The Impact of Activities while Traveling on the Subjective Valuation of Travel Time

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Northwestern University Transportation Center
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Personal travel decision inputs and outcomes

motivation

Abou-Zeid et al. (2012); de Vos et al. (2013); Ettema et al. (2011); Frei et al. (in press); Mokhtarian et al. (in press); etc.
Personal travel decision inputs and outcomes

motivation

travel choice:
- generation
- destination
- mode etc.

content of travel event:
- weather
- unusual events
- companions
- activities
  etc.

outcomes:
- motivation fulfillment
  - side
  - (dis)benefits
  - pros
  - cons
  - got work done
  - spent time with loved ones
  - got sick
  - got tired
  - got mugged

remembered utility:
- liking
- well-being
- happiness
- pleasantness
- fatigue, stress
- satisfaction
- valuation of travel time

Abou-Zeid et al. (2012); de Vos et al. (2013); Ettema et al. (2011); Frei et al. (in press); Mokhtarian et al. (in press); etc.
Satisfaction with Travel Scale

Cognitive component:
- worst – best
- low – high standard
- worked well – poorly

Ettema et al. (2011)
## Sources of travel utility

<table>
<thead>
<tr>
<th>Source →</th>
<th>1. Reaching desired destination</th>
<th>2. Activities conducted while traveling</th>
<th>3. Travel itself</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Nature</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Motivation</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Side (dis) benefit</strong></td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

Mokhtarian & Salomon (2001); Ory & Mokhtarian (2005); Russell & Mokhtarian (2015); Mokhtarian et al. (*Tr. Rev.*, in press)
Family life is busy, and time with your kids is never enough. Car time can be a great chance to chat, heart to heart, about some of the things your children face. Like pressure to try cigarettes.

Talking it through often can help kids resist the pressure they face. Grab the moment while you can. They’ll be out on their own all too soon.
# Sources of travel utility

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</thead>
<tbody>
<tr>
<td>↓Nature</td>
<td>![Motivation](common: “derived demand”)</td>
<td>![unusual but happens:](ride around Beltway to listen to new CD, fly bus. class purely for business devel’mnt opportunities, shopping flights; gambling cruises, opportunity to talk with significant other or children)</td>
<td>![Side (dis) benefit](walk for exercise/social; stop for ice cream, joyride &amp; see interesting place to stop)</td>
</tr>
</tbody>
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Mokhtarian & Salomon (2001); Ory & Mokhtarian (2005); Russell & Mokhtarian (2015); Mokhtarian et al. (Tr. Rev., in press)
## Sources of travel utility

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</thead>
<tbody>
<tr>
<td>Motivation</td>
<td><em>common: derived demand</em></td>
<td><em>unusual but happens:</em></td>
<td><em>common:</em> a key interest of the present study</td>
</tr>
<tr>
<td>Nature</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Motivation</strong></td>
<td>ride around Beltway to listen to new CD</td>
<td>curiosity</td>
<td>buffer</td>
</tr>
<tr>
<td></td>
<td>fly bus. class purely for business deve’mt opportunities</td>
<td>adventure-seeking</td>
<td>escape</td>
</tr>
<tr>
<td></td>
<td>shopping flights; gambling cruises</td>
<td>variety-seeking</td>
<td>exposure to environment</td>
</tr>
<tr>
<td></td>
<td>opportunity to talk with significant other or children</td>
<td>independence</td>
<td>scenery, other amenities</td>
</tr>
<tr>
<td><strong>Side (dis) benefit</strong></td>
<td>walk for exercise/social; stop for ice cream</td>
<td>control</td>
<td>synergy</td>
</tr>
<tr>
<td></td>
<td>joyride &amp; see interesting place to stop</td>
<td>conquest</td>
<td>physical exercise</td>
</tr>
<tr>
<td></td>
<td></td>
<td>status</td>
<td>“need for speed”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>therapy (mental/physical)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>outcomes of (un)pleasant “random” events while traveling</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>inherent properties of modes/routes etc. (comfort, safety, …)</td>
</tr>
</tbody>
</table>

Mokhtarian & Salomon (2001); Ory & Mokhtarian (2005); Russell & Mokhtarian (2015); Mokhtarian et al. (*Tr. Rev.*, in press)
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
- Among the many types of multitasking, we are interested in what people do while traveling

We are all in a state of continuous partial attention – Linda Stone (1998)

http://www.cartoonaday.com/thanksgiving-table-family-texting/
With respect to travel multitasking...

- We’re not just interested in safety (distracted driving)
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 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
Currently active analyses

- How the *anticipated* (dis)benefits of travel-based MTing influence travel choices
  *(companion study of mode choice)*

- How *actual* travel-based MTing behavior influences the “remembered utility” (subjective valuation) of travel *(this study)*

Berliner et al. (2015); Malokin et al. (2015)
**Outcomes**

- **motivation**
- **fulfillment**
- Side
  - **(dis)benefits**
  - **pros**
    - got work done
    - spent time with loved ones
  - **cons**
    - got sick
    - got tired
    - got mugged

**Travel choice**

- ( anticipatory )

**Content of travel event**

- **activities**, etc.

**remembered utility**

- valuation of travel time
Questions addressed by the present study

• Do multitasking propensities and activities conducted while traveling have an impact on the perceived usefulness of time spent traveling?

• How do these influences differ by travel mode?
  ▫ We distinguish between passive-* and active-attention** modes

  * transit, commuter rail (train), ridesharing
  ** driving, biking and walking
Empirical context

- Designed (lengthy!) survey
- Administered to Northern California commuters in fall/winter 2011-2012
- Multiple sampling strategies used
.Data collection

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

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

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

Email blast:
* Infogroup

Mail blast:
* Random addresses along the Amtrak corridor

Online panel:
* Survey Analytics

Neufeld & Mokhtarian (2012)
Sample description (N=2644)

Highly educated

High income

Female = 60%

Average age = 45

Deliberately
- oversampled bicyclists and transit / commuter rail passengers
- undersampled drivers
Survey contents

A. Attitudes and personality
B. Multitasking attitudes
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)
   F5: In terms of its value to you, how would you rate the time you spent on this recent commute?
   mostly wasted time ★★★★★ mostly useful time
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)

- Engagement in various activities for work or leisure/personal purposes on the commute (Part F)
# Activities conducted while commuting (by primary commute mode; N=2586)

<table>
<thead>
<tr>
<th>Activity</th>
<th>Car driver</th>
<th>Car passenger</th>
<th>Transit</th>
<th>Train</th>
<th>Bicycle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ate/drank</td>
<td>50%</td>
<td>41%</td>
<td>16%</td>
<td>68%</td>
<td>15%</td>
</tr>
<tr>
<td>Slept/rested</td>
<td>2%</td>
<td>27%</td>
<td>40%</td>
<td>57%</td>
<td>1%</td>
</tr>
<tr>
<td>Conducted personal care</td>
<td>6%</td>
<td>6%</td>
<td>6%</td>
<td>13%</td>
<td>0%</td>
</tr>
<tr>
<td>Viewed scenery or &quot;people-watched&quot;</td>
<td>44%</td>
<td>63%</td>
<td>74%</td>
<td>75%</td>
<td>82%</td>
</tr>
<tr>
<td>Exercised</td>
<td>1%</td>
<td>2%</td>
<td>7%</td>
<td>9%</td>
<td>96%</td>
</tr>
<tr>
<td>Daydreamed</td>
<td>43%</td>
<td>47%</td>
<td>58%</td>
<td>49%</td>
<td>76%</td>
</tr>
</tbody>
</table>
Activities conducted while commuting (by primary commute mode; N=2586)

- Ate/drank
- Slept/rested
- Conducted personal care
- Viewed scenery or "people-watched"
- Exercised
- Daydreamed

Bar chart showing activities conducted while commuting by primary mode of transportation: Car driver (1151), Car passenger (208), Transit (308), Train (672), Bicycle (247).
Activities conducted while commuting (by primary commute mode; N=2586)
# Activities conducted while commuting (by primary commute mode; N=2586)

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<th>Car passenger</th>
<th>Transit</th>
<th>Train</th>
<th>Bicycle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Listened to music/audio</td>
<td>95%</td>
<td>74%</td>
<td>42%</td>
<td>53%</td>
<td>28%</td>
</tr>
<tr>
<td>Talked on the phone</td>
<td>31%</td>
<td>24%</td>
<td>30%</td>
<td>48%</td>
<td>12%</td>
</tr>
<tr>
<td>Used a smartphone</td>
<td>28%</td>
<td>38%</td>
<td>44%</td>
<td>58%</td>
<td>14%</td>
</tr>
<tr>
<td>Used a laptop, netbook, or tablet computer</td>
<td>~0%</td>
<td>18%</td>
<td>10%</td>
<td>39%</td>
<td>1%</td>
</tr>
<tr>
<td>Thought/planned (e.g., about the day, a meeting, etc.)</td>
<td>73%</td>
<td>70%</td>
<td>66%</td>
<td>70%</td>
<td>80%</td>
</tr>
<tr>
<td>Read (paper)</td>
<td>4%</td>
<td>14%</td>
<td>48%</td>
<td>57%</td>
<td>2%</td>
</tr>
</tbody>
</table>
Activities conducted while commuting (by primary commute mode; N=2586)
Activities conducted while commuting (by primary commute mode; N=2586)
Factor analysis of activities conducted on a recent commute

- 23 different activities
- Factor analysis revealed 5 factors:
  1. **Technological** – usage of smartphone and associated activities
  2. **Recreational** – solitary relaxing activities
  3. **Productive** – using a laptop for writing and reading electronic documents
  4. **Traditional** – activities that don’t involve digital technology
  5. **Maintenance** – activities associated with personal maintenance

Results were used to inform creation of dummy variables for conducting any one or more of an empirically-related cluster of activities.
Factor analysis of attitudinal traits and lifestyles

- 39 attitudinal items, 9 factor scores:
  1. Pro-transit
  2. Necessity of travel
  3. Pro-technology
  4. Commuting advantage
  5. Time pressure (reality)
  6. Time pressure (preference)
  7. Pro-active (non-motorized) modes
  8. Personal satisfaction (with life, job)
  9. Pro-density

- Similarly, other factor scores were computed for lifestyles and personality traits in the dataset
Dependent variable: SVTT

- “In terms of its value to you, how would you rate the time you spent on this recent commute?” Susilo et al. (2012)
- Only 20% saw it as wasted
- Nearly half saw it as useful
- Not necessarily the preferred way of spending time, but people can make good use of the time they must spend
- May be less inclined to reduce travel time

N = 2571
SVTT by primary commute mode

- Car driver (1146)
- Car passenger (213)
- Transit (308)
- Train (660)
- Bicycle (244)
SVTT by passive-a vs. active-a mode
Model estimation

- **Ordinal probit** models of subjective valuation
  - Distinguishing between **passive-attention** and **active-attention** modes

### PASSIVE-A
- Car/vanpool passenger
- Express bus
- Local bus
- BART
- Commuter rail
- Taxi
- Ferry

### ACTIVE-A
- Motorcycle driver
- Motorcycle passenger
- Car driver
- Bicycle
- Walk
Subjective valuation of travel time (ordered probit) (1)

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>PASSIVE-A MODES</th>
<th>ACTIVE-A MODES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal Traits</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Professional/technical occupation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distance (miles) to work</td>
<td></td>
<td></td>
</tr>
<tr>
<td>General Attitudes/Personality</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Commute is a welcome transition between home and work</td>
<td>0.246***</td>
<td>0.310***</td>
</tr>
<tr>
<td>Pro-technology (a)</td>
<td>0.145***</td>
<td>-0.106***</td>
</tr>
<tr>
<td>Pro-transit (a)</td>
<td>0.102***</td>
<td>0.071**</td>
</tr>
<tr>
<td>General life satisfaction (a)</td>
<td>0.066**</td>
<td></td>
</tr>
<tr>
<td>Pro-density (a)</td>
<td>0.073**</td>
<td>0.071**</td>
</tr>
<tr>
<td>Pro-active (non-motorized) transportation modes (a)</td>
<td>0.112***</td>
<td>0.071**</td>
</tr>
<tr>
<td>Explorer (a)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extrovert (a)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*(a) Factor scores from Section A of the survey*
Subjective valuation of travel time (ordered probit) (2)

<table>
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<tr>
<th>VARIABLES</th>
<th>PASSIVE-A MODES</th>
<th>ACTIVE-A MODES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Attitudes toward Time Use</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perception of excessive time spent for leisure/social activities(^{(a)})</td>
<td></td>
<td>0.124***</td>
</tr>
<tr>
<td>Perception of excessive time spent working(^{(a)})</td>
<td></td>
<td>-0.125***</td>
</tr>
<tr>
<td><strong>Expected to work during commute</strong></td>
<td>0.179***</td>
<td></td>
</tr>
<tr>
<td><strong>Likes to work during commute</strong></td>
<td></td>
<td>-0.080**</td>
</tr>
<tr>
<td><strong>Attitudes toward Waiting and Multitasking</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unexpected wait time is unpleasant/wasted time (^{(b)})</td>
<td>-0.189***</td>
<td>-0.189***</td>
</tr>
<tr>
<td><strong>Waiting is a useful transition</strong> (^{(b)})</td>
<td>0.192***</td>
<td>0.136***</td>
</tr>
<tr>
<td><strong>Enjoys multitasking</strong> (^{(c)})</td>
<td>0.090***</td>
<td>0.113***</td>
</tr>
</tbody>
</table>

\(^{(a)}\) Factor scores from Section C.3 of the survey
\(^{(b)}\) Factor scores from Section D of the survey
\(^{(c)}\) Factor score from Section B.2 of the survey
Subjective valuation of travel time (ordered probit) (3)

<table>
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<tr>
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<th>ACTIVE-A MODES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coeff.</td>
<td>Coeff.</td>
</tr>
<tr>
<td>Activities while Commuting</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Traditional (paper) productivity</em> (a)</td>
<td>0.195***</td>
<td>0.189***</td>
</tr>
<tr>
<td><em>Electronic productivity</em> (b)</td>
<td>0.236***</td>
<td>-0.236***</td>
</tr>
<tr>
<td><em>Eat/drink</em></td>
<td>0.327***</td>
<td>0.259***</td>
</tr>
<tr>
<td><em>Relax</em> (c)</td>
<td>-0.236***</td>
<td>0.259***</td>
</tr>
<tr>
<td><em>Sleep/rest</em></td>
<td>0.573***</td>
<td></td>
</tr>
</tbody>
</table>

| Sample Size and Goodness of Fit | | |
| Sample size (N) | 1163 | 1426 |
| Pseudo-$R^2$ | 0.121 | 0.103 |
| LL (final) | -1453.270 | -1941.097 |

(a) DV for doing any of the following activities while commuting: playing non-electronic game, reading (paper), writing (paper)
(b) DV for using a laptop, using an e-reader, playing an electronic game, writing (electronic)
(c) DV for viewing scenery, daydreaming, exercising, watching a movie (leisure), non-electronic game (leisure)
Conclusions

- Most people don’t see commute time as wasted
- Importance of influential factors differs between passive-attention and active-attention modes
- Activities conducted while traveling DO affect the perceived usefulness of travel time
- In particular, some activities (e.g. working on a laptop or reading) significantly increase the perceived usefulness of travel time on passive-attention modes
- Caveat: results are conditional on chosen mode
- Companion study is developing a mode choice model
Future research

With this dependent variable:

- Explore *taste heterogeneity*, e.g. segment based on gender, income, occupation, perceived (dis)benefits of commute multitasking

With the same data set:

- Evaluate impact of multitasking on *VOTTS*
- Use mode choice model to inform assessments of *impacts of autonomous vehicles*
- Enrich our understanding of *types of polychronicity*

Additional data collection:

- Conduct an *international comparison*
Acknowledgements

Graduate students:
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University of California Transportation Center

UC Davis Sustainable Transportation Center

Georgia Institute of Technology
School of Civil and Environmental Engineering

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Selected references (2)