Rerouting Mode Choice Models: How Including Realistic Route Options Can Help Us Understand Decisions to Walk or Bike

Joseph Paul Broach
Portland State University, joebroach@gmail.com

Let us know how access to this document benefits you.
Follow this and additional works at: http://pdxscholar.library.pdx.edu/trec_seminar
Part of the Transportation Commons, Urban Studies Commons, and the Urban Studies and Planning Commons

Recommended Citation
http://pdxscholar.library.pdx.edu/trec_seminar/37

This Book is brought to you for free and open access. It has been accepted for inclusion in TREC Friday Seminar Series by an authorized administrator of PDXScholar. For more information, please contact pdxscholar@pdx.edu.
Rerouting Mode Choice Models: How Including Realistic Route Options Can Help Us Understand Decisions to Walk or Bike

Joseph Broach, PhD, Research Associate
Urban Studies and Planning
Transportation Research and Education Center (TREC)
Portland State University
Friday Transportation Seminar - April 1, 2016
Motivation

1. Understand behavior
2. Inform policy
3. Improve prediction
The story so far

2007-2012
Revealed Preference
Bike Route Choice
Bike GPS Study

2010-2013
Revealed Preference
Walk Route Choice
Family Activity Study

2014
Transferability of
Bike Route Choice
Preferences

2015-2016
Revealed Preference
Mode Choice
The conceit

1. Given trip from A to B

2. Routes that *would* be taken are considered for each mode

3. Attributes along those routes affect mode choice
The plot

**Given:**
Trip from Origin to Destination

**Predict:**
Highest Utility “Best” Walk and Bike Routes

**Estimate:**
Maximum Likelihood Mode Choice Utility Function
The setting

Only trips starting and ending within the City of Portland

Rich GIS data from Metro & City
- walk/bike network
- facilities
- land-use
- terrain
Adult participants in the Family Activity Study (2010-2013)

Compared with block group and typical Portland household with children...

- more educated 60% college
- less diverse 85% white
- more women 62% female
- more owners 81% own home
- similar income $50-75k
- more cars 1.7 cars
- more biking 11% trips
- more driving 75% trips

How does your family get around?
We would like to know!

Dear Portland Resident,
We need your help on an important study that is trying to better understand how, why, and where families with children walk and bicycle and how physically active they are. The results of the study will help Portland and other cities create better neighborhoods.

We are asking families in a handful of neighborhoods, including yours, to participate. For the study to succeed, we need all types of families to participate, even if you do not bicycle or walk very often. Participating families will complete a survey and collect data for five days, once this year and once next year. More information about the study is on the other side of this flyer and at the website listed on the left.

If you want to participate or have questions, please call 503-725-4024, email FamilyActivityStudy@pdx.edu, or complete the card below and mail it back (postage is pre-paid). We will then contact you to set up a time to answer any questions and get you started.
The characters (2)

GPS Trips (& tours)

- 1,419 (11%)
- 1,501 (11%)
- 9,957 (75%)
- 384 (3%)
Editing

walk considered an option <-

trips over 7mi excluded -->

99th %tiles
walk, bike

walk
bike
auto
transit
Editing

data means (trips <= 7mi)

NHTS 2009 (means for trips <= 7mi)
The action

All models include: socio-demographics (gender, car ownership), trip context (purpose, day of week, transit access)

Model 1: Shortest Paths & OD Buffers (0.25-1 mi)

Model 2: Predicted Walk & Bike Routes

Model 3: Combination of Route, OD + Home area
Big reveal #1

Measuring along single best walk & bike routes predicts mode choice significantly better than within origin-destination buffer areas.
Big Reveal #2

Route and area measures complementary to route measures, in some cases.
Big reveal #3

Bike and walk facilities matter in decisions of *whether* to bike or walk.

---

**when present, change in probability of **biking** for 10% increase in...**

- shortest path miles
- detour
- off-street path
- bike blvd
- high traffic (ADT>20k)

---

**when present, change in probability of **walking** for 10% increase in...**

- shortest path miles
- off-street path
- arterial commercial
- missing sidewalk

---

-12% -10% -8% -6% -4% -2% 0% 2% 4%

not shown, each arterial crossing without a signal: -31% prob. walking
Big reveal #4

Gender matters for decisions of **whether** to bike, unlike decisions of **where** to bike.

-38%  Overall, for similar trip

-70%  When “best” route entirely along moderate traffic streets (ADT 5-20k)

+68%  When “best” route entirely along low-traffic bike boulevard

+0%  On trips that cross Willamette River (Men: 2.2x as likely)
Big reveal #5

Sensitivity to corridor-level policies substantially increased using predicted routes.

Route 1: follows shortest path along busy street* with bike lane
shortest path distance is 2 miles

Route 2: requires 10% detour, but uses quiet, local streets

Initial Probability of Biking
("best" route is Route 1)

<table>
<thead>
<tr>
<th></th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area Model</td>
<td>1.7%</td>
<td>1.3%</td>
</tr>
<tr>
<td>Route Model</td>
<td>3.1%</td>
<td>2.1%</td>
</tr>
</tbody>
</table>

Probability of Biking w/ proposed bike boulevard treatment along Route 2 ("best" route shifts)

<table>
<thead>
<tr>
<th></th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area Model</td>
<td>1.7%</td>
<td>1.5%</td>
</tr>
<tr>
<td>Route Model</td>
<td>21.5%</td>
<td>30.1%</td>
</tr>
</tbody>
</table>

* ADT 20k (cars per day)
Plot twist!

• Self-selection: Could those wanting to bike or walk more just live where facilities are better?

• Importance (1-5) in choice of current home...
  ...good walking neighborhood (mean=4.2)
  ...good biking neighborhood (mean=3.8)

• Significant impact but w/in range of travel environment effects (+22% walk, +39% bike)

• Significance and magnitude of route attributes largely unchanged, suggesting complementary effects
Critics always find something!

- Trip-based model (though included tour distance)
- Assumed order entirely destination -> mode
- Panel data (though controlled for time effects)
- Single “best” route for everyone
- Transit/Auto missing variables
- Preferences can only be revealed within existing conditions (new facility types, different urban forms)
- Attitudes not included
Morals of the story

• Quality bike and walk routes not only improve experience on existing trips but also encourage new trips by walking and biking.

• Low traffic-stress facilities are good for all users and may be especially important to encourage women to bike.

• For maximum value, bike facilities should follow shortest paths; however, still have value even when that’s not feasible, particularly when other options poor.
Questions? Ideas?

Special thanks to: NITC Dissertation Fellowship
Portland Metro
City of Portland
Jennifer Dill & FAS Team
Further reading...

Contact me at jbroach@pdx.edu if you need help accessing any of my articles:


Pedestrian Route Choice


Mode Choice

