Passengers' Perception of and Behavioral Adaptation to Unreliability in Public Transportation

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Introduction and Motivation

What is Reliability?
- Commonly associated with travel time variability, but other considerations as well such as schedule adherence, arrival punctuality, probability of finding a seat, or the chance of mechanical problems.
- More comprehensive view of reliability involves repeatability and predictability, and adherence to some "base line.
- Unreliability is dependent on what a passenger perceives as normal; unreliability may be predictable!

How Does Reliability Affect Ridership?
- Previous surveys have been done on the importance of reliability aspects
  - Had no behavioral component (link to ridership)
- Current behavioral models are based on travel time distributions
  - Assume travelers understand statistics
  - Assume rational decisions
  - But are passengers truly knowledgeable?
- Our approach: Exploratory survey to investigate passengers’ long-term adaptation to transit unreliability
  - Learn what strategies passengers use to deal with unreliability
  - Understand influence of prior experiences with unreliability on adaptation strategies
  - Determine if there is a link between previous experiences and people’s perceptions of reliability
  - Try to show that passengers care about more than just the bus arrives: type of delay and when it occurs are also important

Research Approach

- An online survey was distributed to current and former users of the San Francisco Municipal Transit Authority (MUNI)
- Two surveys were created for current MUNI users and for ex-MUNI users. They contained the following parts:
  - Frequency of use and knowledge of the system
  - Identification of a common trip
  - Experiences with each of 26 types of unreliability incidents
  - Users were asked the last time they encountered incident (e.g., for frequency) on how they perceived the impact of the incident on their journey.
- 123 complete responses from users and 15 from non-users were received.

Survey Results

- Socio-demographics: Because the sample population was affiliated with UCSF, it does not entirely mirror San Francisco’s population: they were younger, more educated, and more female. However, many answered that they did have other means of transportation available to them (e.g., bikes, cars, or car sharing memberships).

- Importance of Reliability: Passengers were asked to describe how important several measures of unreliability were for a chosen trip. For both work and non-work trips:
  - Most Important= frequent, consistent service (e.g., can make connection, can walk up to stop without leaving within 10 min)
  - Least Important= comfort (e.g., crowding, ability to find a seat)

- Experiences of Unreliability: Incidents were reported as being seen less than once per month on average to almost never (on a scale of ‘100’ points, where 0 is ‘never’). The full rankings, controlled for frequency of use, can be seen in table 1 above.

- Behavioral Adaptation: Over 95% of respondents reported either having a “strategy” for dealing with unreliability or having reduced their use of the service, and 62% repeat an adaptation. Some of these strategies are described by figures 1 and 2, above.

- Trip Planning: Respondents were very likely to know how long their trip would take (95%) and where they should depart (98%). The use of real-time information was also common: 83% refer to it rather than a schedule and 57% check it before going to a stop.

- Non-User Results: Unreliable service and service cuts were both given as reasons for leaving MUNI by a large proportion of the group (50% and 40%, respectively). They also tended to be different demographically than users, being older, more likely to live outside SF, and more likely to have children, so lifestyle changes may also play a part in their mode shifts.

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<table>
<thead>
<tr>
<th>Unreliability Incident</th>
<th>Frequency of Use</th>
<th>Knowledge of System</th>
<th>Identification of a Common Trip</th>
<th>Experiences of Unreliability</th>
<th>Behavioral Adaptation</th>
<th>Trip Planning</th>
<th>Non-User Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>False</td>
<td>0.06</td>
<td>0.89</td>
<td>0.06</td>
<td>0.89</td>
<td>0.06</td>
<td>0.89</td>
<td>0.06</td>
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</table>

Table 1: Frequency of Unreliability Incidents

<table>
<thead>
<tr>
<th>Mode Access</th>
<th>Frequency of Use</th>
<th>Knowledge of System</th>
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Mode Access: 
1. Live in a neighborhood close to UCSF 0.39 0.4
2. Have a phone with a data plan 1.24 0.01
3. Live outside SF, and more likely to have children, so lifestyle changes may also play a part in their mode shifts.

Survey Results: 
- Socio-demographics: Because the sample population was affiliated with UCSF, it does not entirely mirror San Francisco’s population: they were younger, more educated, and more female. However, many answered that they did have other means of transportation available to them (e.g., bikes, cars, or car sharing memberships).

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Logit Model and Results

- Ordinal Logit Model used to find relationship between unreliability experiences and decrease in MUNI use:
  - Dependent Statement: “I make fewer trips on MUNI due to unreliability and use other modes instead.”
  - Explanatory Variables: frequency of negative events, socio-demographics

- Full results are in table 2, the left. Some key findings:
  - Socio-demographics are insignificant, as are auto and bike access.
  - Living close to work and owning a smartphone with data plan (so easier access to real-time info) are significant.
  - The incidents that are most significant can be perceived as the agency’s fault (e.g., delay from backed up transit vehicles)
  - Where a delay occurs seems to matter: on board delays considered worse than these at a stop, and transfer delays more important than delays at access points
  - Wrong real-time information only important when it occurred more than once per week

Recommendations

- For Operations control:
  - May be preferable to cancel trips or hold empty vehicles rather than hold full buses
  - Communication is key, especially when delays are not agency’s fault.

- For Operations planning:
  - Be aware of the importance of wait time at transfers vs. origin stops, planners should attempt to minimize transfer wait times (‘guaranteed connections’ or vehicles to fill gaps)
  - Crowding seems ok, but not being left behind
  - Passengers seem to prefer small, high-frequency vehicles over larger, low-frequency vehicles, even if they may encounter some crowding.

- Use of real-time information: instead of timetable
  - Line between schedule delays and delays due to unreliability is blurring for riders.

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