MULTIMODAL ACCESS TO TWIN CITIES TRANSITWAYS

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MOTIVATION
Modelling how transit customers choose to travel to Twin Cities Transitways

- Data
- Choice Set
- Models
- Results
- Takeaways
Overview

• Over 31,000 records
• Conducted in-person
• Complete trip information
TRAVEL BEHAVIOUR INVENTORY 2016 TRANSIT ONBOARD SURVEY

Sample Record

Origin Location & Activity → Access Mode → Routes Prior to Surveyed Route → Boarding Location of Route Surveyed → Surveyed Route
### TRAVEL BEHAVIOUR INVENTORY 2016 TRANSIT ONBOARD SURVEY

*What choices did transitway riders have in terms of access mode?*

<table>
<thead>
<tr>
<th>Survey contains:</th>
<th>What we need to infer:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Origin location</td>
<td>• What would access to transitway boarding location using other modes look like:</td>
</tr>
<tr>
<td>• Transitway boarding location</td>
<td>• Walking</td>
</tr>
<tr>
<td>• Access mode from origin to boarding location</td>
<td>• Biking</td>
</tr>
<tr>
<td>• Trip transfer information</td>
<td>• Driving</td>
</tr>
<tr>
<td></td>
<td>• Drop Off</td>
</tr>
<tr>
<td></td>
<td>• Taxi/Transportation Network Company (TNC)</td>
</tr>
<tr>
<td></td>
<td>• Local Transit</td>
</tr>
</tbody>
</table>
CHOICE SET GENERATION USING GOOGLE DIRECTIONS API

Input origin and destination coordinates and mode, return:
- trip time
- trip distance
- unfriendly format

```json
{
  "routes": [
    {
      "bounds": {
        "northeast": {
          "lat": -33.8347115,
          "lng": 140.8547658
        },
        "southwest": {
          "lat": -57.3511758,
          "lng": 138.4951676
        }
      },
      "copyrights": "Map data ©2014 Google",
      "legs": [
        {
          "distance": {
            "text": "139 km",
            "value": 139119
          },
          "duration": {
            "text": "1 hour 51 mins",
            "value": 6648
          },
          "end_address": "Clare SA 5453, Australia"
        }
      ]
    }
  ]
}
```
Distribution of Potential Transitway Access Times by Mode as Generated Using Google Directions API
MODEL SPECIFICATION: MULTINOMIAL LOGIT

Probability of Taking Mode 1 = \( \exp( \text{Utility of Mode 1} ) \) 
\[ \text{sum of } \exp( \text{Utility of all Modes} ) \]
BASE MODEL SPECIFICATION

Utility = Intercept
+ Time Coefficient * Time Cost
+ Distance Coefficient * Distance Cost
+ Monetary Coefficient * Monetary Cost
## BASE MODEL RESULTS

<table>
<thead>
<tr>
<th></th>
<th>Base Model</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bike Constant</strong></td>
<td>-2.07</td>
<td>0</td>
</tr>
<tr>
<td><strong>Drive Constant</strong></td>
<td>-1.79</td>
<td>0</td>
</tr>
<tr>
<td><strong>Drop Off Constant</strong></td>
<td>-2.78</td>
<td>0</td>
</tr>
<tr>
<td><strong>Taxi/TNC Constant</strong></td>
<td>-4.72</td>
<td>0</td>
</tr>
<tr>
<td><strong>Walk Constant</strong></td>
<td>1.3</td>
<td>0</td>
</tr>
<tr>
<td><strong>Cost</strong></td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td><strong>Distance</strong></td>
<td>-0.372</td>
<td>0</td>
</tr>
<tr>
<td><strong>Time</strong></td>
<td>-0.0525</td>
<td>0</td>
</tr>
</tbody>
</table>

*Multimodal Access to Twin Cities Transitways | J. Nowak*
Utility = Intercept
+ Time Coefficient * Time Cost
+ Distance Coefficient * Distance Cost
+ Monetary Coefficient * Monetary Cost * Stored Value Card Indicator
+ Gender Coefficient * Gender Indicator
## INTERACTIVE TERM MODEL RESULTS

<table>
<thead>
<tr>
<th>Factor</th>
<th>Coefficients</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bike Constant</td>
<td>-1.85</td>
<td>0</td>
</tr>
<tr>
<td>Gender/Bike Constant</td>
<td>-0.853</td>
<td>0</td>
</tr>
<tr>
<td>Drive Constant</td>
<td>-1.95</td>
<td>0</td>
</tr>
<tr>
<td>Gender/Drive Constant</td>
<td>0.271</td>
<td>0.04</td>
</tr>
<tr>
<td>Drop Off Constant</td>
<td>-2.98</td>
<td>0</td>
</tr>
<tr>
<td>Gender/Drop Off Constant</td>
<td>0.34</td>
<td>0.05</td>
</tr>
<tr>
<td>Taxi/TNC Constant</td>
<td>-4.52</td>
<td>0</td>
</tr>
<tr>
<td>Walk Constant</td>
<td>1.26</td>
<td>0</td>
</tr>
<tr>
<td>Distance</td>
<td>-0.386</td>
<td>0</td>
</tr>
<tr>
<td>Stored Value Card/Cost</td>
<td>-0.0854</td>
<td>0</td>
</tr>
<tr>
<td>Time</td>
<td>-0.932</td>
<td>0</td>
</tr>
</tbody>
</table>
TAKEAWAYS

 Interpretation of Model Results

• Walking has the highest baseline utility
• Biking has a lower baseline utility than local transit and is worse for women
• Driving has a lower baseline utility than local transit but is better for women
• Use of Stored Value card to pay for surveyed transit route results in access cost being significant
TAKEAWAYS

Interpretation of Model Results

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Policy Recommendations

- Continue to prioritize walking infrastructure improvements near transit stations
- Improve biking infrastructure improvements and address gender differences
- Consider what priority driving access to transitways should take
NEXT STEPS

- Incorporation of personal characteristics
- Testing different model structures