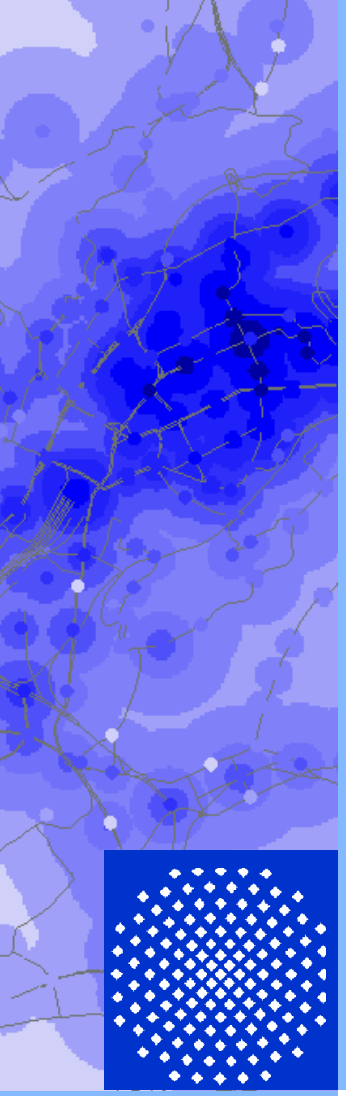

Choice Set Generation and Model Identification for Route Choice using GPS-Data from Smart Phones

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What to expect?

Can traveler's smart phones be used to

- provide a platform for long term recording of GPS data
- determine the size of choice sets in route choice
- help to identify suitable choice models

and which problems need to be addressed to exploit this data source?

Contents

- Data Collection
- Data Processing
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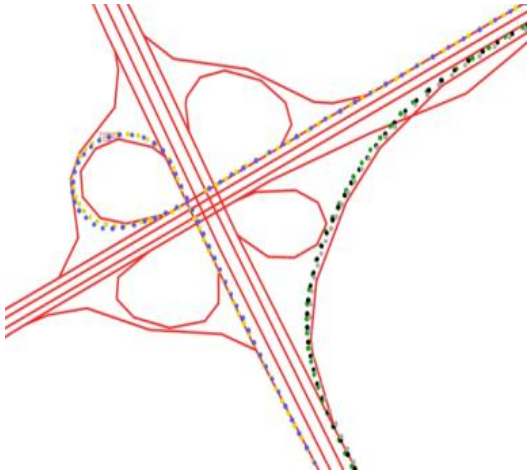
Data Collection

- 278 participants
- > 20 miles commute each day
- 8 week period
- Onboard smart phone
- Data transfer to server via GSM mobile phone network



Data Characteristics

Logging GPS data online with downloadable smart phone applications:

- Benefits:
  - no labor intensive recruiting or instruction needed
  - no investment in survey hardware needed

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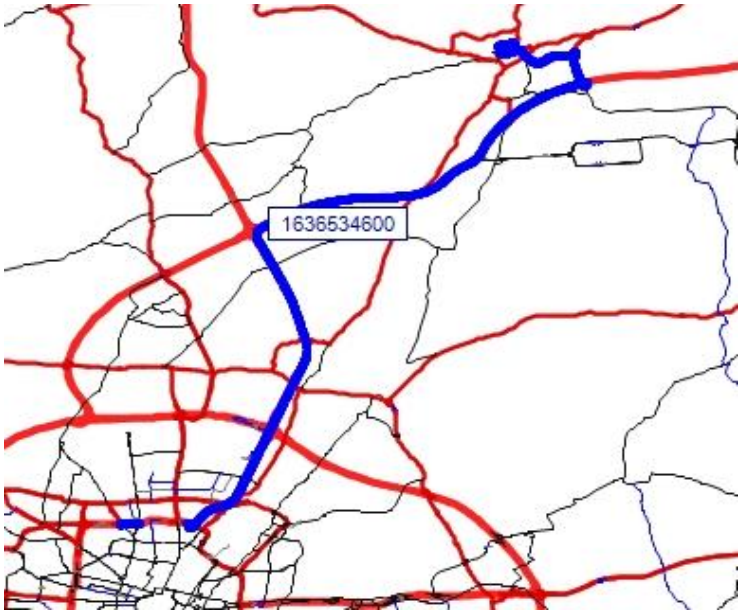
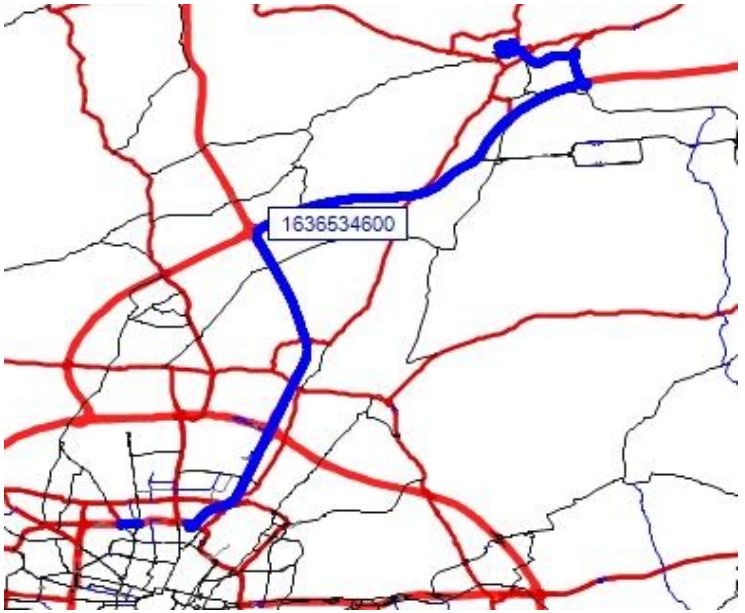
  - data more difficult to interpret



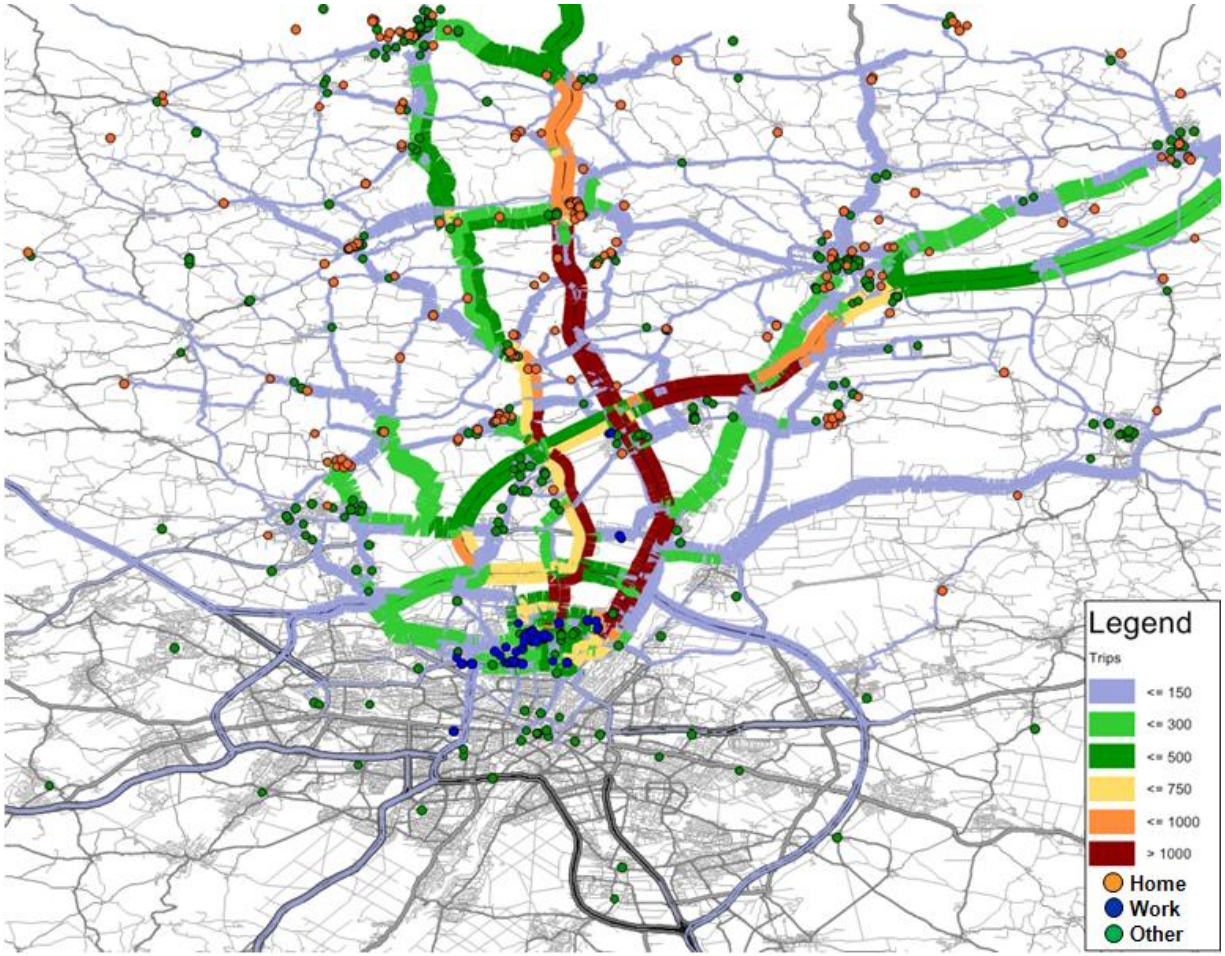
Data Characteristics

Logging GPS data online with downloadable smart phone applications:

- Benefits:
  - no labor intensive recruiting or instruction needed
  - no investment in survey hardware needed
- Drawbacks:
  - data loss possible
  - data more difficult to interpret
- Several trips included in one track
- Inaccurate logging at trip ends



Data Volume



Data Volume		
	Total over 278 participants	Per person
Total time of detection	12,044 hours	43,3 hours
Number of detected trajectories	20,000	71

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Identification of Trip Ends

- Gaps in track due to loss of GSM network connection or unrecorded trips:
  - jump in time stamp of subsequent data points
  - jump in position of subsequent data points

  → Data loss or unrecorded trip?

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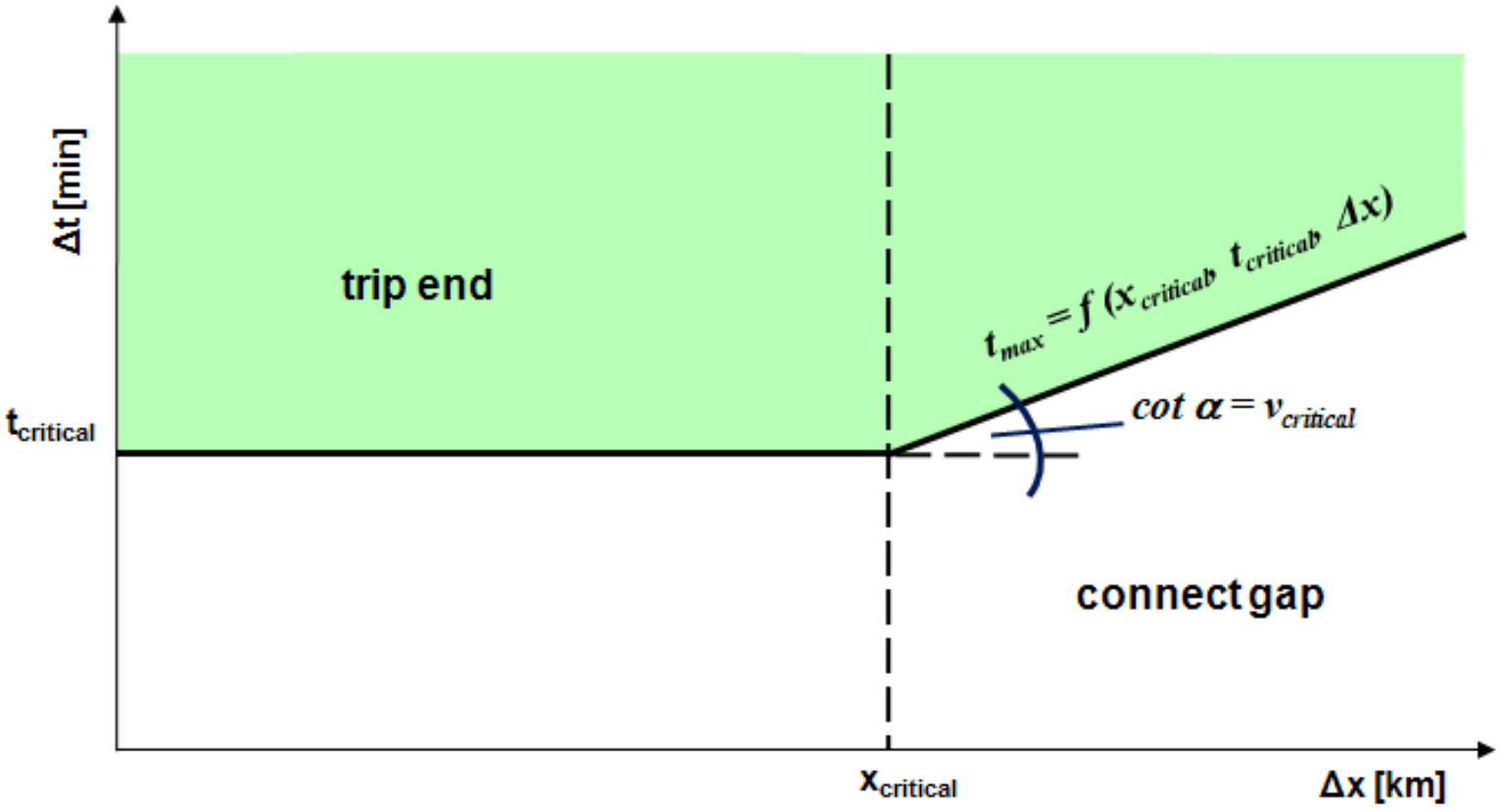
  → Congestion or activity?
- Procedure needed to
  - connect gap with shortest path
  - or identify trip end

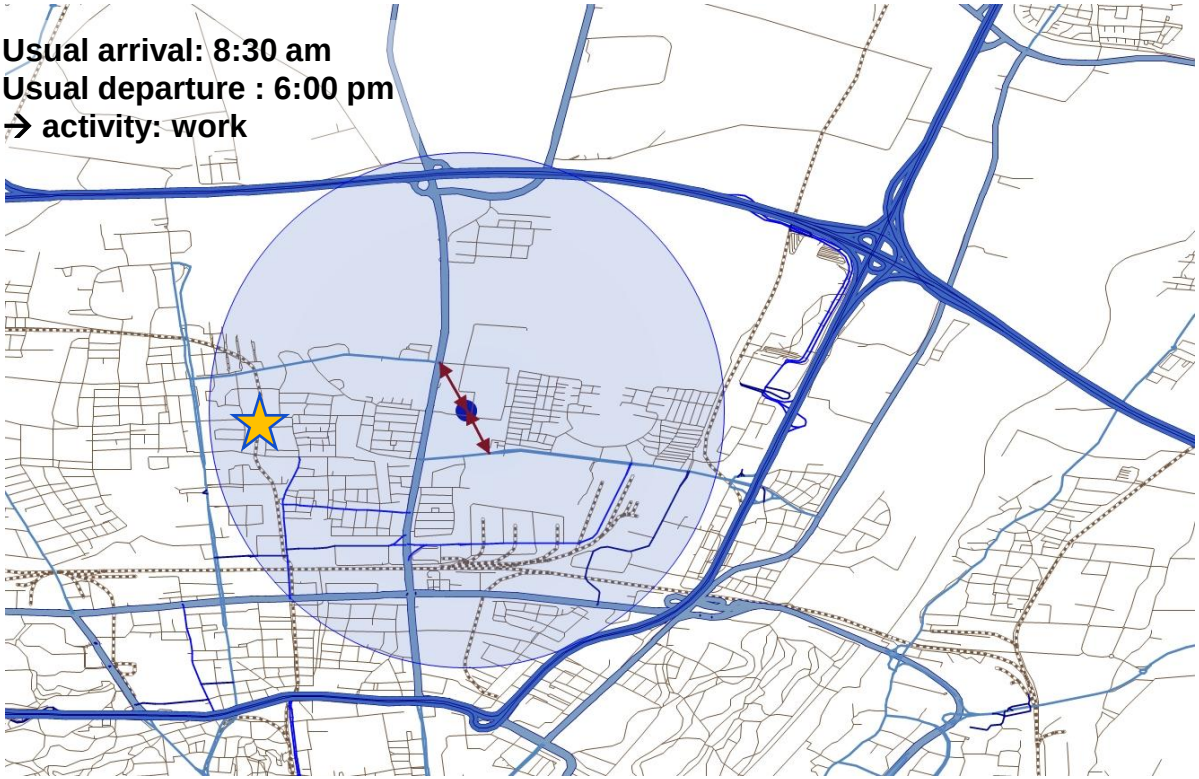
Identification of Trip Ends



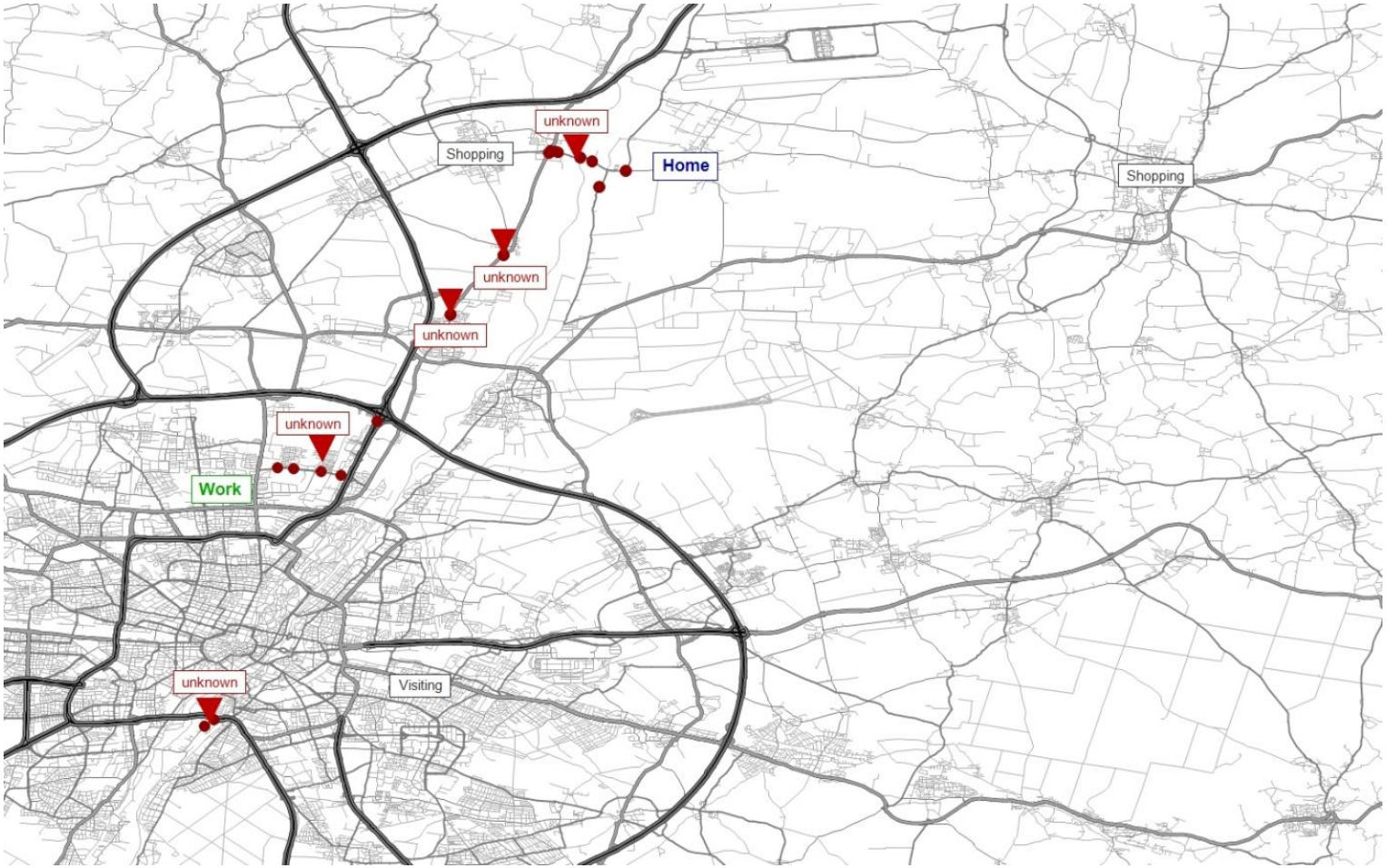
Data Volume		
	Total over 278 participants	Per person
Total number of GPS trajectories	20,000	71
Number of identified trips	25,000	89

Identification Activity Location

- Origin and destination points needed for choice set generation
  - Position match
  - Time match
  - Point of Interest match



Identification Activity Location



Data Volume		
	Total over 278 participants	Per person
Total number of trips	25,000	89
Number of trips between identified activity locations	17,500	63

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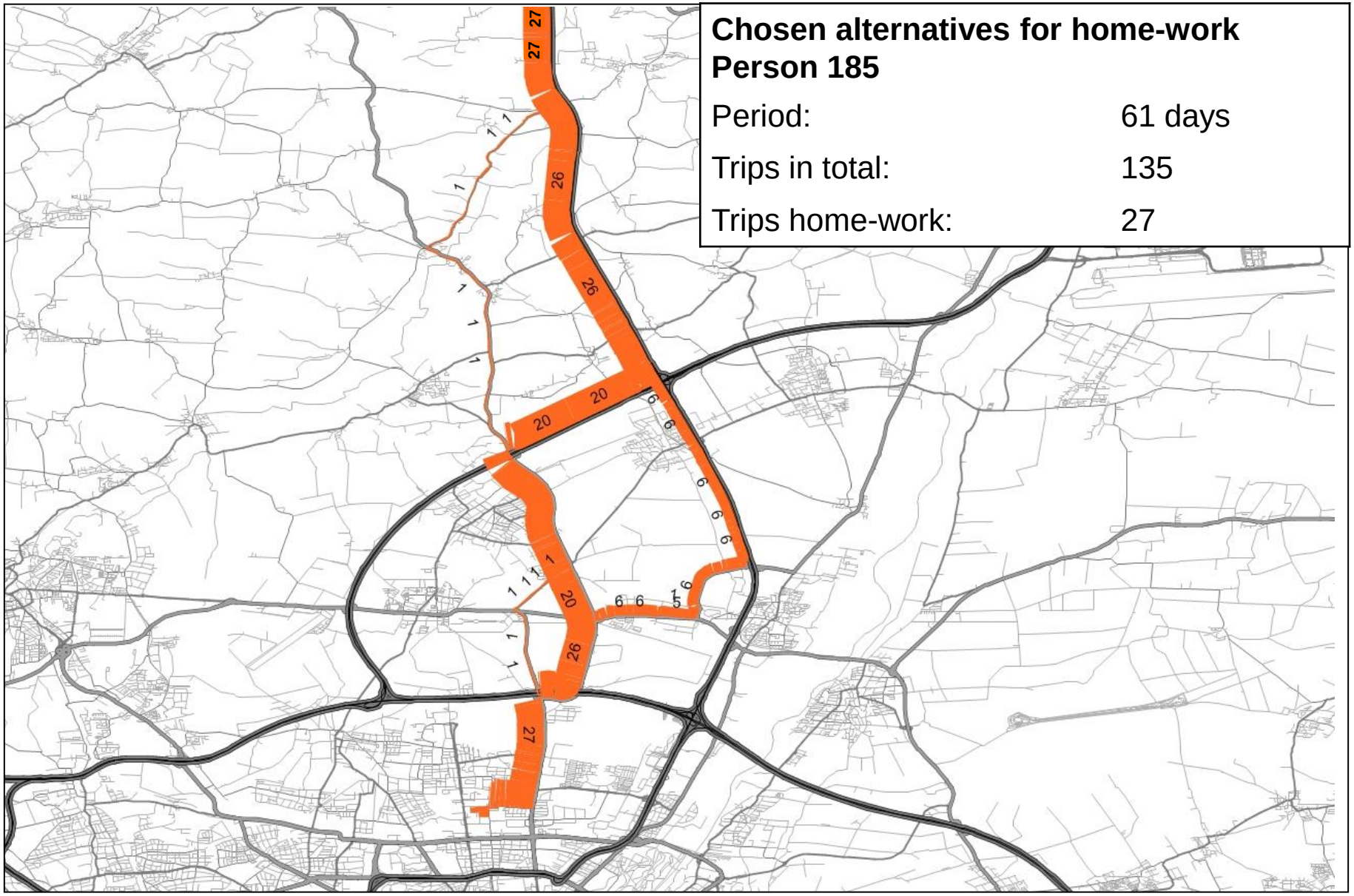
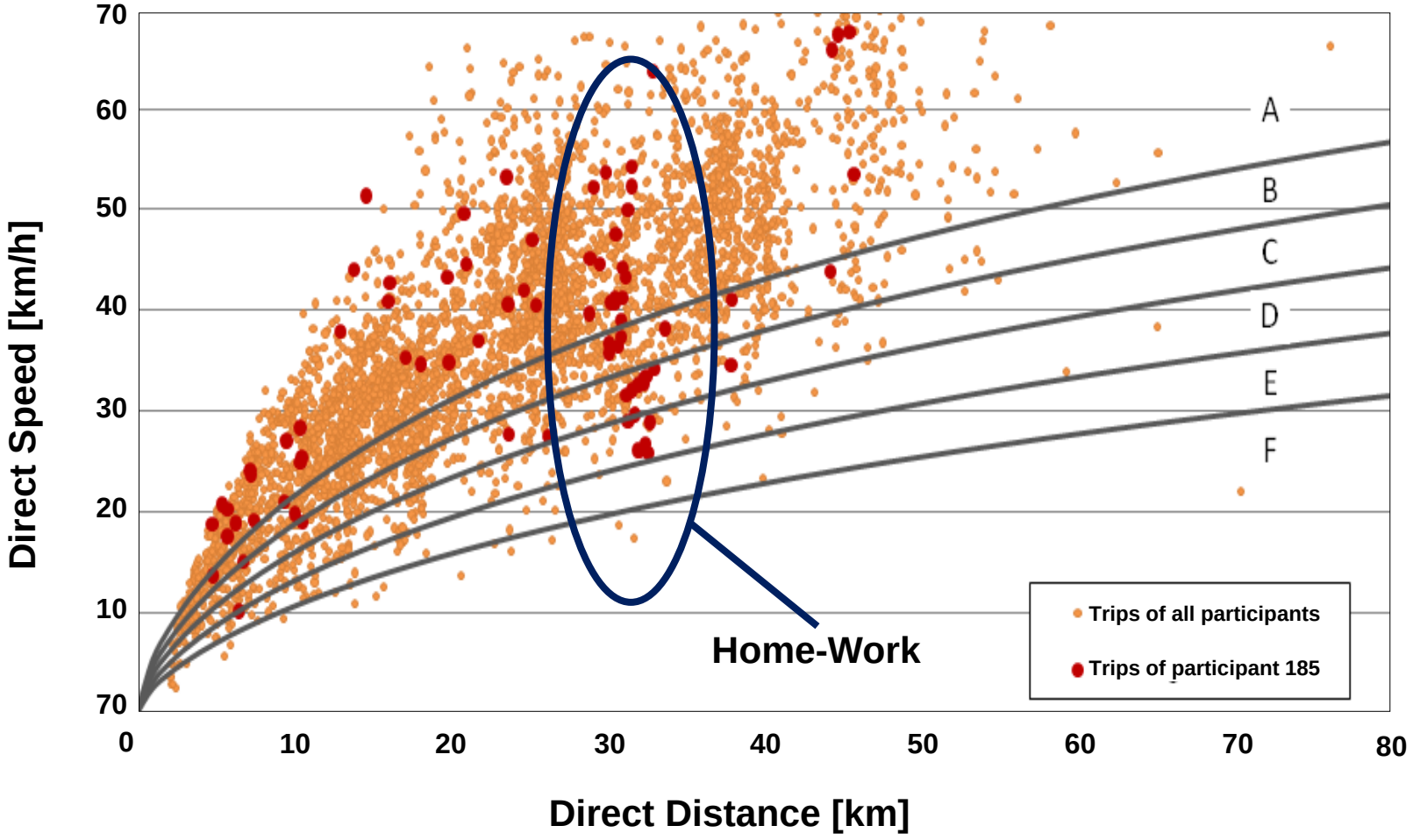
Chosen Routes from home to work



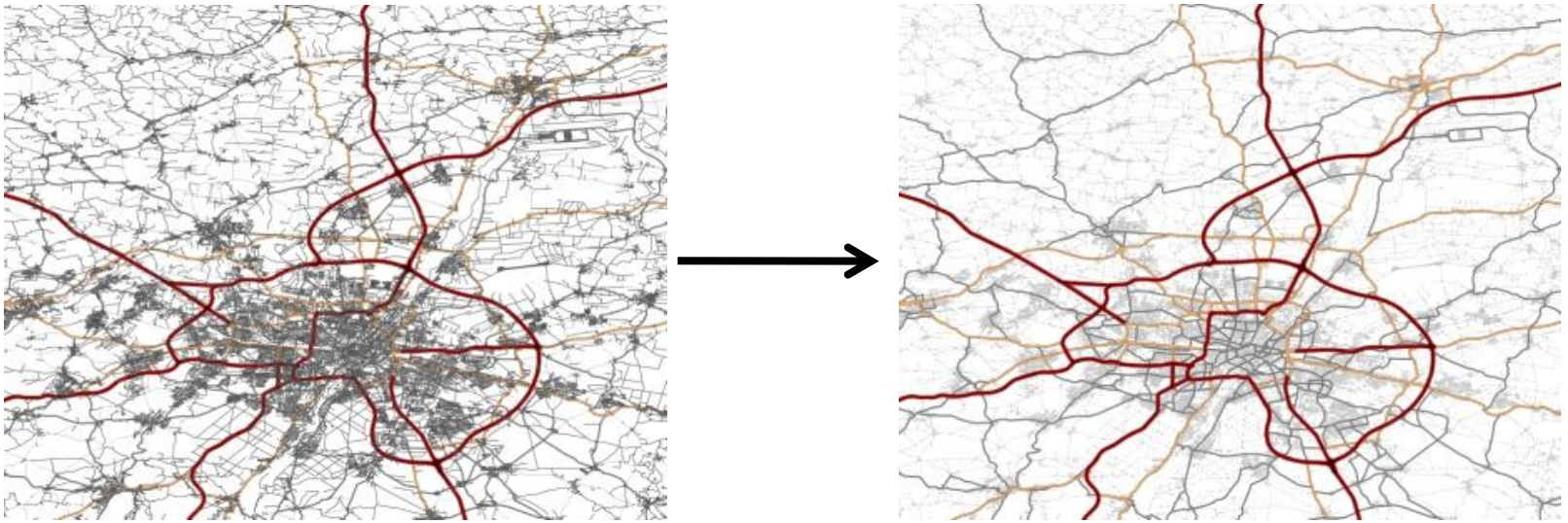
Level of Service experienced



Routes from home to work		
	Total over 278 participants	Per person
Number of chosen routes (GPS)	610	2.2
Number of known routes (interview)	806	2.9

Choice Set Generation

- Equilibrium assignments usually find >30 routes per OD pair for similar size networks
- Choice set generation needs to reflect hierarchical structure of decision process



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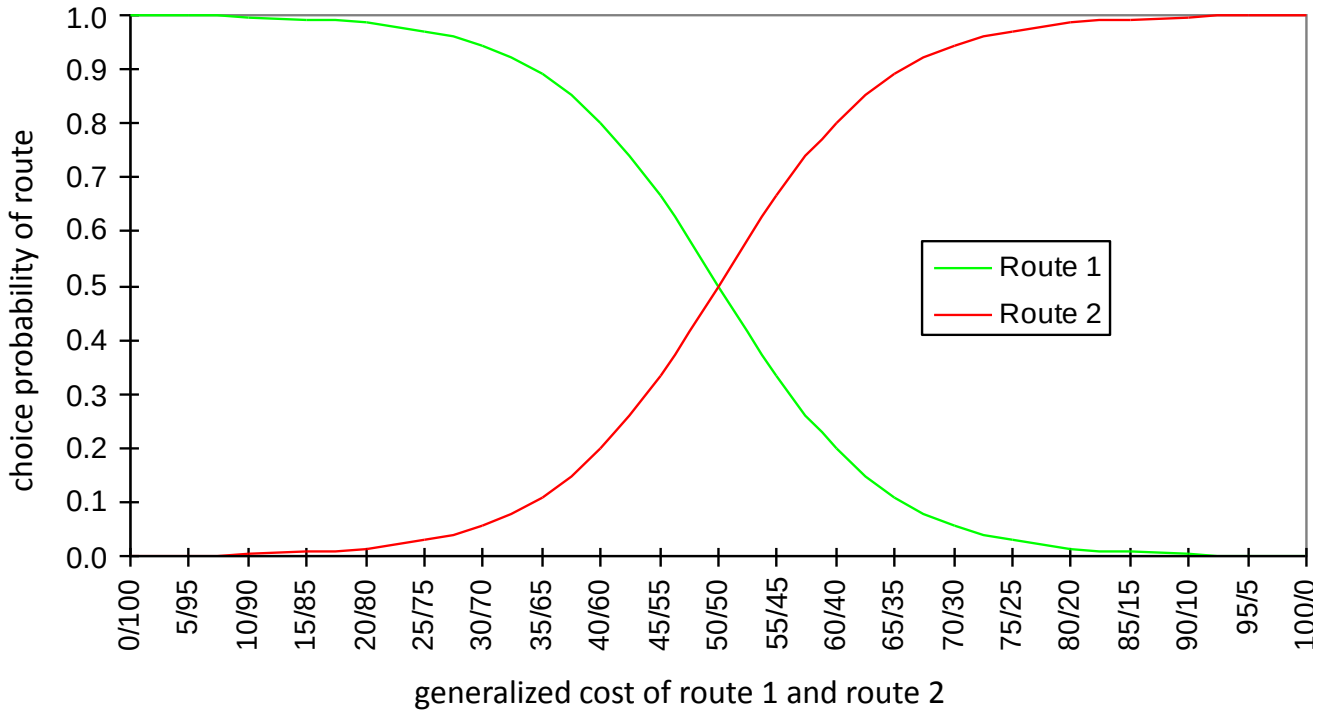
Classical Discrete Choice Models

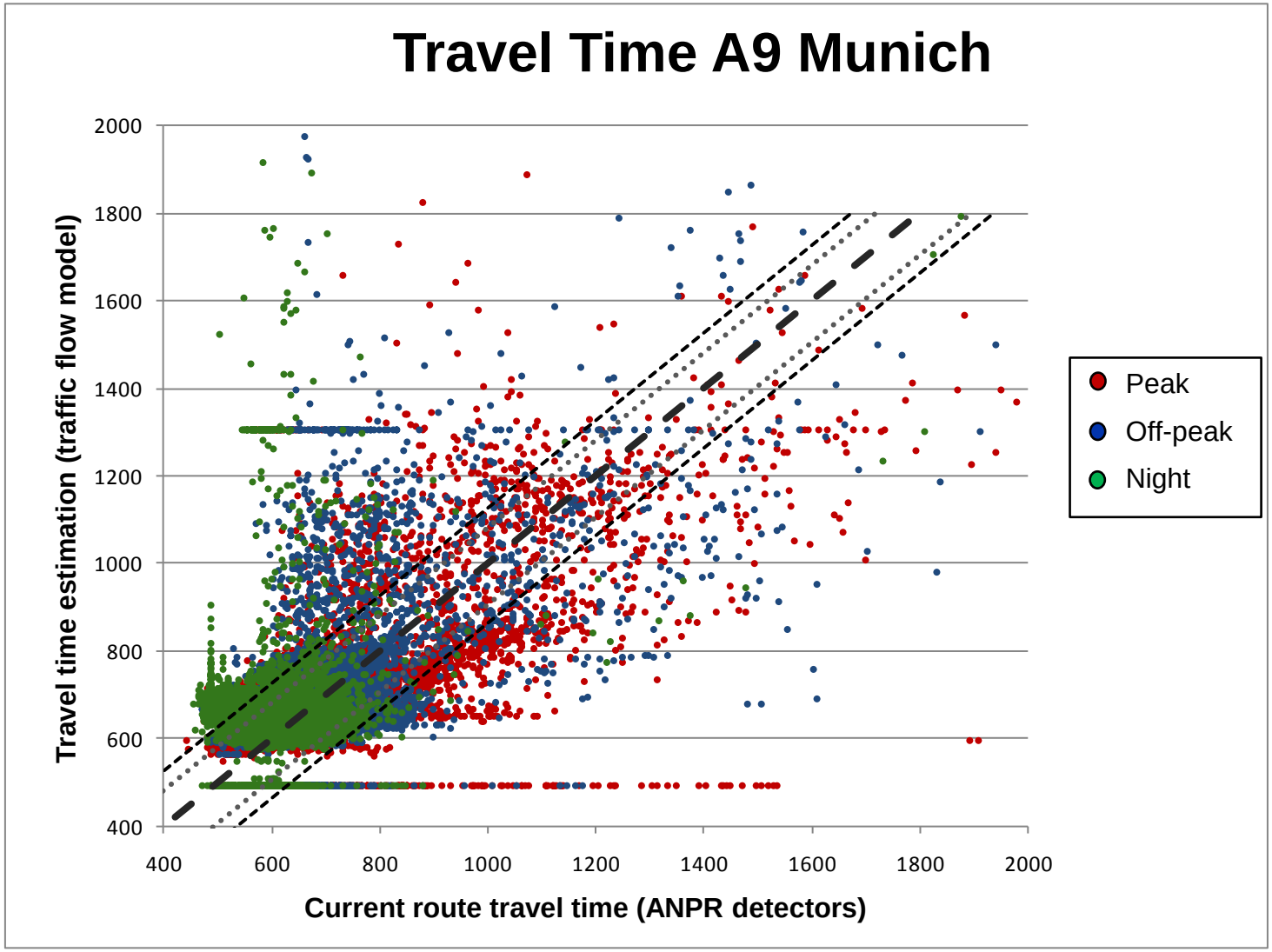
- C-Logit by Cascetta

$$P_r = \frac{f^C \cdot \exp\left(-\beta \cdot G_r\right)}{\sum_{r'} f^C \cdot \exp\left(-\beta \cdot G_{r'}\right)}$$

β	Parameter
f^C	Cascetta coefficient
G	Generalized cost
P	Probability
r	Route



Best possible Knowledge of Current Travel Time



Modified Logit

- Modified Logit with low elasticity for small deviations by Gobiet

$$P_r = \frac{f^C \cdot \exp\left(-\beta \cdot G_r\right)}{\sum_{r'} f^C \cdot \exp\left(-\beta \cdot G_{r'}\right)}$$

β	Parameter
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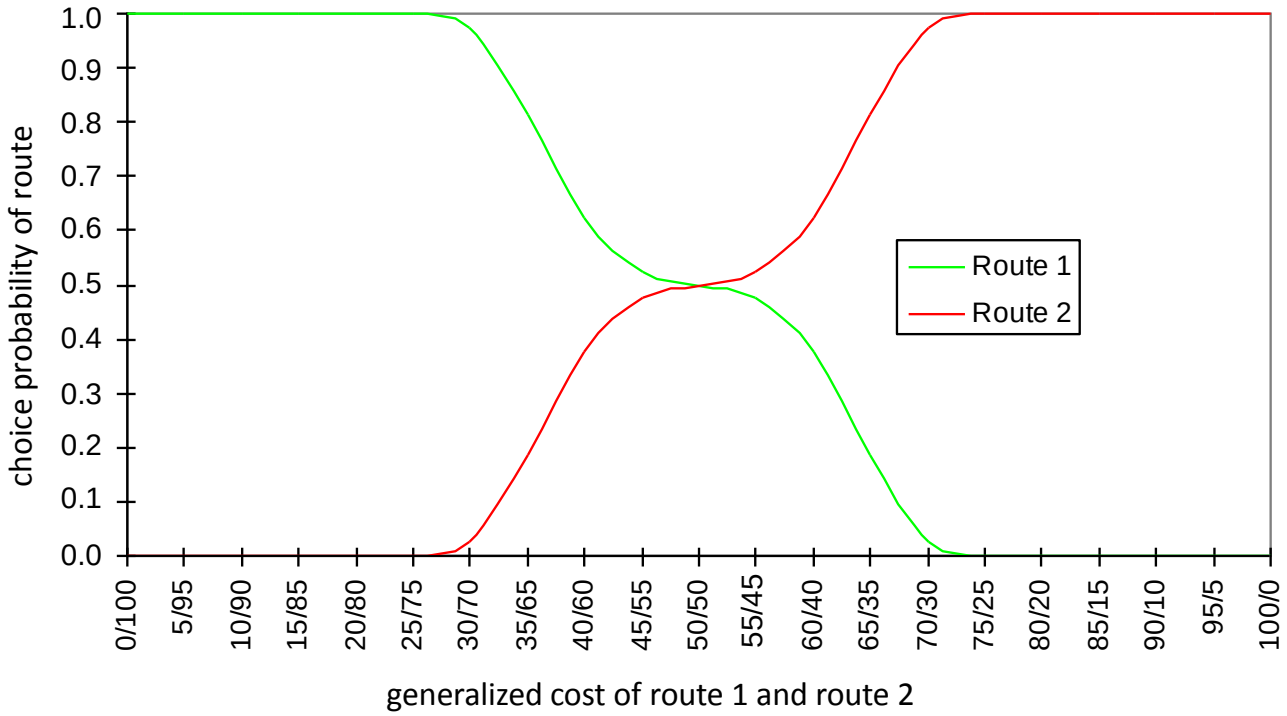

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Conclusions

- Push for developing applications for smart phone GPS tracking
- Profound revealed preference data which can be fused with traffic state and traffic information data for detailed estimation
- Data valuable for providing empirical foundation for choice set generation and model identification
- Data valuable for calibration of equilibrium assignment models on chosen routes

Thank you!

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- Christian Schiller, German Aerospace Center (DLR)