Changing Consumer Preferences and Mobility Behaviors in the Context of a Modal Revolution

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Forum on Preparing for Automated Vehicles and Shared Mobility
4 Revolutionary Transportation Developments

- Vehicles with Connectivity
- On-Demand Ride Services
- Shared Mobility
- Vehicle Automation

Sources:
- Norton Rose Fulbright
- UITP
- TTI
- CNN Money
Context

• American travel still heavily reliant on personal vehicles
• Four transportation developments could influence level and distribution of travel demand
• Some have been in mobility marketplace for decades; others have yet to enter
• Impacts depend on when, how, why, by whom adopted and used
Vehicles with Connectivity

• Communication capabilities to send and receive data and information, sense the physical environment, interact with vehicles or entities
• Provide warnings and information to drivers
• Safety, Infotainment, navigation, diagnostics, and convenience
• Industry push ➔ 22% of all vehicles on road by 2020
• Federal government R&D (V2V, V2I, V2X)
• Understanding and ambiguity in terminology influences “evidence” and use of CV applications
Highly Influential in Car-Buying Decisions

- More important than performance, brand, reputation
- Millennials pay more than average buyer to get tech
- Impacts
  - Traffic safety
  - Traffic flow
  - Auto ownership
Unanswered Questions?

• Can CV applications be designed to prevent driver distraction?
• How should the driving public be informed as to how to use CV applications?
• Will the presence of desired technology applications in vehicles sustain vehicle ownership preferences, and among young adults?
On-Demand Ride Services

• Traveler requests a ride and pays driver through app that connects traveler and driver locations in real-time

• Transportation Network Companies (TNCs) and micro-transit services

• Urban, sub-brand business model (UberEats)

• TNCs operate at a loss due to subsidized fares

• Small starts-ups serve niche markets
TNC and Taxi Ridership in the U.S. 1990-2018

Source: Schaller, 2018

Rapidity of TNC ridership growth is pronounced when compared to taxi ridership, its main urban modal competitor.
Urban Area Bias in Availability and Use

Source: Schaller, 2018

Less than 10% of trips in suburban or rural areas

TNC users are younger, educated, and higher income

Not used for commuting. Used to avoid parking (airport, entertainment) and driving after drinking

11 large less-dense metros

8 large dense metros

Boston, Chicago, Los Angeles, Miami, Philadelphia, San Francisco, Seattle, Washington, DC.

Rest of U.S.

New York area

70%
Public Transit and Congestion Impacts

• Public transit use declining
  • Competitive factors
  • Quality and supply of transit service

• VMT in urban areas increasing
  • Low split ride usage
  • Travelers shifted from space-efficient modes

Transit Ridership 2016-2017

- New York -1.1%
- San Francisco -1.3%
- Atlanta -2.6%
- Boston -3.1%
- Chicago -3.2%
- Washington, DC -3.4%
- Los Angeles -5.4%
- Philadelphia -7.3%
- Miami -8.7%

Source: TransitCenter, National Transit Database
GABRIEL FLORIT/THE WASHINGTON POST
Unanswered Questions?

• Whether TNC model viable in suburban and rural areas?
• If TNC use eventually will decrease auto ownership rates?
Shared Mobility

- Umbrella term: Shared use of a vehicle, bicycle, or other mode; as-needed basis.
- Car-sharing (1994 – Zipcar)
  - Roundtrip
  - One-way, One-way free floating
  - Peer-to-peer
- 21 car-sharing operators
- Membership tapered – competition
- Automakers innovating in space
  - Daimler, BMW, GM, VW
Ride-sharing (Carpooling)

- Act of filling empty seats by pairing drivers and riders who share common origins, destinations, stops.
- Commute mode
  - 1980 23% carpool
  - 2016 9%
  - Urban uptick
- Dynamic ride-sharing
  - App-based platforms
  - Exchange data
  - Ratings
  - Transact payments

Source: CityLab/Census/Google Charts
Bike-Sharing

• Point-to-point, short distance, for a fee
  • Station based
  • Dockless

• Fast growing transportation mode
  • 2017, 35 million bike-share trips
  • 2017, 82 bike-share programs in 70 cities and suburbs
  • 5 dockless bike-share in 25 cities and suburbs

• Variation in who owns
  • Station-based: Public/private
  • Dockless: Private operators

SOURCE: NACTO.ORG
Electric Scooter-Sharing

• Point-to-point, short distance
  • Locate and pay through app
  • Dockless

• Fastest growing transportation mode
  • Available less than 12 months
  • Adoption rate of 4% in cities where they operate

• Fill mobility gap
  • First/last mile and leisure
  • Women and lower-income
  • $1 then, 15 cents/minute

Source: Clewlow, 2018
Unanswered Questions?

- What are the safety and equity implications of shared roads, sidewalks, and curb spaces in urban areas?
- Does shared mobility have a “market” in suburban and rural areas?
- Are all shared mobility manifestations equal in influence on level and distribution of travel demand?
## Vehicles with Automation

<table>
<thead>
<tr>
<th>LEVEL</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>None</td>
<td>Assistance</td>
<td>Partial</td>
<td>Conditional</td>
<td>High</td>
<td>Full</td>
</tr>
<tr>
<td><strong>What car does</strong></td>
<td>Nothing</td>
<td>Assists: Accelerate, brake, or steer</td>
<td>Assists: Accelerate, brake, and steer</td>
<td>Everything for short periods of time</td>
<td>Everything restricted operating environment</td>
<td>Everything</td>
</tr>
<tr>
<td><strong>What driver does</strong></td>
<td>Everything</td>
<td>Everything with some assistance</td>
<td>Everything with more assistance</td>
<td>Remain alert ready to resume control</td>
<td>Nothing restricted operating environment</td>
<td>Nothing</td>
</tr>
<tr>
<td><strong>Where to Find</strong></td>
<td>Your (grand) parents car</td>
<td>Present fleet</td>
<td>Present fleet</td>
<td>Tesla Autopilot</td>
<td>Industry vision</td>
<td>Sometime in the future</td>
</tr>
</tbody>
</table>
Transition to Higher Level AVs Well Underway

• Many automakers skipping Level 3 and advancing to Level 4
  • GM 2019
  • Honda 2020
  • Renault-Nissan-Microsoft 2020
  • Volvo 2020
  • Hyundai, highway 2020, urban 2030
  • BMW-Fiat Chrysler-Delphi-Intel-Mobileye 2021
  • Ford 2021
  • Daimler early 2020s
Many Things To be Solved Before Level 4, 5 AVs

Human

- Acceptance, User expectations

Vehicle

- 3D maps, Learning, Ethics, Connectivity, Cyber

External

- Legacy vehicles, Complexity of cities, Bad weather, Blackspots (GPS), Other infrastructure

Commercial

- Vehicle cost, Mobility provider business model

Frameworks

- Industry and regulatory standards, Privacy, Liability, Insurance
Consumer Trust a Significant Factor

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage</th>
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</thead>
<tbody>
<tr>
<td>Overall</td>
<td>63%</td>
</tr>
<tr>
<td>Men</td>
<td>52%</td>
</tr>
<tr>
<td>Women</td>
<td>73%</td>
</tr>
<tr>
<td>Millennials</td>
<td>49%</td>
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<tr>
<td>Gen Xers</td>
<td>70%</td>
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<tr>
<td>Baby boomers</td>
<td>68%</td>
</tr>
</tbody>
</table>

*Source: AAA, n=1,004, 2018*
Roads Deemed Less Safe with Full AVs

Roadway safer if all vehicles were fully autonomous (vs. operated by people)?

Source: Cox Automotive 2018
Evolution of Mobility Survey, N=1250
Most Appealing Autonomy Level

Preferences shifted from Level 4 to Level 2

Source: Cox Automotive 2018
Evolution of Mobility Survey, N=1250
AV Growth Complex and Uncertain

AVs will be connected, whereas CVs will not necessarily be automated

Technology and infrastructure requirements different for highway versus urban use cases

Passengers and goods vastly different markets each requiring unique technologies, regulation, business cases, etc.

Ownership impacts deployment and adoption
Unanswered Questions?

- When will a critical mass of AVs operate freely on public roads?
- How safe is safe enough (i.e., safer than a human driver)?
- How will AVs be owned and used?
- What are land use impacts?
- What are economic and employment impacts in passenger transport? Goods movement?
Summary

- Technology innovation enabled on-demand and shared transportation services that will eventually have a major impact on mobility
  - Market penetrations are accumulating especially among urban residents
- Connectivity and automation will cause similar or perhaps even greater transformation
  - Testing on public roads (supported by legislation, funding, and government oversight) is critical for safe operations
- Private sector push to market, impact uncertainties, and complexities in effectively operating existing transportation systems create challenges for “correct” policy and regulation
  - Management of public and private interests vital in attaining the potential societal benefits and mitigating negative outcomes