Behaviour Change and Transportation Research

Andrew Duvall, PhD

Behaviour Change for Energy Efficiency: Opportunities for International Cooperation in the G20 and Beyond, Paris, 12 September 2018
How have behavioural insights shaped efficiency policy in this sector?

  - *Traveler Response Architecture using Novel Signaling for Network Efficiency in Transportation (TRANSNET)*
    - Development of smartphone mobility app using incentives/informational levers to nudge travel behaviour

  - *SMART Mobility Consortium: Mobility Decision Science (MDS) research pillar*
    - WholeTraveler behavioural survey/geolocation data collection
    - Integration of behavioural factors into leading research addressing emerging transportation technologies and trends
Results of the policy/programme

• **ARPA-E TRANSNET**
  - Metropia mobility app deployed to thousands of users in Austin and El Paso, Texas & Tucson, Arizona; plans for more cities
  - Identified individual and system level energy benefits due to changed behaviours
    - Changes to departure time, routes, vehicle passenger load, trips avoided
  - NREL developed tools to estimate fuel reduction, economic savings presented to users in real-time

• **EEMS Mobility Decision Science research**
  - Intentional effort to integrate behavioural science as part of interdisciplinary research
  - WholeTraveler project is currently in progress
  - Informing development of current and next generation travel demand models
Metropia Mobility Options and Gamification
Behavioural Economics: Breakpoint

Population-Level (Aggregate) Analysis

- $n = 444$ systematic datasets
- Model $R^2 = .99$

- $\Delta_{\text{max}} = 38.99 \text{ min}$
- Suggests 1.28 Metropia points per minute delay in departure

Likelihood of Changing Departure Time

Delay in Departure (in min) for 50 Metropia Points
## Inferring User Trip Purpose

<table>
<thead>
<tr>
<th>Activity Type</th>
<th>Number of Trips</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home</td>
<td>230,230</td>
</tr>
<tr>
<td>Work</td>
<td>65,065</td>
</tr>
<tr>
<td>School</td>
<td>24,956</td>
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<tr>
<td>Shopping</td>
<td>35,629</td>
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<tr>
<td>Maintenance</td>
<td>127,946</td>
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<tr>
<td>Entertainment</td>
<td>142,120</td>
</tr>
<tr>
<td>Drop off/pickup</td>
<td>26,112</td>
</tr>
</tbody>
</table>
Annualized Cost Savings

- Annualize costs
  - Determine average $/mile savings for a trip and multiply by average annual VMT for a driver
  - Texas average fuel cost = $2.40/gallon
  - National average annual miles driven = 13,476 miles (averaged over all age groups)

- Aggregate results for annualized fuel cost savings
  - Mean = $0.016/mi -> $215.62/year
  - Median = $0.008/mi -> $107.8/year
  - StDev = $0.10/mi -> $134.76/year
Metropia V2.0: TOTAL MOBILITY

**JOURNEY**

Multi-modal Trip Planner
Personalized trip planner for all modes. Integration with transportation systems via instant messaging portal: travel alerts, Mobility Option Discovery.

**INDUCE**

Travel Behavior Shifts
Rich data repository about individual travel behaviors and micro-targeted customer campaigns to alter travel behavior.

**TRANSACT**

Payment & Ticketing
A bank repository for ‘universal’ collection and transfer of points and agency provided rewards, gift cards and CO2 savings.
Lessons learned

- **ARPA-E TRANSNET**
  - Users are willing to shift their behaviour as a result of incentives and energy information
  - Interventions designed to nudge behaviour can result in substantial energy savings
  - Monetary-based incentives can be challenging to scale up
  - Challenges: Infrastructural and cultural inertia for automobile dependence

- **EEMS Mobility Decision Science**
  - Strong interest in behavioural science data and approaches among engineers, researchers
  - Travel demand models benefit from behavioural data
  - Challenges: Vast potential behavioural data from unconventional sources offer insights; improved methods, machine learning/AI analytical tools needed
Opportunities for international collaboration?

- **Fundamental disruption is occurring worldwide in transportation**
  - Opportunity to nudge travel behaviours toward more energy efficient options
  - Shared mobility behaviours, coupled with vehicle electrification can enable increased mobility access while reducing energy costs, especially in developing countries

- **Knowledge exchange to avoid or mitigate past mistakes**
  - As behaviours evolve due to Opportunities for countries to exchange knowledge
  - “Leapfrog” technologies such as distributed power generation/renewable energy can transform travel behaviour in rural and less developed areas
  - Several current behavioural trends in transportation first emerged in developing countries

- **Applied behavioural research in transportation is still in early stages**
  - Much is to be gained through collaborative research efforts
  - Strong possibilities to inform “leapfrog” strategies in developing countries
Further questions

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