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

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

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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

Revealed Preference
Bike Route Choice
Bike GPS Study

2007-2012

2010-2013

Transferability of
Bike Route Choice
Preferences

2014

2015-2016

Revealed Preference
Walk Route Choice
Family Activity Study

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
The characters (2)

GPS Trips (& tours)

- 1,419 (11%)
- 1,501 (11%)
- 9,957 (75%)
- 384 (3%)
walk considered an option <- trips over 7mi excluded ->

99th %tiles
walk, bike

Density
walk
bike
auto
transit

miles (shortest path)
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.

-12%  -10%  -8%  -6%  -4%  -2%  0%  2%  4%
not shown, each arterial crossing without a signal: -31% prob. walking
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

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<tr>
<td><strong>Area Model</strong></td>
<td>1.7%</td>
<td>1.3%</td>
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<tr>
<td><strong>Route Model</strong></td>
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Initial Probability of Biking
(“best” route is Route 1)

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<tr>
<td><strong>Area Model</strong></td>
<td>1.7%</td>
<td>1.5%</td>
</tr>
<tr>
<td><strong>Route Model</strong></td>
<td>21.5%</td>
<td>30.1%</td>
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Probability of Biking w/ proposed bike boulevard treatment along Route 2 (“best” route shifts)

* 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?

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- 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:

**Bike Route Choice**


**Pedestrian Route Choice**


**Mode Choice**

