Assessing the Impact of Fuel Cost on Traffic Demand in Flanders using Activity-Based Models

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Outline

- Introduction to Activity-Based (AB) models
- Feathers framework
- Data collection
- Scenarios
- Fuel Cost scenario
- Conclusions and Future Research

Activity-Based (AB) models

- AB models predict interdependencies between several facets of activities
- Facets:
  - Which type of activity ?
  - When ?
  - For how long ?
  - Conducted where ?
  - Which transport mode ?
  - With whom ?
- Travel demand derived from activities

Feathers framework

- AB simulation research laboratory
  - Dynamic AB model
- Platform for model development
  - Implementation of prototype models
  - Implementation of experiments
    - Accessibility of required data
    - Expandability of data objects / ‘functions’
    - Benchmarking
  - Configurable for multiple study areas
  - Recuperation of research / implementation efforts
- Accomodate (anticipated) future needs
  - Life span exceeds SBO project duration

Feathers framework

- Modular
  - Manage complexity
  - Research contained within modules
- Agent-based
  - Unit of investigation: ‘agent’: person
  - Relations (constraints) between agents:
    - Households, social networks
- Object oriented
  - Manage complexity
  - Compatibility with modules and agent-based design
  - Code reusability
  - Borland C++

Feathers Framework: Schedule Engine

- Currently a decision tree (DT) based scheduling core is implemented in the Feathers framework
- *Heuristic choice modeling* using DT’s and personal, HH & schedule attributes, e.g.:
  - Time of getting up in the morning
  - Time of going to sleep in the evening
  - Going to work or not
  - Including (flexible) leisure activity/activities
  - Chosing the locations for the activities
  - Chosing the mode of transportation
- Currently 26 DT’s are used to obtain a complete schedule
- Different types of constraints apply

Data Collection

- Activity-travel diaries
  - 2 500 households
  - Up to 2 adults/HH surveyed
  - One week survey
  - (Re-)planning and execution
- Data collection method
  - Paper-and-pencil
  - PARROTS
- Linked data objects
  - Persons
  - Activities
  - Households
  - Cars
  - Journeys
  - Lags

Scenarios

- Policy measures that can be calculated
  - Changes in multimodal transport characteristics
  - Changes in institutional constraints
  - Changes in urban and spatial characteristics
  - Changes in socio-economic and demographic characteristics

Scenarios

- Policy measures that can be calculated
  - Changes in multimodal transport characteristics
    - Cost of use of different transport modes
      - Congestion pricing
      - Increased fuel costs
    - Travel time
      - E.g. reduction in travel time for different transport modes

Scenarios

- Policy measures that can be calculated
  - Changes in institutional constraints
    - Widening/shortening opening hours
    - Schedule skeletons
      - Changes in structure of work week

Scenarios

- Policy measures that can be calculated
  - Changes in urban and spatial characteristics

Spatial distribution (De-urbanization, concentration of facilities, spatial separation of work and home, …)

- Household distribution per zone
- Employment distribution per zone
- Person distribution per zone

Scenarios

- Policy measures that can be calculated
  - Changes in socio-economic and demographic characteristics

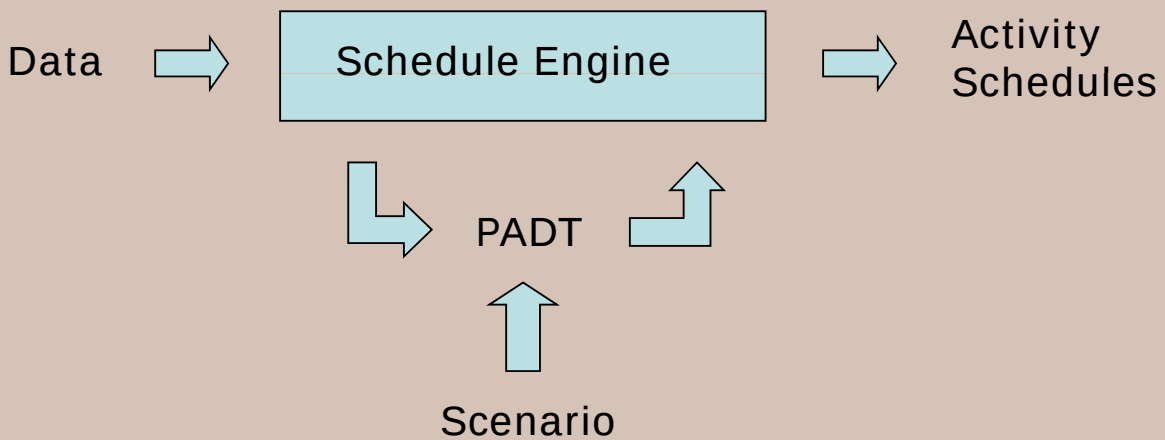
- Composition of labour force
- Household composition
- Household income
- Composition of population
- Car ownership
- Population and employment totals
- Employment distribution

Scenarios

- Adaptation of input data
- Modification of the Schedule Engine
- PADT

Scenario: PADT

Albatross 3 core:



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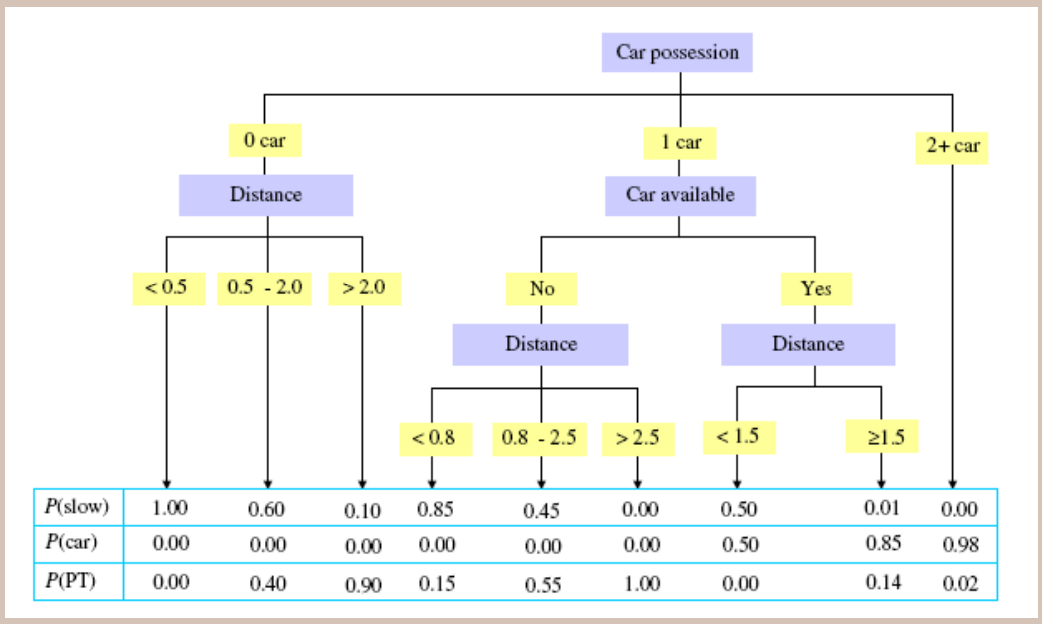
Scenario: PADT



P(slow)	1.00	0.60	0.10	0.85	0.45	0.00	0.50	0.01	0.00
P(car)	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.85	0.98
P(PT)	0.00	0.40	0.90	0.15	0.55	1.00	0.00	0.14	0.02

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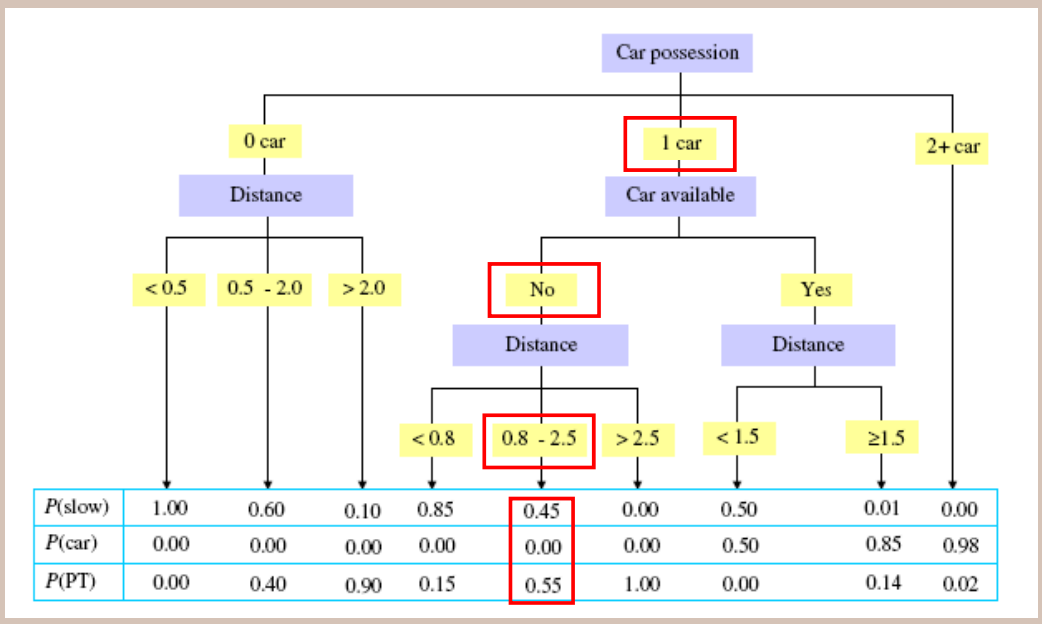

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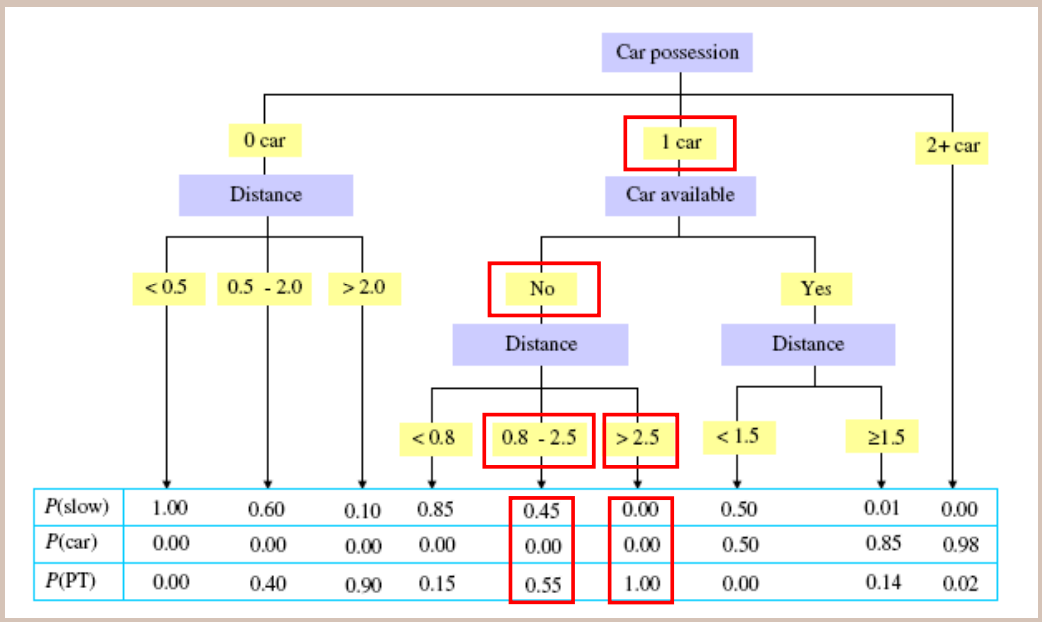

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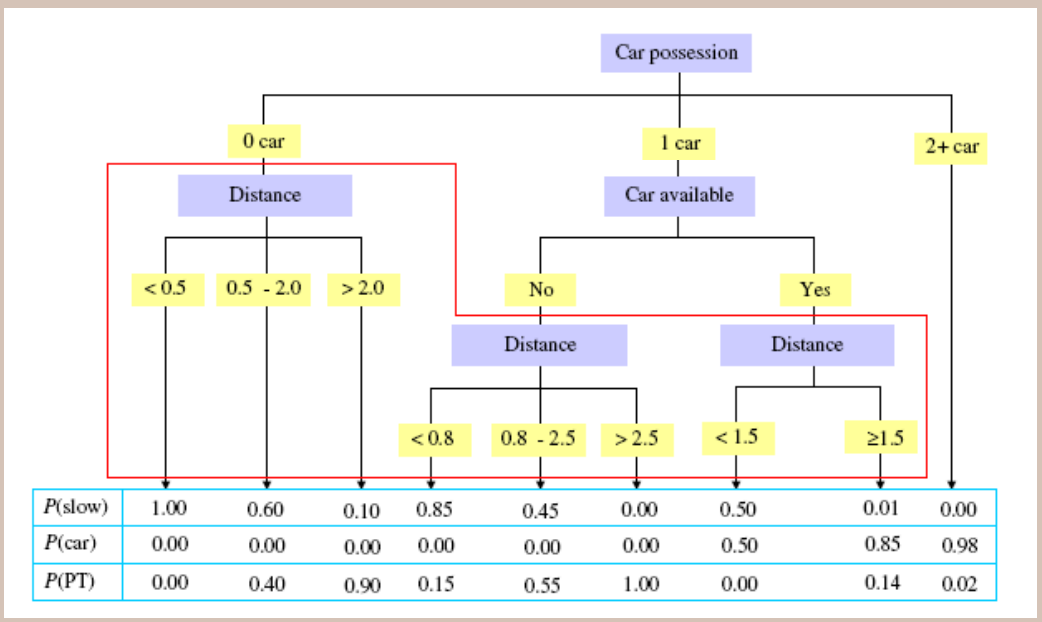

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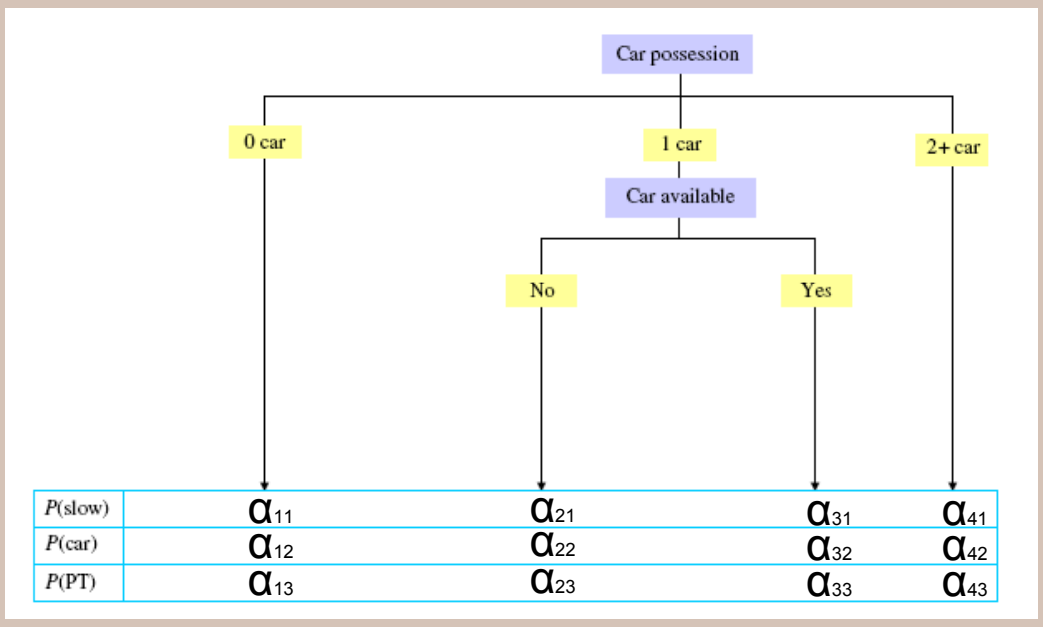

$$P_{kj} = \frac{\exp(\alpha_{kj} + \beta'_j X^C_{ij})}{\sum_{j'} \exp(\alpha_{kj'} + \beta'_{j'} X^C_{ij'})}$$

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Scenario: PADT

- PADT -> discrete choices

-2 continuous variables:
- Expected travel time
- Expected travel cost

- Action assignment rule: A multinomial logit model (MNL model) defining the choice probability distribution of the action variables in function of leaf node membership and travel time and travel cost

Fuel Cost Scenario

Increase in Fuel Cost:

- Impact of Fuel cost on average number of trips per mode per day :

Car driver	-
Car passenger	+
Slow	-

Fuel Cost Scenario

Increase in Fuel Cost:

- Impact of Fuel cost on total travel distance :

Car driver	+
Car passenger	+
Slow	+

Conclusions and Future Research:

- Fuel cost increase leads to changes in travel demands and travel distances
- The model quality can be improved by further integrating more datasets
- Investigate and validate the relationships between changes in trip and activity facets

Questions ?