INNOVATION AND DISRUPTION IN URBAN MOBILITY: DO WE NEED TO RETHINK EVERYTHING?

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OVERVIEW

- Innovations disrupting mobility
- What’s changing? What’s not?
- Trends & risks impacting public transportation
- Areas to rethink
- Guiding principles for public agencies

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http://scholarcommons.usf.edu/jpt/vol21/iss1/8/
SHIFTING TRANSPORTATION LANDSCAPE

Innovative partnerships and emerging technologies are changing how we travel

- State and local DOT’s leveraging TNCs, taxis, and volunteer drivers to address service gaps
- Integrated multimodal traveler information apps improving to include a variety of public and private options
- Carpooling and ridesharing start-ups enabling high-occupancy commuting
- Auto manufacturers rebranding as mobility companies, acquiring start-ups, and pursuing self-driving vehicles
- Mobility as a Service (MaaS) piloting in Europe (e.g., Finland, Sweden, Netherlands)

GROWTH OF ON-DEMAND AND FLEXIBLE ROUTE OFFERINGS

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Sheehan, 2018
WHAT’S CHANGING? WHAT’S NOT? .... SUBURBANIZATION

• US population still trending toward suburbanization
• 75% of households reside in single-family or mobile homes (US Census)
• Growth in employment centers has been occurring outside of urban cores and in various suburban nodes (i.e., edge cities) (Kneebone 2009)
• Between 1990-2010, suburbs generally grew faster than urban cores (Frey, 2012)

TRENDS IMPACTING PUBLIC TRANSPORTATION

1. Changing Generational Behavior
2. New Attitudes Toward Technology
3. Changing Attitudes Toward Mobility
POTENTIAL TREND

MILLENIALS WILL CONTINUE TO SUBURBANIZE AS THEY RECOVER FROM THE GREAT RECESSION AND ATTAIN KEY LIFE MILESTONES (GETTING MARRIED, HAVING CHILDREN, ETC.)

Shaheen and Cohen, 2018

KEY QUESTIONS

WILL RESUME HISTORIC PATTERNS OF SUBURBAN LIVING AND AUTO DEPENDENCY WHILE PROGRESSING THROUGH LIFE MILESTONES? (NAUGHTON 2017)

DOES DELAYED PARENTHOOD LEAD TO DELAYED VEHICLE OWNERSHIP? (OAKIL ET AL., 2016)

Shaheen and Cohen, 2018
ATTITUDES TOWARD TECHNOLOGY

• Millennials have embraced apps and other technologies
• More travelers are substituting physical trips with virtual trips
• Impact of telecommuting and e-commerce on public transportation is unclear
• NHTS does not account for impacts and changes in technology use
REDUCED NEED FOR BRICK AND MORTAR RETAIL AND OFFICES

- Emerging technologies are reducing need for brick-and-mortar retail consumption and workers to be physically present in an office
- May reduce vehicle and public transit trips

TELECOMMUTING IMPACTS

- Employers often do not monitor and track telecommuting closely, making the travel impacts difficult to assess and monitor (Nilles 1988; Mokhtarian 1991; Mokhtarian et al. 1995)
- 45% of U.S. workforce has occupations compatible with part-time telework (Lister and Harnish 2011)
- Telecommuting grew by 61% between 2005 and 2009 (Lister and Harnish 2011)
- More research on telecommuting needed to understand, if it adversely impacts public transit ridership or shifts public transit demand (from peak commuting to non-work trips)
E-COMMERCE IMPACTS

• No consensus on whether e-commerce is having a negative, neutral, or complementary effect
• Subscription e-commerce firms focusing on on-demand delivery of products (e.g., ShopRunner) rather than regular delivery cycles
• Role of e-commerce and goods delivery on public transit ridership and broader transportation network is evolving

RISKS CONFRONTING PUBLIC TRANSPORTATION

• Protecting public transit riders from crime and terrorism
• Demographic shifts changing modal choice
• Technological innovation creating new demand for real-time information services, rider amenities, and on-demand/flexible route services
• Labor interests & security risks may slow or limit automated applications in public transit
• Rising transit fares, as other modes (ridesourcing and driving) are less expensive
• Many public transit systems in need of maintenance and repair
• Competition with low fuel prices (auto use)
RECENT DECLINES IN PUBLIC TRANSIT RIDERSHIP

<table>
<thead>
<tr>
<th>City Name</th>
<th>2015 Ridership</th>
<th>2016 Ridership</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seattle, WA</td>
<td>170,640,154</td>
<td>165,615,534</td>
<td>4%</td>
</tr>
<tr>
<td>Houston, TX</td>
<td>63,259,295</td>
<td>60,131,169</td>
<td>-5%</td>
</tr>
<tr>
<td>Milwaukee, WI</td>
<td>40,610,951</td>
<td>41,769,961</td>
<td>2.8%</td>
</tr>
<tr>
<td>Chicago, IL</td>
<td>26,739,190</td>
<td>28,879,560</td>
<td>8%</td>
</tr>
<tr>
<td>New York-Queens, NY-ALL-TOT</td>
<td>4,223,700,561</td>
<td>4,341,716,656</td>
<td>3%</td>
</tr>
<tr>
<td>San Francisco-Oakland, CA</td>
<td>454,832,418</td>
<td>454,696,066</td>
<td>0.3%</td>
</tr>
<tr>
<td>Boston, MA-MBN</td>
<td>653,864,723</td>
<td>656,841,950</td>
<td>2%</td>
</tr>
<tr>
<td>Pittsburgh, PA</td>
<td>53,000,420</td>
<td>52,870,397</td>
<td>-0.3%</td>
</tr>
<tr>
<td>Denver-Aurora, CO</td>
<td>101,029,365</td>
<td>99,777,469</td>
<td>-1.3%</td>
</tr>
<tr>
<td>Portland, OR-WA</td>
<td>112,480,300</td>
<td>110,985,033</td>
<td>-1.2%</td>
</tr>
<tr>
<td>San Antonio, TX</td>
<td>57,885,580</td>
<td>57,740,281</td>
<td>-0.2%</td>
</tr>
<tr>
<td>Salt Lake City-Uintah, UT</td>
<td>44,000,141</td>
<td>43,704,825</td>
<td>-0.7%</td>
</tr>
<tr>
<td>Minneapolis-St Paul, MN-MN</td>
<td>96,725,956</td>
<td>95,716,829</td>
<td>-0.9%</td>
</tr>
<tr>
<td>Chicago, IL</td>
<td>653,593,983</td>
<td>639,174,707</td>
<td>-2.2%</td>
</tr>
<tr>
<td>Los Angeles-Long Beach, CA</td>
<td>68,607,549</td>
<td>68,361,182</td>
<td>-0.4%</td>
</tr>
<tr>
<td>Las Vegas-Henderson, NV</td>
<td>13,044,767</td>
<td>12,620,913</td>
<td>-3.2%</td>
</tr>
<tr>
<td>Dallas-Fort Worth-Arlington, TX</td>
<td>76,088,371</td>
<td>75,137,905</td>
<td>-1.3%</td>
</tr>
<tr>
<td>Baltimore, MD</td>
<td>111,075,576</td>
<td>108,215,571</td>
<td>-2.5%</td>
</tr>
<tr>
<td>Atlanta, GA</td>
<td>141,514,134</td>
<td>132,625,293</td>
<td>-6.9%</td>
</tr>
<tr>
<td>Phoenix-Mesa-AZ</td>
<td>209,044,065</td>
<td>246,476,496</td>
<td>17.5%</td>
</tr>
<tr>
<td>San Diego, CA</td>
<td>94,531,930</td>
<td>98,267,937</td>
<td>3.9%</td>
</tr>
<tr>
<td>St Louis-MO</td>
<td>47,250,808</td>
<td>48,920,519</td>
<td>3.6%</td>
</tr>
<tr>
<td>Cleveland, OH</td>
<td>46,044,014</td>
<td>43,907,067</td>
<td>-5.4%</td>
</tr>
<tr>
<td>Los Angeles-Long Beach, CA</td>
<td>610,495,277</td>
<td>572,785,750</td>
<td>-6%</td>
</tr>
<tr>
<td>San Jose, CA</td>
<td>44,149,344</td>
<td>41,936,656</td>
<td>-5%</td>
</tr>
<tr>
<td>Miami, FL</td>
<td>156,495,391</td>
<td>141,556,080</td>
<td>-9.9%</td>
</tr>
<tr>
<td>Washington, DC/VA/MD</td>
<td>441,232,366</td>
<td>386,838,565</td>
<td>-12.8%</td>
</tr>
<tr>
<td>Austin, TX</td>
<td>32,795,671</td>
<td>30,895,666</td>
<td>-6%</td>
</tr>
<tr>
<td>San Jose, CA</td>
<td>32,833,316</td>
<td>31,289,572</td>
<td>-5%</td>
</tr>
</tbody>
</table>

Note: Mode replacement findings of these studies employ various methodologies, depending on survey instrument used and analysis methods chosen. Different methodologies can have a notable impact on findings.

SHIFTS TO RIDESOURCING PREDOMINANTLY FROM DRIVING, PUBLIC TRANSIT, AND TAXIS

<table>
<thead>
<tr>
<th>Mode</th>
<th>Drive (%)</th>
<th>Public Transit (%)</th>
<th>Taxi (%)</th>
<th>Bike or Walk (%)</th>
<th>Would not have made trip (%)</th>
<th>Carsharing / Car Rental (%)</th>
<th>Other / Other ridesourcing (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drive (%)</td>
<td>7</td>
<td>33</td>
<td>18</td>
<td>39</td>
<td>34</td>
<td>45</td>
<td></td>
</tr>
<tr>
<td>Public Transit (%)</td>
<td>30</td>
<td>22</td>
<td>42</td>
<td>15</td>
<td>14</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Taxi (%)</td>
<td>36</td>
<td>10</td>
<td>23</td>
<td>1</td>
<td>8</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Bike or Walk (%)</td>
<td>9</td>
<td>12</td>
<td>12</td>
<td>23</td>
<td>17</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Would not have made trip (%)</td>
<td>8</td>
<td>12</td>
<td>5</td>
<td>22</td>
<td>1</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Carsharing / Car Rental (%)</td>
<td>-</td>
<td>4</td>
<td>-</td>
<td>-</td>
<td>24</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Other / Other ridesourcing (%)</td>
<td>10</td>
<td>7</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>42 (another TNC) 2 (other)</td>
<td></td>
</tr>
</tbody>
</table>

Note: Mode replacement findings of these studies employ various methodologies, depending on survey instrument used and analysis methods chosen. Different methodologies can have a notable impact on findings.
# Summary of Shared Mobility Impacts on Public Transportation

<table>
<thead>
<tr>
<th>Mode</th>
<th>Decrease/Increase</th>
<th>Public Transit Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roundtrip Carsharing (N. America)</td>
<td>Net decrease (-)</td>
<td>For every 5 members that use rail less, 4 ride it more; For every 10 members that use the bus less, 9 ride it more.</td>
</tr>
<tr>
<td>One-Way Carsharing (N. America)</td>
<td>Net decrease, although an exception in Seattle (- / +)</td>
<td>In Seattle, where a small percentage of respondents increase their use exceeding the smaller percentage of respondents decreasing their rail use. Across the other four cities, more people report a decrease in their frequency of urban rail and bus use than an increase.</td>
</tr>
<tr>
<td>P2P Carsharing (N. America)</td>
<td>Net decrease (-)</td>
<td>Those increasing and decreasing their bus and rail use were closely balanced in number, with 9% increasing bus and 10% decreasing use. Similar effects were found with rail, as 7% reported increasing rail use, while 8% reported decreasing it.</td>
</tr>
<tr>
<td>Station-Based (Docked) Bikesharing (N. America Multi-City Studies)</td>
<td>Net increases in bus/rail in small- and medium-sized cities Small net decreases in bus/rail in larger cities (+ / -)</td>
<td>- Small net increases in bus and rail use in small- and medium-size cities (e.g., Minneapolis) - Small net decreases in bus and rail use in larger cities (e.g., Mexico City)</td>
</tr>
<tr>
<td>Pooling (Casual Carpooling in Bay Area)</td>
<td>Net decrease (-)</td>
<td>Majority of casual carpoolers were public transit users. In the Bay Area, 75% were casual carpoolers.</td>
</tr>
<tr>
<td>Ridesourcing/TNCs (SF Bay Area)</td>
<td>Net decrease (-)</td>
<td>33% competition with public transit, 4% first mile and last mile (destination or origin is public transit stop)</td>
</tr>
</tbody>
</table>

**Shaheen et al., 2018**

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**Areas to Rethink**
PUBLIC OR PRIVATE? BLURRING BUSINESS MODELS

THE RELATIONSHIP BETWEEN SHARED MOBILITY & PUBLIC TRANSIT

- First-and-Last Mile Connections
- Public Transit Enhancement & Replacement
- Late-Night Transportation
- Paratransit
- Others...

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EQUITY CHALLENGES

Some common challenges ...

- **No smartphone/data access** (cannot access)
- **Un- and under-banked** households (cannot pay)
- **Low-income users** (cannot afford)
- **Low-income / minority neighborhood** (lack of service availability)
- **People with disabilities** (cannot access / lack of service availability)
UNDERSTANDING EQUITY CONSIDERATIONS

SUMMARY OF SHARED MOBILITY USER DEMOGRAPHICS

<table>
<thead>
<tr>
<th>Mode</th>
<th>Race/Ethnicity</th>
<th>Income</th>
<th>Educational Attainment</th>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roundtrip Carsharing (N. America)</td>
<td></td>
<td>21% earned &gt;$100K 23% earned &lt;$40K</td>
<td>81% had a 4-year degree or higher</td>
<td>35% ages under 30 31% Ages 30-40</td>
</tr>
<tr>
<td>One-Way Carsharing (N. America)</td>
<td>80-87% Caucasian 1-10% Hispanic/Latino 1-5% African American</td>
<td>35-56% earned &gt;$100K 7-17% earned &lt;$35K (US)</td>
<td>72-96% had a 4-year degree or higher (across 5 cities)</td>
<td>48-64% ages under 35 32-41% ages 35-54</td>
</tr>
<tr>
<td>P2P Carsharing (N. America)</td>
<td>67% Caucasian 3% Hispanic/Latino 3% African American</td>
<td>30% earned &gt;$100K 21% earned &lt;$35K (US)</td>
<td>86% had a 4-year degree or higher</td>
<td>73% ages under 35 23% ages 35-54</td>
</tr>
<tr>
<td>Station-Based (Docked) Bikesharing (N. America Multi-City Studies)</td>
<td>74-92% Caucasian 1-5% Hispanic/Latino 1-2% African American</td>
<td>29-39% earned &gt;$100K 9-26% earned &lt;$35K</td>
<td>55-89% had a 4-year degree or higher (2 studies)</td>
<td>37-54% ages under 35 36-51% ages 35-54</td>
</tr>
<tr>
<td>Ridesourcing/TNCs (SF Bay Area)</td>
<td></td>
<td>38% earned &gt;$100K 9% earned &lt;$30K</td>
<td>81% had a 4-year degree or higher</td>
<td>73% ages under 35 25% ages 35-54</td>
</tr>
<tr>
<td>Microtransit (Kansas City)</td>
<td>89% Caucasian 6% African American</td>
<td>50% earned &gt;$100K 6% earned &lt;$35K</td>
<td>100% had a 4-year degree or higher</td>
<td>55% ages under 35 39% ages 35-54</td>
</tr>
</tbody>
</table>
**STEPS TO TRANSPORTATION EQUITY FRAMEWORK**

- **SPATIAL EFFECTS**
- **TEMPORAL**
- **ECONOMIC**
- **PHYSIOLOGICAL**
- **SOCIAL**

Examples:
- Same transportation modes
- Same hours and frequency of service
- Comparable wait times

**NEIGHBORHOODS WITH SIMILAR DENSITIES AND BUILT ENVIRONMENTS SHOULD HAVE EQUAL ACCESS & EQUIVALENT LEVEL OF TRANSPORTATION SERVICES**


Shaheen et al., 2017

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RIGHTS-OF-WAY MANAGEMENT

• Context in the built environment matters
• One size does not fit all
  • Commuter
  • Mid-day trips
  • Non-work trips
  • Urban walkable
  • Urban quasi-walkable
  • Edge City
  • Suburban

Shared mobility solutions must be tailored to meet a diverse array of needs, use cases, and urban contexts
RIGHTS-OF-WAY MANAGEMENT: KEY ELEMENTS

- **Service Characteristics** (e.g., hourly rentals, membership-based services)
  - Business characteristics (e.g., for-profit, nonprofit)

- **Procedures for Allocating Rights-of-Way**
  - Jurisdiction (e.g., city staff, city council, parking authority)
  - Process (e.g., first-come, first-served; lottery, auction; request for proposals)

- **Methodology for Valuing Rights-of-Way**
  - Cost recovery of program administration
  - Foregone meter, permit, and other revenue
  - Supply and demand (e.g., auctions)
  - For profit (e.g., generate revenue for local coffers)


RIGHTS-OF-WAY MANAGEMENT: METHODS NEEDED

- Managing competition among operators (e.g., two carsharing operators seek the same on-street parking locations/space)

- Managing competition among modes (e.g., ridesourcing/TNCs, taxis, liveries, and other for-hire services)

- Dispute resolution (e.g., administration hearings/appeals, mediation, arbitration, litigation)
GUIDING PRINCIPLES: CONCLUDING THOUGHTS

- Shared mobility impacts everyone, not just users
- **Clear and consistent definitions** can help to clear confusion about modes and service models
- Public agencies should embrace **public and private collaboration**
- **Public participation** is key to involve the public and to listen to concerns when implementing shared mobility services
- Public agencies should **collect data** and consider compulsory reporting requirements
- Incorporation of shared mobility into **transportation planning is critical**
- Public agencies should ensure **social, interregional, and intergenerational equity** to meet the basic transportation needs of travelers

Shaheen et al., 2016

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GUIDING PRINCIPLES: CONCLUDING THOUGHTS

- **Tracking growth and impacts of shared mobility** is important to managing rights-of-way and developing public-private partnerships
- Providing **open data** allows public agencies the ability to offer real-time transportation information to their communities, without the cost or responsibility of developing or maintaining mobile applications
- Public agencies could establish **data exchanges** to serve as a repository for public and private sector data sets
- The public and private sector should continually develop/enhance policies that **protect user data privacy**
  - Location data are just as sensitive as financial data

Shaheen et al., 2016

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INNOVATIVE MOBILITY HIGHLIGHTS, CARSHARING OUTLOOK, AND LATEST RESEARCH

Subscribe for the latest updates (Innovative Mobility Highlights, Carsharing Outlooks, Policy Briefs, Research Highlights and more) at:
www.innovativemobility.org (bottom of home page)

RECENT RESOURCES

https://www.planning.org/publications/report/9107556/
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