EMPIRICAL EVIDENCE ON DETERMINANTS OF TRANSIT CUSTOMER LOYALTY, BEHAVIOR CHANGE, AND STATED PREFERENCE PREDICTION ACCURACY

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• Many large US transit agencies see high levels of ridership turnover

• Little is known about the reasons for turnover

• How do personal experiences with service quality influence transit customer loyalty?
• The San Francisco Travel Quality Study (SFTQS) was conducted in autumn 2013
  - Focused on users of the San Francisco MTA, commonly referred to as “Muni”
  - 838 participants, 2 cohorts, 6-8 weeks

• Data collected included:
  - Entry survey (October 2013)
    o Sociodemographics
    o Series of questions on how likely the participants were to continue using transit in the future
  - Multiple satisfaction surveys during the study
  - Exit survey (December 2013)
    o Series of questions on how likely the participants were to continue using transit in the future
• Directly observing shifts in behavior during study was unlikely
• Series of questions based on the Theory of Planned Behavior (TPB) and Model of Goal-Directed Behavior (MGB)

• 8 Measures:
  - Long-term intentions (for all of 2014) – 2 measures
  - Long-term desired behavior – 3 measures
  - Short-term intentions (January 2014) – 2 measures
  - Short-term desired behavior – 1 measure
• February 2015: Short follow-up survey distributed to all original study participants
  - Compared to the time during the study (October-December 2013), how much do you use Muni now?
  - If there were any shifts, what factors were influential?

• This provided us with a revealed preference data set on long-term shifts in transit use.

• 442 complete and usable responses
• 12% had stopped using Muni
  - 29 out of these 52 respondents had moved to a new home outside San Francisco

• 47% were still using Muni the same

• 10% had increased Muni use

• 32% had decreased Muni use

• 50 respondents who had moved to a new home outside San Francisco were excluded from further analyses

• Frequency of use measured in days/week (columns)

<table>
<thead>
<tr>
<th>Avg. change (SF)</th>
<th>&lt;2-3 days/week</th>
<th>2-3 days/week</th>
<th>4-5 days/week</th>
<th>6-7 days/week</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.45 days/week</td>
<td>-0.64 days/week</td>
<td>-1.62 days/week</td>
<td>-1.46 days/week</td>
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</tbody>
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Respondents rated the influence of 20 factors from “not influential” to “very influential”

Remaining 147 respondents who decreased or stopped using Muni:
• In original survey design, it was not clear which of the 8 predictors of future travel were most correlated with actual behavior

• Follow-up survey provided opportunity to evaluate predictors

• Pairwise correlation analysis between predicted and observed behavior

• Ordinal scales with many ties  
  - Nonparametric rank correlation measure: Kendall’s τ-b
### EVALUATION OF PREDICTORS OF FUTURE BEHAVIOR: RESULTS

<table>
<thead>
<tr>
<th>Measure</th>
<th>Correlation with Behavior</th>
</tr>
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<tbody>
<tr>
<td>A. Long-term intention #1</td>
<td>0.17</td>
</tr>
<tr>
<td>Long-term intention #2</td>
<td>0.101</td>
</tr>
<tr>
<td>Short-term intention #1</td>
<td>0.133</td>
</tr>
<tr>
<td>B. Short-term intention #2</td>
<td>0.251</td>
</tr>
<tr>
<td>C. Short-term preference (desire?)</td>
<td>0.226</td>
</tr>
<tr>
<td>Long-term desire #1</td>
<td>0.01</td>
</tr>
<tr>
<td>Long-term desire #2</td>
<td>0.033</td>
</tr>
<tr>
<td>Long-term desire #3</td>
<td>-0.103</td>
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Best-performing measures:

A. In 2014, do you intend to use [Muni] more or less than you do now, or the same way as you do now?”

B. Compared to how often you used Muni during the study, you anticipate using Muni in January…”

C. Compared to how often you used Muni during the study, you would prefer to use Muni in January…”
Example of a long-term desire question that did not perform well:

As soon as my circumstances permit, I would like to use public transportation more. [agree/disagree]

*Note the difference between the two “desire” formulations*
• Intention is a good predictor of future travel behavior, which is consistent with the TPB
• Long-term behavioral desire (per MGB) was not a good predictor
• Short-term preference was a good predictor, may be capturing short-term desire

• The three best-performing predictors were more correlated with each other than with the outcome
  - This may reveal something about an individual's “planning horizon”
  - It is possible that many participants did not have any concrete intentions for all of 2014, and that they therefore extrapolated from their intentions for January
• Systematic discrepancies between SP and RP have been observed before (Fujii & Gärling, 2003)

• Question: What is the effect of socioeconomic/demographic variables on prediction accuracy?

• Define two groups:
  - A: Outcome matched prediction
  - B: Outcome did not match prediction

• Specified a set of binary Logit models

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<tbody>
<tr>
<td>Reduction in Muni use</td>
<td>58-59%</td>
<td>35-39%</td>
<td>6-11%</td>
</tr>
<tr>
<td>Muni use will remain the same</td>
<td>33-37%</td>
<td>63-67%</td>
<td>6-8%</td>
</tr>
<tr>
<td>Increase in Muni use</td>
<td>30-40%</td>
<td>44-55%</td>
<td>18-26%</td>
</tr>
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</table>
• Results are most consistent for group that predicted stable Muni use

• Predictions more accurate for participants who:
  - Were older
  - Used Muni more frequently before the study (effect of habit?)
  - Lived in larger households

• Predictions less accurate for participants:
  - With a driver's license
  - With access to a car in the household

• Participants with auto access could increase their number of car trips without buying a vehicle. All else being equal, this was easier in smaller households where fewer people shared the cars.
For group that predicted decreased Muni use, the final models contain different variables than on previous slide
  - Different driving factors

Consistent results for two out of the three models

Predictions more accurate for participants who:
  - Were students

Predictions less accurate for participants who:
  - Lived in a zero-car household
  - Had no driver’s license
  - Used a car frequently before the study

Do frequent car users already have a specific “use case” for transit?
For group that predicted increased Muni use, no good models could be found, due to:

- Small sample sizes
- A lot of intra-group variation
• Shifts in transit use could not be observed over 6-8 weeks, but were clearly observable over a year
  - Importance of reliability

• The group that had reduced its Muni use (on average by 2-3 days/week) outnumbered the group that had stopped using Muni
  - Cessation of transit use is often a gradual process
  - More difficult to detect this effect with surveys that classify participants as transit users or non-transit users

• “Negative experiences while using Muni” was one of the most frequently named reasons
  - Consistent with the concept of “negative critical incidents", as described by Friman et al. (2001)
• The questions that had the highest correlation with the outcome explicitly stated a time frame
  - e.g., the following year or month.

• Two out of three variables that were highly correlated with observed behavior related to behavioral intention, underscoring the usefulness of the Theory of Planned Behavior

• Systematic effects of socioeconomic/demographic variables on accuracy of some predictions
  - Whether a prediction of “no change” is correct is affected by different variables than whether a prediction of “decreased use” is correct
  - If population characteristics are skewed in some way, be mindful of this
Thank You!

Questions, Comments?

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