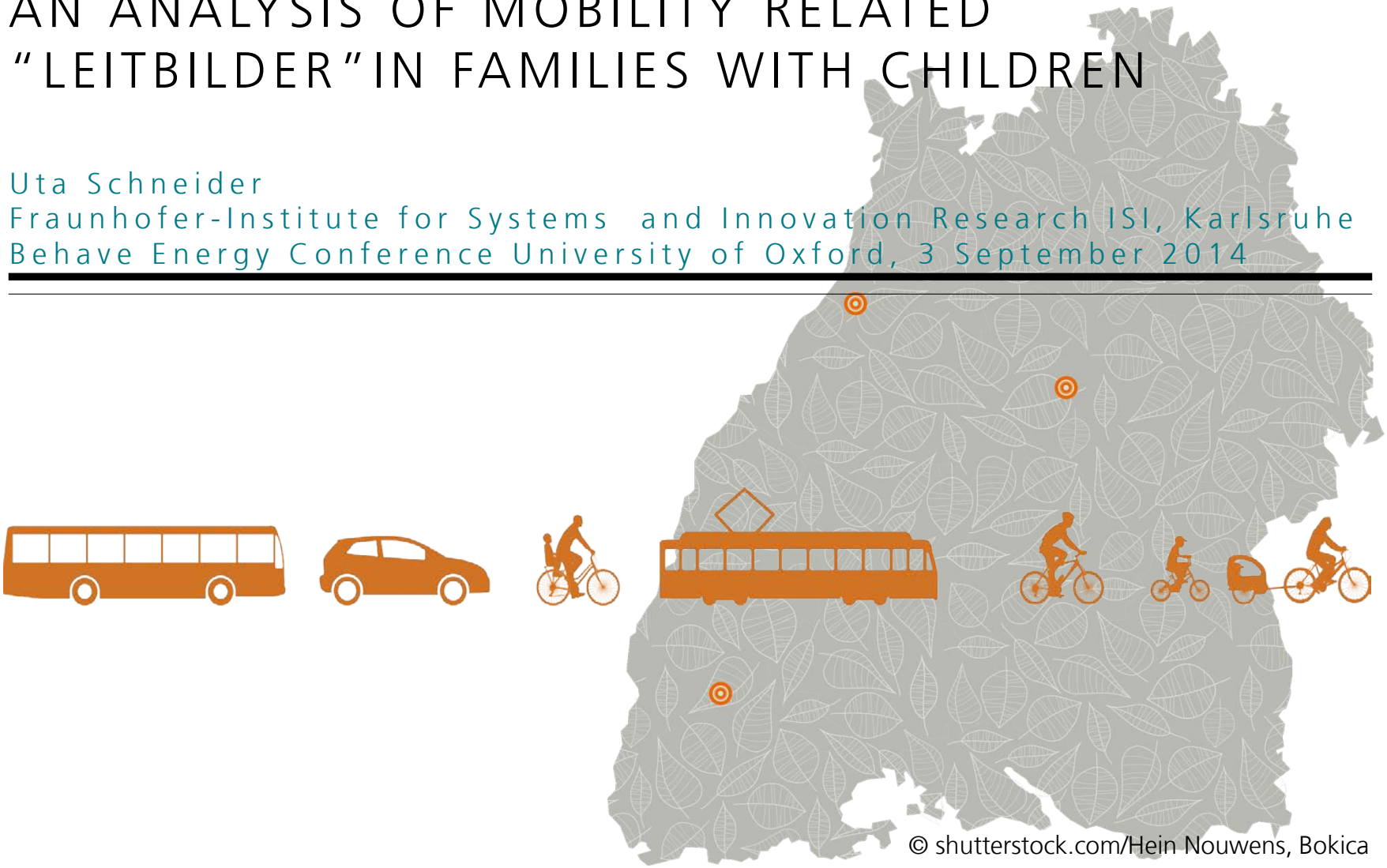
# WHAT IF THE CAR WAS ELECTRIC? AN ANALYSIS OF MOBILITY RELATED "LEITBILDER" IN FAMILIES WITH CHILDREN

Uta Schneider
Fraunhofer-Institute for Systems and Innovation Research ISI, Karlsruhe
Behave Energy Conference University of Oxford, 3 September 2014





regional eco mobility 2030

Fraunhofer ISI

# Agenda

- Introduction
- Research questions and methods
- The data
- Sample description
- Results: Mobility behaviour of families
- Results: Mobility types
- Conclusions
- Next steps

# Introduction

- **Electric vehicles (EV's):** innovation in the sphere of mobility to reduce CO2-emissions in transport. Two usage-scenarios: individual and collective usage
- **EV's in Germany**: ~12.000 battery-electric cars (BEV's) and ~86.000 Hybrids / Plug-In-Hybrid cars (PHEV's) (~43.8 mio. cars in total). Goal of German government: one million electric cars by 2020. **EV's in carsharing-fleets and integrated mobility services:** ~600 EV's in carsharing-fleets available in 2013 (share: 4%)
- For EV diffusion: **shift in user behaviour** / understanding of mobility

- Theoretical framework: New technologies, like EVs, only can prevail if they correspond to existing **Leitbilder** (Leitbild-concept in sociology of culture).

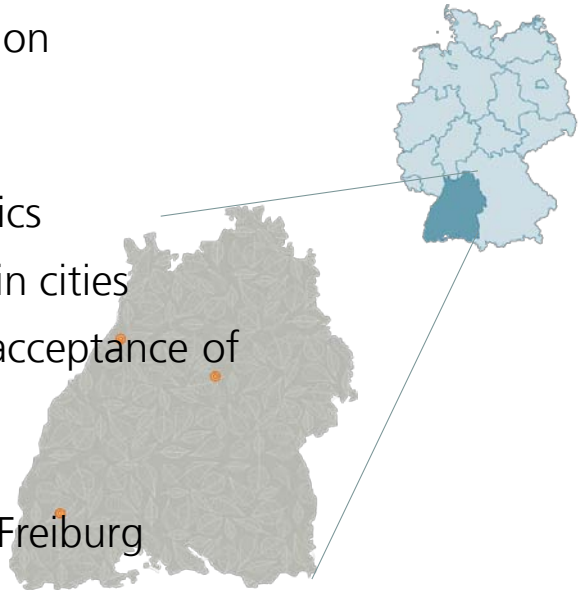
  Leitbilder influence mobility behaviour and perception of new mobility technologies. **Leitbild of the car** as cost-efficient, multifunctional and independent means of transport dominates common understanding of mobility.
- Consequence: Car use remains on high level (infas/DLR 2010), especially in families with children (Ahrend/Herget 2012).

# Research questions and methods

- **Research Questions:**
  - How can mobility behaviour of families in cities be described?
  - Which mobility-related Leitbilder are guiding families with children and how do they relate to their mobility behaviour? How do mobility-related Leitbilder influence the acceptance of EVs?

➢ **First research question** is to be addressed in this presentation

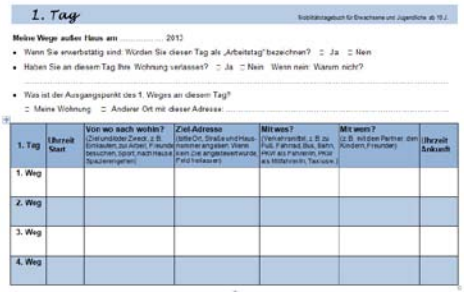
- **Methods**:
  1. Pre-diary questionnaire: Describe household characteristics
  2. Mobility diaries: Describe mobility behaviour of families in cities
  3. In-depth-interviews: Explanation of mobility behaviour, acceptance of new technologies/concepts in the sphere of mobility



- **Study area** Baden-Wurttemberg: Karlsruhe, Stuttgart and Freiburg (230.000 – 610.000 inhabitants)

# The data

- **Mobility-diary (quantitative)** data: Recorded in a personal and trip matrix


1. Tag

Meine Wege außer Haus am ..... 2012

- Wenn Sie erwerbstätig sind: Würden Sie diesen Tag als „Arbeitstag" bezeichnen? ☐ Ja ☐ Nein
- Haben Sie an diesem Tag Ihre Wohnung verlassen? ☐ Ja ☐ Nein Wenn nein: Warum nicht?

- Was ist der Ausgangspunkt des 1. Weges an diesem Tag?
  ☐ Meine Wohnung ☐ Anderer Ort mit dieser Adresse: .....

| 1. Tag | Uhrzeit Start | Von wo nach wohin? (Gebäude der Zweck, z.B. Einkaufen, zur Arbeit, Freunde besuchen, Sport, nach Hause, Spazierengehen) | Ziel-Adresse (bitte Ort, Straße und Hausnummer angeben. Wenn kein Ziel angegeben werden, Feld freilassen) | Mit was? (Verkehrsmittel, z.B. zu Fuß, Fahrrad, Bus, Bahn, Pkw als Fahrerin, Pkw als Mitfahrerin, Taxi usw.) | Mit wem? (z.B. mit dem Partner, den Kindern, Freunden) | Uhrzeit Ankunft |
|---|---|---|---|---|---|---|
| 1. Weg | | | | | | |
| 2. Weg | | | | | | |
| 3. Weg | | | | | | |
| 4. Weg | | | | | | |

7

  - **Personal matrix:**
    - 42 respondents / 22 households (parents)
  - **Trip matrix:**
    - 1460 documented trips
    - Each household documented mobility behaviour for 7 days: 283 documented days of parent's mobility.
    - Trips of 47 children not yet included, except from those made with their parents.

- **Interview (qualitative)** data: 22 Interviews with 42 interviewees

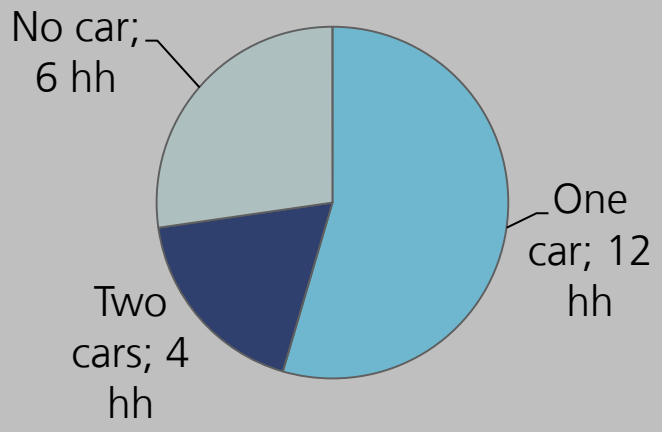
# Sample description

N=22 households (hh)

N=42 respondents (resp.)

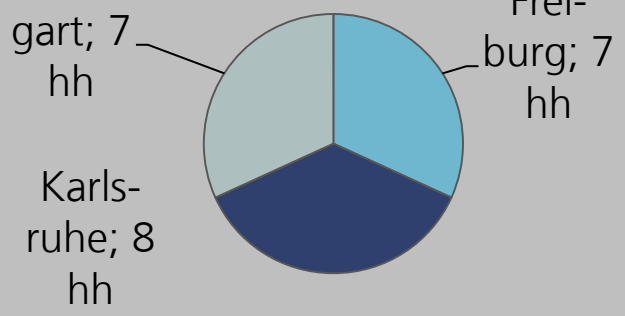
## MOBILITY RESOURCES

*Car ownership*

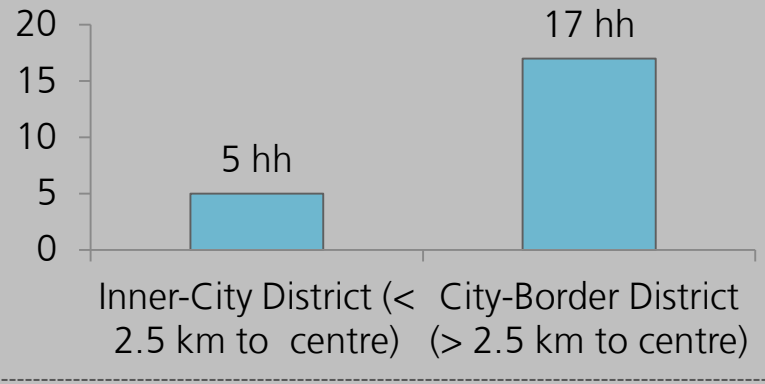



## GEOGRAPHICAL CHARACTERISTICS

*City*




*District type*

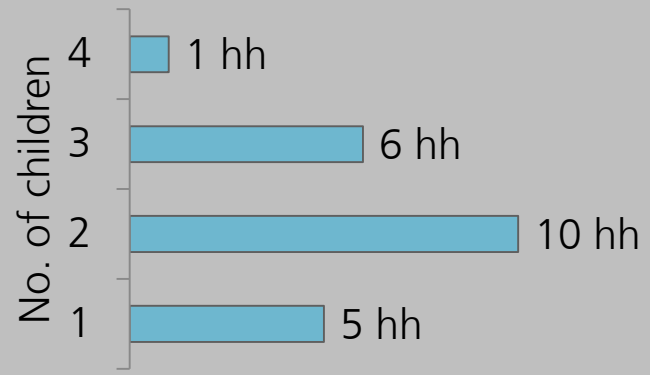


# Sample description

## FAMILY CHARACTERISTICS

In total: 47 children in the households

*No. of children in hh*

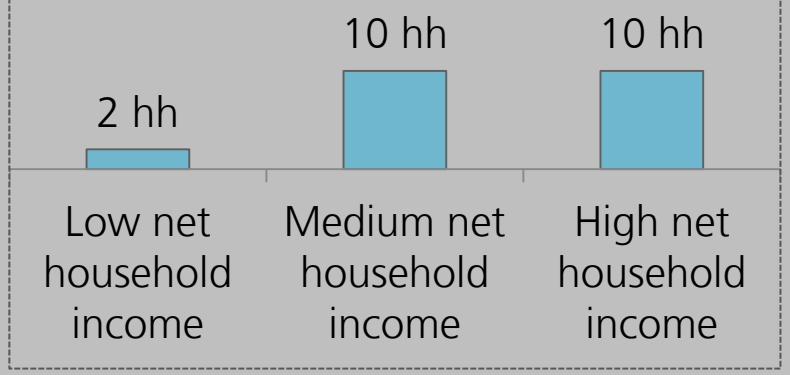



Two single-mother Families

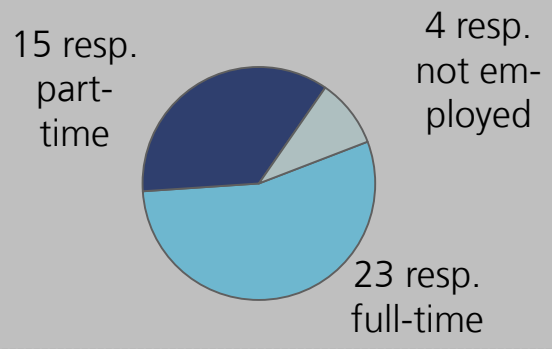
Life cylces (Jäger 1989): 22 households with at least one child 6 years or younger, 20 households with no children under 6 years

## SOCIOECONOMIC DESCRIPTION

*Household net income*



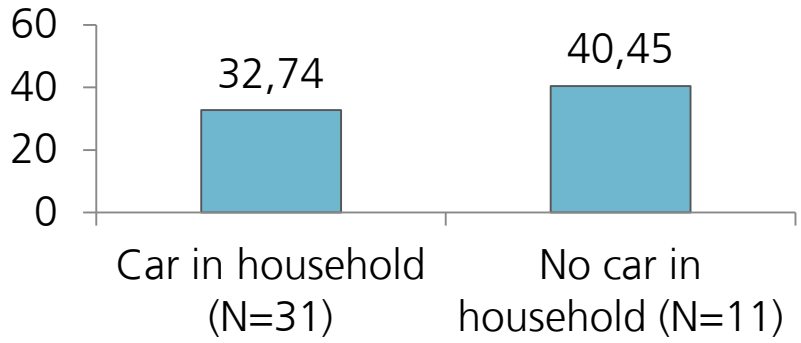

*Employment status*



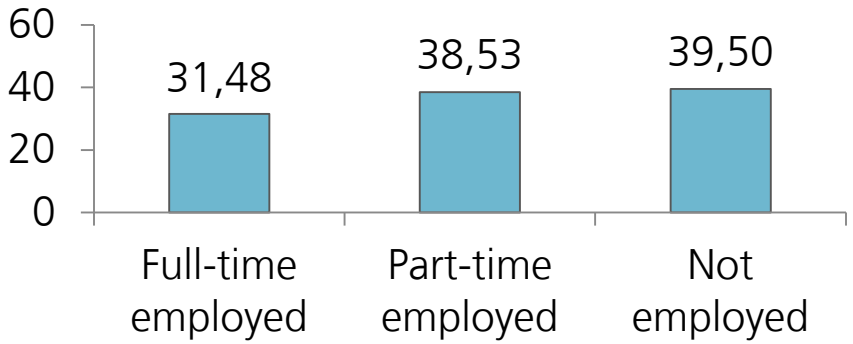
# Results: Mobility behaviour of families: No. of trips

- The respondent make **5 trips per day** on average (Mobilität in Deutschland: 3.4 trips)
- Respndents in households **without cars make significantly more trips** in the documented week (T-Test: T=-2,439, p<0.05)
- Respondents **part-time employed make significantly more trips** in the documented week than persons full-time employed (MANOVA F=3,379, p<0.05)
- No significant results for life cycles and city (based on personal matrix)

No. of trips (mean) by car ownership

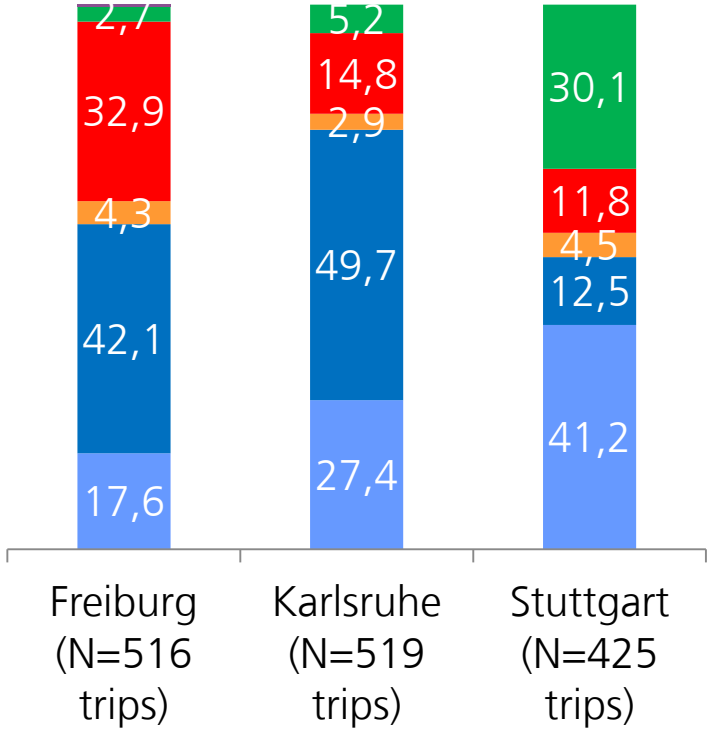



No. of trips (mean) by employment status

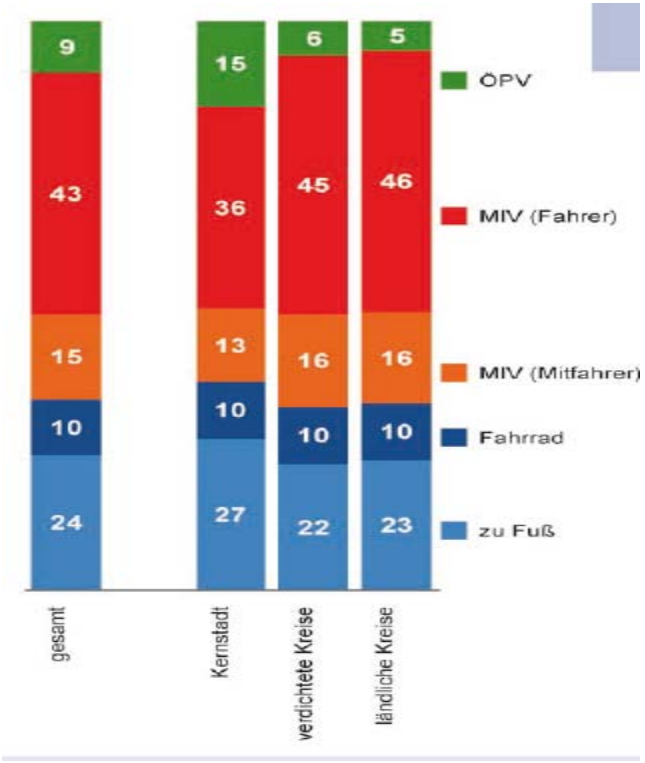


# Results: Mobility behaviour of families: Modal split by place of residence

- Significant differences (Chi² Test: p<0.01) in the modal split in the three analyzed cities (based on trip matrix and trips; main means of transport)




Comparison: Mobilität in Deutschland (infas/DLR 2010)

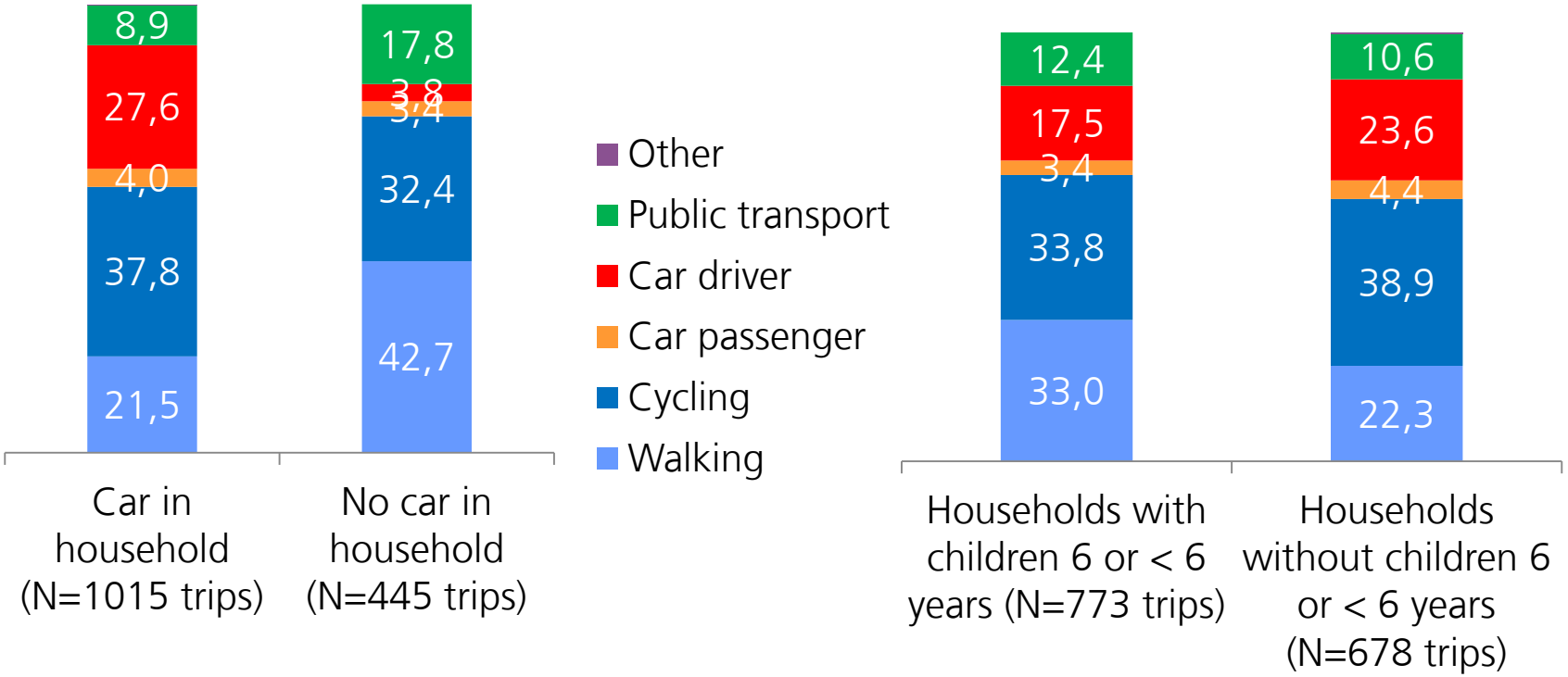



regional eco mobility 2030

Fraunhofer ISI

# Results: Mobility behaviour of families: Modal split by car-ownership and life cycles

- Significant differences (Chi² Test: p<0.01) in the modal split in households with and without cars and in households with younger children compared to those without younger children (based on trip matrix and trips; main means of transport)



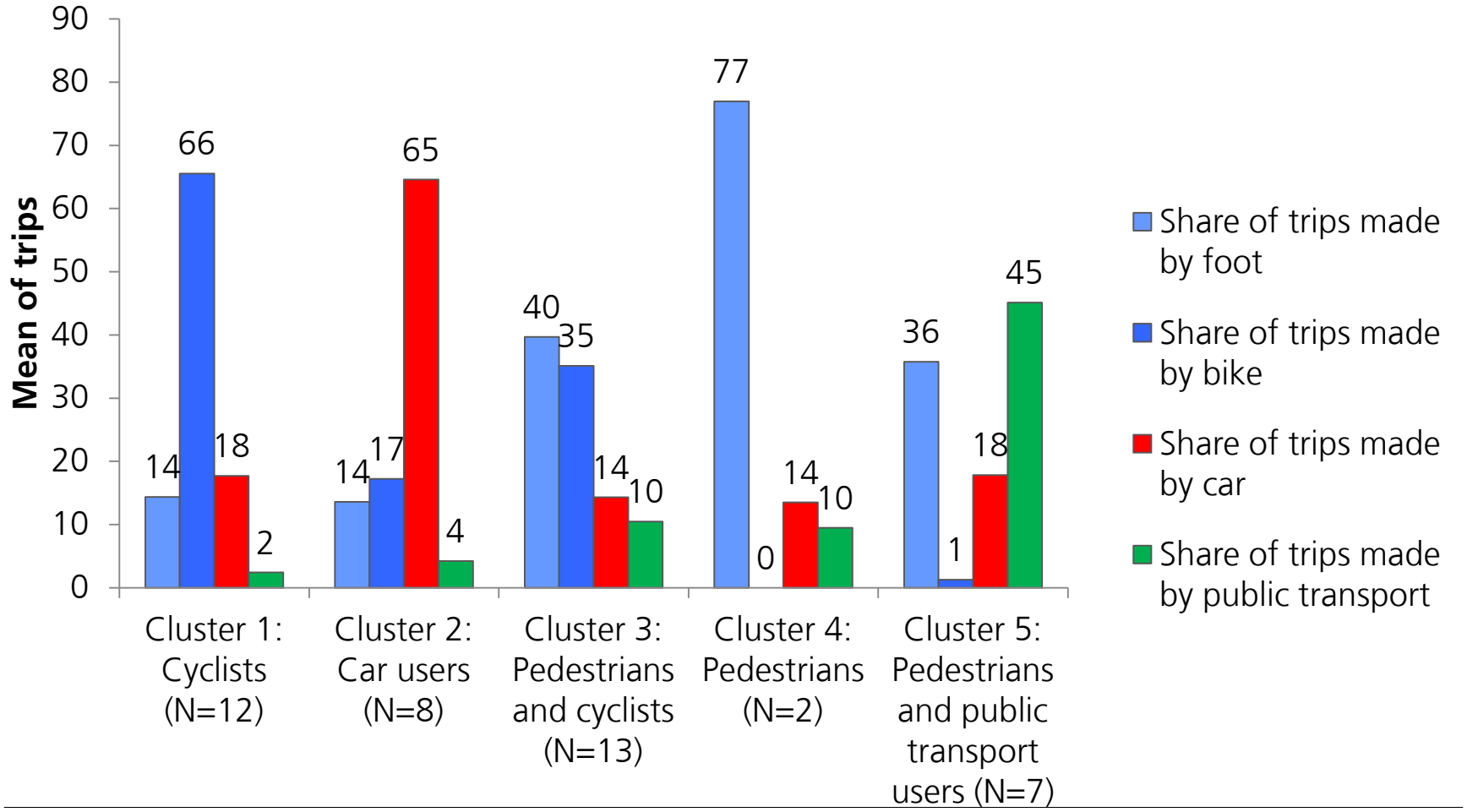
# Results: Mobility types: behaviour-based segmentation

- **Behaviour-based segmentation** based on mobility-diary-data
  - Purpose: analyzing differences and similarities within the sample regarding mobility behaviour, finding groups of households with similar mobility behaviour
  - In a second step: profile and compare mobility types with qualitative results, reveal motivations for mobility behaviour in a certain cluster

- Hierarchical **cluster analysis** (Analyzed persons: parents. Data base: personal matrix. Agglomerative; method: average group linkage): 4 Variables (scores: 0 to 100):
  - Share of trips made **by foot** in the documented week
  - Share of trips made **by bike** in the documented week
  - Share of trips made **by car (driver and passenger)** in the documented week
  - Share of trips made **by public transport** in the documented week

- **Result**: 5-Cluster solution

# Results: Mobility types: 5 Clusters



# Results: Mobility types: Profiling the clusters

| | Size | Share of resp. sharing one hh | Gen-der: Share of women | Place of residence | Car ownership: Share of resp. without car | Life cycles: Share of resp. with children 6 or < 6 years in hh | Employ-ment status: Share of resp. full-time employed |
|---|---|---|---|---|---|---|---|
| Cluster 1: Cyclists | 12 | 67% | 50% | Freiburg & Karlsruhe | 17% | 50% | 58% |
| Cluster 2: Car users | 8 | 50% | 50% | Freiburg & Karlsruhe | 0% | 38% | 63% |
| Cluster 3: Pedestrians and cyclists | 13 | 46% | 62% | Freiburg, Karlsruhe & Stuttgart | 23% | 38% | 46% |
| Cluster 4: Pedestrians | 2 | 0% | 50% | Karlsruhe & Stuttgart | 100% | 50% | 0% |
| Cluster 5: Pedestrians and PT users | 7 | 57% | 43% | Stuttgart | 57% | 57% | 71% |

# Conclusions

- **Mobility behaviour of families** in cities:
  - Relatively high share of households without a car; most of them car-club-members
  - Rather low car use and high bike use compared to Mobilität in Deutschland data
  - ➢ Higher openness towards new mobility technologies and concepts?
  - City characteristics and car ownership have a big influence on modal split of the sample. Life cycles and employment status little effect.

- **Behaviour based segmentation**: Majority in cluster of cyclists and cyclists and pedestrians. Car ownership and city of residence with strong influence on clusters.

- **Methodological conclusions**
  - Homogenous sample concerning sociodemographics and geographical characteristics, small sample size: challenges for creating mobility types with statistical analyses
  - Self-selection effects

# Next steps

- Further **analyses of (quantitative) mobility diary data**:
  - Profiling the clusters with further quantitative (e.g. trip purposes)
  - Distances and times of trips, analyzes of purposes
  - Applying a **household perspective** for analyzing household mobility behaviour: develop further approaches for segmentation. Motivation:
    - Shared/inter-dependent mobility household resources (e.g. car access, bike trailers) and infrastructure/geographic characteristics. Shared trip purposes: e.g. escort trips
    - Fits research questions and research design

- **Analyzing qualitative data**
  - Motives and attitudes regarding mobility behaviour
  - Acceptance of electric vehicles and new mobility concepts

➢ Identifying Leitbilder related to the car, to mobility in general and to electric vehicles

➢ Comparison with and profiling the mobility types created from diary data.

# Thank you for listening

Uta Schneider
Fraunhofer Institute for Systems and Innovation Research ISI
uta.schneider@isi.fraunhofer.de