Welcome to the CTS Fall Luncheon
Monday, December 8, 2014

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Will Rising Trip Productivity Change Travel Choices? Evidence from Northern California Commuters

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CTS Fall Luncheon
December 8, 2014
Outline

1. Study motivation
2. Data collection
3. Sample description
4. Survey design
5. Multitasking variables in the model
6. Mode choice model
7. Multitasking scenario testing
8. Future research and conclusions
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Study motivation

• Multitasking:
  ▫ Hallmark of modern life
  ▫ Mixed blessing

• Travel:
  ▫ Considered a "disutility" to be minimized
  ▫ Assume there's a strong tendency to choose the fastest means

Among the many types of multitasking, we are interested in what people do while traveling.

Circella et al., 2012

We are all in a state of continuous partial attention’

With respect to travel multitasking...

- We’re not *just* interested in safety (distracted driving)
WHAT IF YOUR BEAUTY SECRET WAS SITTING IN TRAFFIC?
VITAMIN-C AIR CONDITIONER
Rather (in addition), we’re interested in questions such as...

- Why do people (travel) multitask?
  - Decrease the burden of disliked travel/activity
  - Increase the pleasure of liked travel/activity
  - Increase productivity
  - Decrease time pressure
  - Decrease (or increase) stress
  - Reinforce self-identity
  - For its own sake

- ... and how do those diverse benefits interact with choices of activity, mode, etc.?
How does multitasking affect travel (and location) behavior?

• The desire to minimize travel time is a bedrock presumption underlying most transportation planning, policies, and models
  ▫ We assume people trade off time and money, and are willing to pay to reduce their travel time
  ▫ Monetization of travel time savings is \textit{by far} the largest component of “benefit” in standard cost-benefit analyses of proposed improvements

• But what if travel multitasking alters those calculations?
Does travel multitasking ... 

... make people less inclined to reduce their commuting distance?

- May be bad for sustainability – contribute to sprawl, resource consumption
- May improve quality of life – increase job, housing choices
Does travel multitasking ... 

- ... make people less inclined to reduce their commuting distance?
- ... offer a competitive advantage to transit?
  - Some may prefer a longer transit commute to a shorter driving one, if they can use the time productively
-- at least for now??
Does travel multitasking ...

- ... make people less inclined to reduce their commuting distance?
  - May be bad for sustainability – contribute to sprawl, resource consumption
  - May improve quality of life – increase job, housing choices
- ... offer a competitive advantage to transit?
  - Some may prefer a longer transit commute to a shorter driving one, if they can use the time productively
- ... reduce the inclination to pay for travel time savings?
  - Could wreak havoc with conventional cost-benefit analyses
Questions addressed by the present study

• Do multitasking propensities and activities conducted while traveling have a measurable impact on mode choice?

• If so, can we quantify the contribution of multitasking to the adoption of a given mode?
Data collection

Mode-specific:
* SacRT
* Capital Corridor (Amtrak)
* BART
* Yolobus
* UCD & Bay Area carpoolers

Organization-specific:
* Google
* Commuter Club
* UC Davis staff, students

Email blast:
* Infogroup

Mail blast:
* Random addresses along the Amtrak corridor

Online panel:
* Survey Analytics

3 weeks of paper survey distribution (~3,000)
+ 3 months of online surveys (~30 varieties)
+ 6 months of data entry, filtering and conditioning
Sample description (N=2149)

Primary commute mode

- 38% Driving alone
- 30% Transit *
- 16% Shared ride
- 8% Bicycle
- 8% Rail**

* Bus, light rail, and metro rail (BART)
** Commuter rail (Amtrak & Caltrain)

Paper surveys = 22%
Females = 61% (N=2135)
Average car ownership = 2.07
Average HH size = 2.67 (N=2142)
Survey contents

A. Attitudes and personality
B. Multitasking attitudes ("polychronicity")
C. Time use expectations and preferences
D. Attitudes toward waiting
E. Perceptions of four commute modes
F. A recent commute trip (primary commute mode, and activities conducted during the commute)
G. “Internet Access On-the-Go”
H. Daily commute
I. Sociodemographic traits

→ more than 800 original variables
Multitasking-related explanatory variables

- General propensity (Part B)
- Mode-specific perception (Part E)
- Engagement in various multitasking activities for work or leisure (Part F)
## Mode choice model (1)
- Objective mode attributes

<table>
<thead>
<tr>
<th>Variable</th>
<th>Bicycle</th>
<th>Rail</th>
<th>Transit</th>
<th>Shared ride</th>
<th>Driving alone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Headway, ( min )</td>
<td></td>
<td></td>
<td></td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>Total travel time, ( min )</td>
<td></td>
<td></td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Monthly commuting cost, $</td>
<td></td>
<td></td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
</tbody>
</table>

Significance: --- < 1%
## Mode choice model \(^{(2)}\)
- Mode perceptions (generic variables)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Bicycle</th>
<th>Rail</th>
<th>Transit</th>
<th>Shared ride</th>
<th>Driving alone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Convenience</td>
<td>++ + +</td>
<td></td>
<td>++ + +</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Benefit/cost</td>
<td></td>
<td></td>
<td>++ + +</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comfort</td>
<td></td>
<td></td>
<td>++ + +</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ability to multitask</td>
<td></td>
<td></td>
<td>++ + +</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Significance: +++ < 1\%
## Mode choice model (3)
- Socioeconomic characteristics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Bicycle</th>
<th>Rail</th>
<th>Transit</th>
<th>Shared ride</th>
<th>Driving alone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Driver’s license</td>
<td></td>
<td></td>
<td>***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td></td>
<td></td>
<td></td>
<td>***</td>
<td>***</td>
</tr>
<tr>
<td>Presence of children</td>
<td></td>
<td></td>
<td>***</td>
<td>***</td>
<td></td>
</tr>
<tr>
<td>Income, $</td>
<td>***</td>
<td>***</td>
<td></td>
<td>***</td>
<td>***</td>
</tr>
</tbody>
</table>

**Significance:**

- *** < 1%
- ** < 5%
Mode choice model (4)
- General attitudes

<table>
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<th>Transit</th>
<th>Shared ride</th>
<th>Driving alone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pro-active modes</td>
<td>+++</td>
<td>-</td>
<td>**</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Necessity of travel</td>
<td>-</td>
<td>**</td>
<td>**</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Pro-transit</td>
<td>+++</td>
<td>+++</td>
<td>**</td>
<td>**</td>
<td></td>
</tr>
<tr>
<td>Polychronicity</td>
<td>**</td>
<td></td>
<td>**</td>
<td>++</td>
<td></td>
</tr>
</tbody>
</table>

Significance: *** < 1%  ** < 5%
### Mode choice model (5)
- Propensity to travel multitask & Const’s

<table>
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<th>Transit</th>
<th>Shared ride</th>
<th>Driving alone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Propensity to use laptop/ tablet/ netbook</td>
<td>++ + + +</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Constant                  | --- | +++ | --- | base |

Significance: *** < 1%
Scenario testing: Transit advantage

*Percentage point* change in mode shares given laptop propensity assumptions of *universal unavailability* (= 0 for all modes, people) and *rail saturation* (= 1 for rail)

<table>
<thead>
<tr>
<th></th>
<th>Bicycle</th>
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<th>Shared ride</th>
<th>Driving alone</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Universal unavailability, % pts.</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline mode shares (weighted sample)</td>
<td>1.5%</td>
<td>0.7%</td>
<td>8.2%</td>
<td>12.5%</td>
<td>77.1%</td>
</tr>
<tr>
<td><strong>Rail saturation, % pts.</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
### Scenario testing: Driverless cars

*Percentage point* change in mode shares given laptop propensity assumptions of *equality of drive alone & shared ride to rail* and *drive alone & shared ride saturation* (laptop propensity = 1 for car & carpool).

<table>
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<tr>
<td>Equality of driving-alone &amp; shared ride and rail, % pts.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Driving alone &amp; shared ride saturation, % pts.</td>
<td></td>
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Future refinements to this model

• Incorporate more “propensity to use/do” variables (e.g. for smartphone, writing [electronic, paper], reading, etc.)

• Examine other scenario specifications

• Allow impacts of key variables to differ by alternative

• Examine time and cost tradeoffs with respect to multitasking behaviors

• Split shared ride mode to distinguish drivers from passengers

• Test for IIA consistency and develop more general functional forms if needed (NL, CNL, heteroscedastic EV, MNP)
Future research

**Same data**
- Identify and analyze groups of people with similar polychronicity profiles
- Explore the role of population heterogeneity (with respect to multitasking propensity and behavior) in mode choice
- Develop structural equations models reflecting multiple directions of causality

**New data**
- Undertake international comparisons

**Ultimately**
- Use information from this dataset to inform scenario-testing at a regional scale, with demand forecasting models that are already in use
Summary and closing thoughts (1)

• Travel multitasking has a
  ▫ statistically *significant*
  ▫ and (in our view) *non-trivial* in practical terms
  ▫ albeit *modest*

impact on mode choice

• To our knowledge, this is the first time that has been empirically demonstrated with revealed preference (actual choice) data
Each of our three types of multitasking variables was significant in a model of mode choice:

1. The *perception of multitasking conduciveness* of a given mode significantly increased the utility of that mode

2. Ironically, one’s generic MTing *propensity* (polychronicity) may not have a strong (net) influence on mode choice
   - Direct influence only on the shared ride mode
   - Indirect influence on transit, through its influence on propensity to use laptop
3. Propensity to MT (specifically through laptop usage) appears to account for a non-negligible slice of rail and carpool mode share

- For this sample,
  - rail share would be \(0.08\) p.p. (11%) lower,
  - carpool share would be \(0.83\) p.p. (7%) lower,
  - and drive alone share would be \(0.85\) p.p. (1%) higher, if laptop usage not possible

- Marketing levers for transit operators:
  - Appeal to the pro-technology, organized, polychronic individual who wants to work during the commute
  - I.e. those who have a higher propensity to use the laptop
  - And therefore a higher probability of choosing transit
Summary and closing thoughts (4)

- Rail/transit’s competitive advantage may be short-lived, as driverless cars become a reality (scenarios suggest a 1-3 p.p. increase in drive-alone share under those circumstances)

- However, this approach offers a way to predict likely effects on mode choice (& later, trip generation) of the ability to use travel time productively

- More research is needed regarding population heterogeneity and other issues
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Selected references


