The Future is Already Here: Connected and Autonomous Vehicles

Three Revolutions
Steering Automated, Shared, and Electric Vehicles to a Better Future

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Today: Electrification at a Tipping Point?

**Figure 5.** Forecasts of global electric vehicle penetration

- **Annual Sales of EVs (Millions)**
- **EVs in Fleet (Millions, Cumulative) EVs Share in the Total Fleet (%)**

Source: CEP Survey & Analysis

Kah, 2018

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Today: Many More Electric Cars on the Market

- I3
- CHEVROLET Bolt EV
- Fiat500e
- Fordfocus Electric
- Honda clarity Electric
- Hyundai ioniq Electric
- Hyundai kona Electric
- Jaguari-pace
- Kiasoul EV
- Nissanleaf (1st Gen)
- Nissanleaf (2nd Gen)
- Smarted
- Teslamodel 3 (Long Range)
- Teslamodel S 100D
- Teslamodel S 75D
- Teslamodel S P100D
- Teslamodel X 100D
- Teslamodel X 75D
- Teslamodel X P100D
- Volkswagen e-golf

EV Rater, 2018
**Today: Ridehailing, Ridesourcing, Legal Designation: Transportation Network Companies (Tncs)**

- Uber
- Lyft
- ExecutiveRide
- Ride Plus
- See Jane Go
- Silver Ride
- Sitbaq Inc
- SocialDrv
- Wingz
- Altruistic
- Ainos
- MVN
- Uber

**Today: Ridehailing (E.G. Lyft Uber) Mixed Societal Impacts Sharing Or “Ride-pooling” Will Mitigate These Impacts**

Ridehailing linked to reduced GHG/VMT associated with:
- lower auto ownership
- Use as first/last mile to transit
- Impact of hypothetical increases in densification in CBDs

Ridehailing linked to increased GHG/VMT due to:
- hypothetical fringe development
- trip generation and mode shift from transit/walk/bike
- network travel (deadheading)

Other Societal Impacts:
- Reduced drunk driving
- Improved mobility options

Rodier, 2018
Today: Automated Vehicle Deployments

Today: 3 Revolutions Are Here
Shared, Automated, Electric Low-speed “Pod” Vehicles

Currently operating:
- Las Vegas, NV
- San Ramon, CA
- Arlington, TX (On park paths)
- Ann Arbor, MI
- Tampa, FL

Demonstrations Occurred
- Austin, TX
- San Francisco, CA
- Minneapolis and Rochester, Minnesota
- Detroit, MI
- Several Others
How Will Automation Impact Future Travel?

- Automation could double or triple travel (despite small increases in capacity) due to assumed reduced costs of travel
- Automation could enable new traveler, e.g. old and young, and people with mobility disabilities (10-14%)
- Parking demand could be reduced by 90%, which could result in relocation travel (mixed effects)

**Absent policy intervention the Net effects of automations will likely be more traffic**

Rodier, 2018

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**Costs Of Future Travel**

<table>
<thead>
<tr>
<th>Mode</th>
<th>Private ICE</th>
<th>Private EV/AV</th>
<th>TNC ICE</th>
<th>TNC EV</th>
<th>TNC EV/AV</th>
<th>TNC EV/AV pool</th>
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<tbody>
<tr>
<td>$ / passenger-mile</td>
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<td>Parking/walking time</td>
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<td>Travel time cost per passenger</td>
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<td>TNC overhead</td>
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<td>Driver cost</td>
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<td>Vehicle taxes</td>
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<td>Insurance</td>
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<td>Fuel</td>
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<tr>
<td>Automation Costs</td>
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<tr>
<td>Amortized Purchase Cost</td>
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</table>
Automated Modes are Cheap - Both in money and time

Climate Findings

Note: Graph shows CO2 emissions from urban passenger mobility including 2 & 3 wheelers, passenger vehicles, buses, and trains.

(Chart: Eggart, Sperling, Gauthier, 2018; Data: Fulton, Meroux and Mason, 2017)
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Travel and Traffic impacts: Shared Robot Taxis

- **1.5% --- 4.5% Vehicle Miles Traveled (VMT)**
  - (30%, 50% shared taxis) (Fagnant et al 2016)

- **+ 30% VMT**
  - (75% shared fleet) (Fulton et al 2017)

- **- 22% - 15%**
  - (100% shared taxis) (Bishoff et al. 2017)

**NOTE**: These studies are not technically comparable; only shown for context

What do we do about all this?

- **Champion pooling** increase choices and build "pooling-supportive" infrastructure (bus-only lanes, pooling-only curbs, ridehailing charging hubs)
- **Get the pricing right** (roads, curbs, occupancy)
- **Keep the environment/public health in mind** (reforms to CAFE, ZEV, LCFS)
- **Keep “mobility have-nots” in mind** (use 3Rs as tools to improve access and mobility)
- **Enable ongoing research** by balancing data collection and availability (more research!) with privacy concerns and private sector IP protection.

**Theme is “Pooling & Pricing”**
Policy Solutions for Regional Gov’ts
(MPOs/RTPAs/Counties/AQMDs/Ports)

• KEY POLICY: Create comprehensive system of regional price signals to encourage pooling e.g.
  • Congestion pricing - increase choices then give points for good behavior, e.g. “Decongestion Zone” in L.A. (Eaken, NRDC, 2017) publicizing communal + personal benefits, direct revenues very locally to increase choices.
  • HOT lanes on freeways
  • Waived bridge/tolls for pooled vehicles
  • Airport fees for standard taxis/TNCs (rebates for pooling)

Policy Solutions for Regional Gov’ts
(MPOs/RTPAs/Counties/AQMDs/Ports)

• Redouble commitment for multi-modal planning and investment in high capacity, high quality transit along major corridors
• Support innovation with grants for cities and transit agencies to grow capacity for pilot testing focusing on first-last mile solutions for seamless connections to high quality transit
• Get smarter about TDM
• Develop regional data warehouses to collect data on emerging technology access and usage, vehicle occupancy, etc.
Policy Solutions for Transit Agencies

- Actively pursue grants to grow capacity for pilot testing
  - Including funds for data collection and pilot research/evaluation(!)
  - Develop criteria for pilot success that quickly transitions pilots into longer term programs
  - Identify funding mechanisms for all phases of partnerships and service provision

Policy Solutions for Cities

- Redouble efforts to develop mode separated corridors for transit and active modes, and encourage slow-speeds and complete streets for local roads and retail areas.
- Support the regional pooling supportive pricing systems with local land use authority
  - Price access to curbs
  - Create “shared use mobility zones” for pooled ridehail drop-offs only (Rogers, Eno 2018)
  - Pair TNC subsidies with low-density transit routes or during off-peak hours
  - Parking price management
  - Landbank parking lots to install better pricing and prepare for potential redevelopment
Thank you & Read the book

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

SAVE THE DATE

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