

# **Moving towards sustainability? The consequences of residential relocation for mobility and the built environment – methodological aspects of our experimental intervention study**

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## ***Abstract***

Our study aimed towards an improved understanding of mobility relevant decision-making processes associated with moving house. The theoretical underpinnings were transport and spatial sciences and action theory in the social sciences. In this contribution we focus on methodological issues connected with the combination of a panel survey and an experimental intervention design. We give a description, how we measured the impact of an experimental intervention on people's mobility behavior and mobility tools (cars, combined public transport season tickets) in the direction of greater sustainability in transport by means of targeted interventions.

We started with the assumption that the research questions could best be accessed and answered through a *combination of qualitative and quantitative approaches*. Thus the research project has been conducted in four steps:

1. *In-depth biographical interviews* for reconstruction of the decisive relationships and effects in individuals' mobility biographies.
2. *A panel survey* in two waves, yielding representative evidence.
3. *Experimental intervention*: one half of the survey participants has been provided with a set of information and advice relevant to mobility.

## 2 Moving towards Sustainability

4. In the last step, a *qualitative case study*, on the basis of selected participants from different target groups, has been conducted.

Most attention is given to methodological aspects and discussions about the strengths and weaknesses of methods adapted and less to detailed results. Nevertheless, some crucial findings resulting from this methodology will be presented in separate frames to illustrate data validity and reliability generated by our research design.

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# 1 Introduction

Among experts there is a broad consensus that transport policy measures implemented up to now have not succeeded in initiating the desired development towards sustainability. As a way out of this situation, people were encouraged to undertake voluntary measures. However, the discouraging result was that people still showed little willingness to change their behaviour, because it is strongly routinized, habitual practice. Are there ways to get around these habitualized patterns of daily mobility that are so disastrous for mobility management through transport policy?

Recent studies suggest that routinized behaviour becomes weakened at certain moments when people change the organisation of their daily lives, making those moments windows of opportunity to influence mobility behaviour. Examples of such circumstances of biographical change are: establishing a family, starting out with a new life partner, or moving to a new place of residence or place of work. We built our research design around this last life event. The methodological core of the project is a split experimental design coupled with a 2-wave-panel. CATI interviewing techniques have been used in these steps. They were combined with qualitative interviews in a first exploratory step and again in step 4, to cross check the results (cf. figure 1 in the appendix).

Our project has been supported by the Swiss National Science Foundation through its research programme on “Sustainable Development of the Built Environment” (National Research Programme 54).

## 2 Research questions, and hypotheses

We started with the main question: How does their mobility behavior change (individuals and households), when people relocate residentially in Swiss agglomerations? From this we derived the following subdimensions (see table 1).

*Table 1*

Research questions [at the initial stage]

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1. *What changes are made in connection with ownership of mobility tools?*
  2. How does the ownership of mobility tools affect the choice of residential location?
  3. *What is the stock of knowledge on which mobility-related decisions are based?*
  4. How can any possible intervention influence these decisions?
  5. How does being satisfied with mobility affect being satisfied with the new residential location in general?
  6. What are the differences between German and French-speaking regions of Switzerland in these regards?
  7. What are the differences between central cities and other towns in an agglomeration?
  8. *What are the differences among various mobility style types?*
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The project started out from the following working hypothesis, based on the highlighted questions (italics) above:

- at 1. There is a close, mutual relation between residential location and the mobility tools owned in a household, or the mobility biographies and mobility knowledge of central persons in the household.
- at 3. With regard to attitudes and orientations towards mobility, homogeneous groups can be identified.
- at 8. There is considerable potential for influencing the use of mobility tools and mobility behavior through providing information and advice that aims at sustainable development.

### 3 Research design

Our initial assumption was that the research questions listed above can best be answered using a skillful and creative combination of qualitative and quantitative approaches, which accords with a frequently supported postulate on research strategy. The link between the qualitative and quantitative research results in the analysis is ensured due to shared concepts, conceptualizations and research questions.

Specifically, the research design (see figure 1 in the appendix) provided

- The conducting of in-depth biographical interviews with representatives of various mobility groups in a first, qualitative step. The interviews allowed deep insights into the individual mobility biographies and thus formed an indispensable precondition for the subsequent steps of the work.
- Following from that, there was a quantitative panel survey in two waves that allowed representative findings. The panel survey was combined with an intervention (experimental approach):
- 50% of the survey participants were provided with a set of mobility-related information directly following the first wave of the panel. The second wave of the panel served (among other things) to capture differences in mobility behavior between the experimental group and the control group. At the same time, the survey participants were assigned to various mobility style groups.
- In the final step, a qualitative case study was conducted on the basis of semi-structured interviews with a limited number of panel participants. In the framework of the case study, the objective was to acquire more precise information on the effect of the intervention on the various target groups as well as to clarify remaining open questions from the evaluation of the panel.

## 4 First Step: topic-centered-interviews

Biographical research is a long-established qualitative research method, that aims at investigating one single life story with regard to as many dimensions as possible and, deriving from that, to identify typical events and processes (Lamnek 1989, 362). After having incorporated experience from literature and extracted main topics on course of life and mobility change (typical trajectories?) we conducted twelve interviews to generate further and prove existing hypotheses. The goal of these topic-centered interviews on mobility biography was to reconstruct the individual mobility biographies. This means that the interviews didn't focus on the entire biography of the participants, but instead only on (certainly diverse) aspects that through the course of the interview became evident as significant aspects of the interviewed person's mobility-related decisions. This kind of interview is a largely open-ended interview that follows a loose catalogue of question categories and thus is not highly structured (Flick 1994, 178). The individual interviews were evaluated using methods of content analysis.

It was important, that most of the various mobility styles as reported in the literature had to be represented in the sample. The core of the interview guidelines was based on the available literature on various aspects of mobility biographies and was open to the following topics:

- Interviewees' different places of residence (trajectories from childhood to the present)
- Reasons for the moves (push and pull, foresight and retrospective)
- Mobility behavior and ownership of mobility tools at the different places of residence
- Mobility-relevant knowledge
- Attitudes towards mobility
- Role of mobility when evaluating new places of residence.

In addition to that, the open form of the problem-centered interview made it possible to take up further topics that indicate relevance for the interviewee. The interviews took about two to three hours and were conducted face-to-face and not by telephone. The interviews were recorded on tape, transcribed, and evaluated by content analysis. The

summarized results (below) formed the basis of the design of the questionnaire for the panel survey.

#### **Main Findings**

- Strong connection between change of residence and change of mobility
- Travel to working place and mobility options mostly influence place of residence to choose
- Declared need for mobility advice is low
- Specific knowledge on transport is sparse (health aspects, environmental impact, security, comfort, costs/time spent)
- There is room for a personalized intervention (special target groups on the move)

## 5 Panel Study with intervention in between

Surveys of a panel design are used to assess changes over time (longitudinal analyses). In a panel survey, the same sample of participants is asked the same questions at different points in time. In the field of mobility research, the German Mobility Panel ([www.mobilitaetspanel.de](http://www.mobilitaetspanel.de)) is a good example to mention. The most common form of a panel is the household panel, in which every adult person in the selected households is surveyed annually. Switzerland has been conducting a household panel since 1999, with good success (Zimmermann/Tillmann 2004). Earlier experience in this area was highly useful for the conduct of the panel survey in the project esp. when it came to measures required in order to keep the rate of participation in the second wave of the panel as high as possible (feedback to the participants, address follow-up and maintenance). We hoped to achieve a second-wave participation rate of 75% (actually it were 73% of the participants).

The panel survey was combined with an intervention, that accounts for the experimental approach. One-half of the survey participants were provided with a set of mobility-related information directly following the first wave of the panel.

As the panel survey deals with the mobility behavior of households, the basic unit is the household. The survey was conducted with households that had recently relocated.

*Table 2*  
 Sample, selection, and origin of addresses

Group of comparison	Wave I Oct. - Dec. 2006	Wave II April - Mai 2007	city of Zurich	„Agglome- ration of Zurich“	Intervention group (N=304)	Control group (N=300)
Origin of adress						
estate agents	121	80	50	30	- 80	0
People's registration office in Zurich	955	459	459	0	224	235
People's registration office in Uster (town)	125	65	0	65	0	- 65
Total	1201	604	509	95	224	235

Wave I was based on 2671 addresses available. 1959 addresses were used for the survey, which resulted in 1201 interviews conducted. Wave II used 659 addresses and ended with 604 interviews conducted. An average contact lasted 15 minutes each wave. The response rate in wave I was approx. 50%, in wave II approx. 73%.

Sample methods relied partly on self-selection (i.e. people with contracts from estate agents 121), or were partly at random (1080). Persons living in collective households were not included and neither were persons aged below 18 years and above 70.

The firm in charge with the fieldwork was in trouble finding the according phone-numbers, with a yield of less than 150 numbers resulting from 1200 addresses. After having enlarged the prime sample towards 6000 addresses (based on persons/households who have moved during the last six month), we had at least 1350 additional phone numbers at hand.

## 5.1 Wave I

The panel survey was planned in three urban centers: Lucerne, Lausanne, Zurich. Lausanne being in the French-speaking part of Switzerland; language-regional peculiarities might have been included in the analysis. For various reasons (cooperation failed, costs increased, time delay) we had to shorten the target cities and ended up with Zurich and Uster (a small town nearby). Both municipal authorities had assured us assistance in procuring addresses of households that have moved to their areas. Legal data privacy agreements secured access to the data (6000 adresses from Zürich, 300 from Uster). First counts relied on an oversampling by 2.5 times, which turned out to be underestimated in the case of Zürich. The selected households received an announcement letter informing them that they will be contacted soon by telephone (CATI = Computer Aided Telephone Interviewing). This method has become well-established in Switzerland, not least due to cost efficiency considerations. This is the method used by, among others, the Swiss Federal Statistical Office for all large-scale studies (Swiss labour force survey, EVE, Microcensus) and the Swiss Household Panel. The interviews in both waves were done by a professional survey institute. From the most important and qualitatively best research institutes in Switzerland, we chose the institute that offered the best cost/performance ratio and with which we had worked successfully in past projects.

The interviews covered mainly the following topics:

- mobility behavior, mobility tools in their household,
- Attitudes and opinions to determine mobility style (attitudes and behavior)
- reasons for moving
- knowledge and procuring knowledge in the area of mobility
- Socio-economic data.

At the end of the interview permission to contact the participant a second time at a later date was secured.

This step was important for two reasons: First, the analysis of the data collected so far allowed us to verify the empirical design and the quality of the data. Specifically, if required, (limited) corrections could have been made of the questionnaire, as long as they wouldn't endanger longitudinal

comparison. Second, factor analysis and cluster analysis of the participants' responses on their attitudes towards mobility were performed in order to assign the participants to various mobility style groups. We expected between four and five different mobility style groups as a result, but found eight, based on three independent factors and differentiating variables.

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### Findings

Cross-checked and compared with results from the statistical survey of the population's travel behavior (Mikrozensus Verkehr 2005, conducted by the Federal Statistical Office (FSO) and the Federal Office for Spatial Development (ARE)) based on an enlarged sample of the city of Zürich (1255 persons; CATI of approx. 22 minutes) we noted relevant divergences, partly due to differences in unit (persons instead of household), partly due to difference in sample (people who had moved) and partly due to different specifications of answering categories.

*Table 3*

Vehicle ownership depending on persons per household  
[in %; sources: own survey and Microcensus 2005]

	no car	1 car	2+ cars
1 Pers., own survey	54	44	2
Microcensus 2005	65	32	3
2 Persons, own survey	43	45	12
Microcensus 2005	32	54	14
3 Persons, own survey	42	44	14
Microcensus 2005	30	46	24
4+ Persons, own survey	30	48	22
Microcensus 2005	18	57	25
all househ. own survey	46	44	10
Microcensus 2005	51	39	10

*Table 4*

Public transport travel cards depending on age of person of reference  
[in %; sources: own survey and Microcensus 2005]

Ticket age	none	GA	Half-fare travelcard	Half-fare travelcard+	season tickets	others
65+, own survey	7	32	43	26	13	3
Microcensus	16	24	21	18	18	3
50-64, own survey	12	25	49	20	22	2
Microcensus	30	10	23	17	16	4
30-49, own survey	13	15	48	19	26	2
Microcensus	26	11	23	21	18	2
18-29, own survey	11	33	45	10	23	6
Microcensus	28	20	10	13	23	6

*Table 5*

Factor analysis of attitudes towards transport modes

Mobility style group	Factor	F+B	MPT	PT
1) F+B/MPT/PT weak		-.737	-.845	-.829
2) F+B strong/MPT very strong		.468	.768	-.745
3) F+B very strong		1.360	-.817	-.655
4) F+B strong/PT strong		.595	-.659	.533
5) PT very strong		-.681	-1.179	.795
6) MPT strong/PT very strong		-.542	.622	.831
7) MPT very strong		-1.309	.792	-.778
8) F+B/MPT/PT very strong		.857	.948	.889
Total		.007	-.004	.010

Abbreviations: F+B = by foot + by bicycle;

MPT = motorised private transport; PT = public transport

## 5.2 Experiment and intervention

Although experiments are a well-established research method also in the social sciences, for practical research reasons, they are rarely used. The big advantage of an experiment is that the effects of an intervention – in our case the provision of mobility information and advice – can be measured representatively in those cases where measurement using an appropriate quantitative method is possible, as it was the case here. Interventions belong to the armory of tried-and-tested instruments used by action research approaches, and they were implemented successfully, for example, in Switzerland in the framework of the Swiss Priority Programme (SPP) Environment in traffic projects (compare also Gutscher et al. 2001).

The goal of our experiment was to evaluate the potential effectiveness of providing mobility information and advice under the circumstances of residential relocation. For this reason, the intervention took place with one half of the survey participants (chosen at random) directly after the first wave of the panel survey; the other half of the participants served as a control group.

The intervention consisted of providing individualized mobility information and advice, part of which was based on previous experience with existing instruments of mobility advice. Experiences had shown that interventions of this kind had the best chance of success when they were tailored specifically to the mobility styles of the recipients. Originally, we had planned to evaluate the data on mobility behavior collected in the first wave of the panel and to form scenarios (one of them being “business as usual”). In the end, we provided direct access to the tool. Scenarios contained information on mobility costs, travel times, and qualitative information on safety, comfort and convenience, and health and environmental effects. Using a computer-assisted tool developed within the project mentioned above, time required for this information intervention can be restricted to approximately 15 minutes per participant. Using this tool represents an added value as the individual could benefit immediately from optimizing mobility in the direction of sustainability. But the final use, as stated by the participants, turned out to be very low.

**Intervention measures**

[use of it in percent; descending order]

The set consisted of the following information and vouchers:

- one 24 hours-ZVV-ticket (ZVV being a public transport network covering the canton of Zurich) (68%) and corresponding timetable information
- bicycle map (58%) and footpath map (47%) of Zurich and the surroundings
- map indicating the shortest way from respondent's new domicile to public transport and <Mobility> stations (32%)
- access (password & username) to the tool <[www.mobilitaetsdurchblick.ch](http://www.mobilitaetsdurchblick.ch)> (25%)
- trial subscription of the CarSharing company <Mobility> for 4 months (14%)
- voucher for a trial subscription of an E-bike for 2 days (7%)

### 5.3 Wave II

The second wave of the panel served (among other things) to capture differences in mobility behavior between the experimental group and the control group. The second wave took place approximately 5 months after the first wave. The method and the institute providing the telephone interviewing services remained the same, large parts of the content as well and some new questions were covering the topics:

- changes after moving
- satisfaction with infrastructure and mobility after relocation
- evaluation of documents received (i.e. intervention measures).

The participants were again contacted beforehand by letter; the letter offered thanks and recognition for their participation in the first wave of the survey and was designed to increase their motivation to participate in the second wave of the panel. Some participants were lost for the second wave (they had moved, became unavailable by telephone, were ill or had died, others refused to participate). We expected to be able to conduct a total of 600 interviews. In other words it should have been possible to interview 75% of the original participants a second time (panel attrition reached 27% effectively). From 604 interviews conducted, we had 314 neutral dropouts (because of age, language problems, cell of quota plenished, 228 relevant dropouts (invalid number, non-contact, person abroad/moved/refused). In the end 604 interviews were available for the evaluation of the experiment, half of them without receiving mobility information and advice (intervention). Often the number proved to be too small to allow for generalized conclusions.

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**Findings**
*Table 6*

Weekly trips before and after relocation  
[zero values not included]

Group	All	Control	Control Zurich	Control Uster	Intervention total	Interv. & mob. change	Interv. registr. office	Interv. estate agents
Count N=	604	300	235	65	304	47	224	80
Work before	8.4	8.5	8.5	9.2	8.2	8	8.2	7.8
Work now	8.8	8.9	8.9	9	8.7	8.9	8.7	8.1
<b>Δ in %</b>	<b>5</b>	<b>5</b>	<b>5</b>	<b>-2</b>	<b>6</b>	<b>11</b>	<b>6</b>	<b>4</b>
Shopping before	2.2	2.1	2.1	1.9	2.2	2.4	2.2	2.5
Shopping now	2.5	2.5	2.5	2.3	2.5	2.4	2.5	2.6
<b>Δ in %</b>	<b>14</b>	<b>19</b>	<b>19</b>	<b>21</b>	<b>14</b>	<b>0</b>	<b>14</b>	<b>4</b>
Leisure before	2.8	2.8	2.8	2.2	2.8	2.5	2.9	2.6
Leisure now	3	3	3	2.2	2.9	2.6	2.9	2.6
<b>Δ in %</b>	<b>7</b>	<b>7</b>	<b>7</b>	<b>0</b>	<b>4</b>	<b>4</b>	<b>0</b>	<b>0</b>
Total before	13.6	13.5	13.5	13.5	13.4	13	13.5	13.8
Total now	14.5	14.7	14.7	13.7	14.2	14.1	14.2	14.3
<b>Δ in %</b>	<b>7</b>	<b>9</b>	<b>9</b>	<b>1</b>	<b>6</b>	<b>8</b>	<b>5</b>	<b>4</b>

*Table 7*

Mode of transport before and after dislocation

[minutes per week; outliers, i.e. 5% max. values not included]

	Intervention group (n=224)			Control group (n=235)		
	before	after	<b>Δ in %</b>	before	after	<b>Δ in %</b>
Foot	3704	4235	<b>14</b>	3301	5709	<b>73</b>
Bicycle	3867	6205	<b>60</b>	3372	4742	<b>41</b>
MPT	14277	7678	<b>-46</b>	16766	9586	<b>-43</b>
PT	28715	25932	<b>-10</b>	29684	29742	<b>0</b>
Others	865	820	<b>-5</b>	712	739	<b>4</b>
Total	51428	44870	<b>-13</b>	53835	50518	<b>-6</b>

*Table 8*

Travel to/from work and travel for leisure purposes on average  
[minutes per week by means of transport]

	Intervention group (n=224)			Control group (n=235)		
	before	after	<b>Δ in %</b>	before	after	<b>Δ in %</b>
Travel to workplace						
MPT	134.0	93.0	<b>-31</b>	157.0	137.0	<b>-13</b>
PT	177.0	129.0	<b>-27</b>	203.0	161.0	<b>-21</b>
Leisure time travels						
MPT	71.0	63.0	<b>-11</b>	70.0	63.0	<b>-10</b>
PT	73.0	65.0	<b>-11</b>	67.0	63.0	<b>-6</b>

In the intervention subgroup consisting of people who answered to have changed their mobility behaviour due to the intervention, results were as follows:

	MPT Δ in %	PT Δ in %
travel to place of work	-38	-29
travels during leisure time	-24	+22

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## 6 Case study and cross-check

Qualitative case studies have the task to throw light on complex connections and to reveal as yet undiscovered chains of effects. In particular, they can be used as a method of clarification of puzzling relations and effects revealed by quantitative analyses. The methodology examines individual cases that are as typical as possible and subjects them to in-depth analysis. All relevant aspects are captured and described by means of various methods, out of which we had chosen telephone interviews and content analysis.

In this final step, inquiry was conducted with a very limited number of panel participants: half-structured interviews with 14 persons. The main objective was to acquire more precise information on the effect of the intervention on the various target groups (change of behavior or not, significant reduction of motorised private transport). In some cases we tried as well to clarify remaining open questions from the evaluation of the panel. Permission to contact the participants for this purpose was obtained at the end of the second wave panel interview.

Respondents revealed detailed information and evaluation of the past, current, and anticipated future mobility behavior in connection with the move to the new place of residence. Special attention was given to the following questions:

- Why does the intervention trigger behavior changes in certain groups of persons and not in others?
- How must an intervention be designed in order to achieve the greatest possible effect in the selected target group?

A report has been written for each interview, based on notes taken during the phone inquiry.

Further clarification from case study:

- Reasons and arguments for moving and new forms of mobility have changed in retrospect (in contrast to what respondents said in the foresight about their motivations and intentions to move)
- Bond between attitudes (mobility stiles) and mobility behavior is weak and non-symmetrical
- Share of respondents who were directly influenced in their new mobility behavior by the intervention < 16%
- These persons showed a stronger urge for slow forms of mobility, i.e. more often they use their bicycle during leisure time, they walk to their working place, to the shop, or during their outdoor activities)

## 7 Lessons learnt (selection)

### 7.1 On the level of research design

#### Sampling technique

Although innovative at the beginning, self-recruiting didn't work under these circumstances and caused time delays and distortions in our sample, which were far from being at random. These sampling problems did not only cost a lot of money, they also influenced analysis quite a lot. Groups had to be tailored to an acceptable degree of homogeneity at the level of households and mobility conditions.

To discuss:

- what measures are at hand to optimize sample and sampling techniques?
- measures to control differences between urban and rural areas (intervening variables)?

#### „Transl(oc)ation“

We could leave aside translation problems by excluding the French-speaking towns: These problems would have occurred not only in a literal sense (for example technical issues), they'd have rather stressed different interpretation schemes as well (suitable labels for the mobility styles across different mobility cultures and infrastructure). All the same in our sample we have to concede noncoverage of language groups in households unable to communicate in (Swiss) German. Because we'd intended mainly to proof hypotheses and generate target groups, thus neglecting estimates of distribution (e.g. population parameters) was acceptable in our opinion, although township authorities might look at it differently.

To discuss:

- how can marginal groups effectively be incorporated in complex research design?

### 7.2 On the level of methods

#### Intervention

Overall measures of intervention didn't charge our budget very much, but influence wasn't as big as expected either. Asked about the appropriate incentive, people for instance voted for free seasonal tickets valid at least 6 months.

To discuss:

- why not an intervention in advance, i.e. before the move?
- other, stronger incentives and effects?

## Panel

Respondents could report subjective and objective changes in mobility behaviour, although on a rather moderate level. Closer details we probably missed: first of all we didn't get a complete picture of the situation before moving (baseline measurement), and secondly we don't know how transient mobility behaviour is, having asked only a couple of months after people's dislocation (e.g. additional shopping, leisure travels) due to address collection problems.

To discuss:

- follow up study (wave III or IV) to provide us with deeper insight into other crucial life events changing mobility patterns in a comparative perspective.

### **7.3 On more detailed levels (questions, concepts)**

Cross-checking and triangulation with other data sets was hindered by the use of different units of analysis (household vs. person) or budget restrictions (estimated minutes per week instead of geo-coded distances and no travel or trip diaries). Some other flaws could have been avoided in advance others didn't appear until final analysis had started; e.g. interviewer deficits while asking about changes in mobility tools resulted in a partial underreporting.

To discuss:

- reliability of selected operationalizations and validity of selected variables.

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# Appendix

Figure 1

