiftly to locate new road-building revenues that don’t rely on gasoline taxes and that depend less on personal car ownership and operation.
Weather

Will Weather differences lead to differential deployment with travel and economic impacts?

https://www.nohrsc.noaa.gov/snowfall_v2/
Integration with Emergency Services

• How Police Are Preparing for the Arrival of Autonomous Cars
  • Linda Poon
  • Oct 25, 2017
• Before self-driving cars take over the road, first responders need to know what they’ll do in an emergency.
Murses (man purse) gains popularity to replace center counsels, trunks, and gloveboxes.
The Transformation of Transportation Requires a Transformation of Transportation Planning
Uncertainty Regarding Automatic Vehicles Undermines Transportation Planning

• Timing and impact uncertainty jeopardize long range planning.
• This uncertainty undermines planners ability to contribute information to support decision-making.
• Uncertainty enables poor decisions including decisions to procrastinate.
• The AV/CAV community has tolerated hype and advocacy exacerbating uncertainty and confusion.
• The planning community has been slow to tactically respond to how planning should respond to the uncertainty inherent in this transformation.
What Should Planners Do?

• Acknowledge a markedly different set of stakeholders and the private sector actively engaged in transportation.

• Reevaluate all aspects of transportation planning in light of changing conditions.

• Adapt goals, metrics, data, scenarios, evaluation and programming criteria, and planning tools, etc. that integrate uncertainty and dynamic change.