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

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Agenda

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

- No car; 6 hh
- One car; 12 hh
- Two cars; 4 hh

**GEOGRAPHICAL CHARACTERISTICS**

- Freiburg; 7 hh
- Karlsruhe; 8 hh
- Stuttgart; 7 hh

**District type**

- Inner-City District (< 2.5 km to centre): 5 hh
- City-Border District (> 2.5 km to centre): 17 hh
Sample description

### FAMILY CHARACTERISTICS

In total: 47 children in the households

<table>
<thead>
<tr>
<th>No. of children in hh</th>
<th>1 hh</th>
<th>6 hh</th>
<th>10 hh</th>
<th>5 hh</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Two single-mother Families

Life cycles (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**

<table>
<thead>
<tr>
<th>Household net income</th>
<th>2 hh</th>
<th>10 hh</th>
<th>10 hh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low net household income</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medium net household income</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High net household income</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Employment status**

- 15 resp. part-time
- 23 resp. full-time
- 4 resp. not employed
The respondent make **5 trips per day** on average (Mobilität in Deutschland: 3.4 trips)

Respondents 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)
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)

<table>
<thead>
<tr>
<th>City</th>
<th>Car driver</th>
<th>Car passenger</th>
<th>Cycling</th>
<th>Walking</th>
<th>Other</th>
<th>Public transport</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freiburg (N=516 trips)</td>
<td>27.4</td>
<td>14.8</td>
<td>4.3</td>
<td>17.6</td>
<td>42.1</td>
<td>32.9</td>
<td></td>
</tr>
<tr>
<td>Karlsruhe (N=519 trips)</td>
<td>5.2</td>
<td>11.8</td>
<td>2.9</td>
<td>24.9</td>
<td>32.9</td>
<td>49.7</td>
<td></td>
</tr>
<tr>
<td>Stuttgart (N=425 trips)</td>
<td>30.1</td>
<td>4.5</td>
<td>12.5</td>
<td>27.4</td>
<td>41.2</td>
<td>49.7</td>
<td></td>
</tr>
</tbody>
</table>

Comparison: Mobilität in Deutschland (infas/DLR 2010)
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)

<table>
<thead>
<tr>
<th>Car in household (N=1015 trips)</th>
<th>No car in household (N=445 trips)</th>
<th>Households with children 6 or &lt; 6 years (N=773 trips)</th>
<th>Households without children 6 or &lt; 6 years (N=678 trips)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8,9</td>
<td>17,8</td>
<td>12,4</td>
<td>10,6</td>
</tr>
<tr>
<td>27,6</td>
<td>3,8</td>
<td>33,8</td>
<td>23,6</td>
</tr>
<tr>
<td>37,8</td>
<td>32,4</td>
<td>33,0</td>
<td>38,9</td>
</tr>
<tr>
<td>21,5</td>
<td>42,7</td>
<td>33,0</td>
<td>22,3</td>
</tr>
</tbody>
</table>

- Other
- Public transport
- Car driver
- Car passenger
- Cycling
- Walking
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

  - 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

Cluster 1: Cyclists (N=12)  
Cluster 2: Car users (N=8)  
Cluster 3: Pedestrians and cyclists (N=13)  
Cluster 4: Pedestrians (N=2)  
Cluster 5: Pedestrians and public transport users (N=7)

Mean of trips

- Share of trips made by foot
- Share of trips made by bike
- Share of trips made by car
- Share of trips made by public transport
## Results: Mobility types: Profiling the clusters

<table>
<thead>
<tr>
<th>Cluster</th>
<th>Size</th>
<th>Share of resp. sharing one hh</th>
<th>Gender: Share of women</th>
<th>Place of residence</th>
<th>Car ownership: Share of resp. without car</th>
<th>Life cycles: Share of resp. with children 6 or &lt; 6 years in hh</th>
<th>Employment status: Share of resp. full-time employed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cluster 1: Cyclists</td>
<td>12</td>
<td>67%</td>
<td>50%</td>
<td>Freiburg &amp; Karlsruhe</td>
<td>17%</td>
<td>50%</td>
<td>58%</td>
</tr>
<tr>
<td>Cluster 2: Car users</td>
<td>8</td>
<td>50%</td>
<td>50%</td>
<td>Freiburg &amp; Karlsruhe</td>
<td>0%</td>
<td>38%</td>
<td>63%</td>
</tr>
<tr>
<td>Cluster 3: Pedestrians and cyclists</td>
<td>13</td>
<td>46%</td>
<td>62%</td>
<td>Freiburg, Karlsruhe &amp; Stuttgart</td>
<td>23%</td>
<td>38%</td>
<td>46%</td>
</tr>
<tr>
<td>Cluster 4: Pedestrians</td>
<td>2</td>
<td>0%</td>
<td>50%</td>
<td>Karlsruhe &amp; Stuttgart</td>
<td>100%</td>
<td>50%</td>
<td>0%</td>
</tr>
<tr>
<td>Cluster 5: Pedestrians and PT users</td>
<td>7</td>
<td>57%</td>
<td>43%</td>
<td>Stuttgart</td>
<td>57%</td>
<td>57%</td>
<td>71%</td>
</tr>
</tbody>
</table>
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

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