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# **Field Report: One-Week GPS-based Travel Survey in the Greater Zurich Area**

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# Field Report: One-Week GPS-based Travel Survey in the Greater Zurich Area

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## Abstract

This paper reports on a GPS-based activity diary survey accompanied by psychometric scales to observe the influence of different attitudes on mode and route choice. The survey was implemented as online questionnaire. 156 participants collected approximately one week of GPS data each; the first participant in August 2011 and the last in December 2012, all living in the greater Zurich area. Completion of the questionnaires is very diverse, but overall a very detailed GPS data set was gained, which will be very valuable in further development of post-processing routines.

## Keywords

GPS, post-processing, activity detection, mode identification, prompted recall, respondent burden

# 1 Introduction

Travel behaviour is commonly modelled using socio-demographic as well as mobility specific attributes. But there are less easily surveyed latent variables that influence behaviour. Examples of such variables are risk propensity, attitude towards the environment as well as search for variety. The goal of this study is to evaluate the influence of these attitudes on route choice behaviour with a special focus on public transport. For example, it could be analysed if different public transport lines are chosen on every day routes such as home to work.

To better observe the route choice behaviour, a person-based GPS travel survey was combined with the attitude questionnaire. Person-based GPS data has recently become increasingly popular as a basis for travel diaries (Murakami and Wagner, 1999, Wolf *et al.*, 2001, Bricka *et al.*, 2009) as they promise higher accuracy of duration and distance, increased reporting of short trips and activities. In addition, it is often argued, that GPS devices allow for longer survey periods with less fatigue effects as response burden is reduced by automatically generated diaries. The responsibility for data annotation is still given to participants and is recently mostly handled using self-guided web-based prompted recall approaches (Auld *et al.*, 2009, Bohte and Maat, 2009, Doherty *et al.*, 2006, Frignani *et al.*, 2010, Giaimo *et al.*, 2010, Oliveira *et al.*, 2011). For this study particularly the high resolution of the position data to accurately observe taken routes and the long survey period to investigate behavioural patterns were appealing.

This paper is the field report of the study and is structured as follows. First, the survey design is discussed including target group and used tools. The second part describes who actually participated and is followed by some preliminary results. To conclude, some lessons learned and an outlook on future work is given.

## 2 Survey design

This survey aimed at collecting one week of GPS data of participants living in and around Zurich. The exact study area contains all municipalities within 22 km of Zurich Bellevue, just including the cities Winthertur in the north and Zug in the south. Addresses including telephone numbers were bought from an address dealer. As age distribution of such address databases are in our experience not representative for the population, in particular older people are over represented, addresses were bought per age category.

The survey was implemented as online questionnaires, the two major parts are:

1. Psychometric scales for the attitudes towards risk, environment and change
2. The one week gps-based travel diary

These parts are described in more detail in Section 2.2 and Section 2.3 respectively. The third questionnaire concerning person and household characteristics covered basics such as age, gender, income, education level, was enriched by mobility tool ownership (e.g. cars, bikes, public transport season ticket) and concluded with questions about typical locations (home, work as well as two main shopping addresses).

### 2.1 Survey process

The survey was conducted between August 2011 and December 2012, and the design of the survey was changed early 2012. Following, both process designs and the reasons for the changes are described in detail. The six main steps of the survey process and their differences in the two designs are outlined in Table 1. Technical details of the survey are addressed in Section 2.4.

The first two steps, constituting the recruitment of participants, remained the same in both designs. First, an introduction letter was sent out explaining the aim of the survey and announcing the recruitment call. Typically, participants were called 2 to 7 days after receiving the letter. All recipients were called up to 5 times over several days. After 5 unsuccessful calls the person was categorised as non-responsive. If the call was successful it was first checked that the person answering the phone is the recipient of the letter. Referencing the introduction letter, the goals and design of the survey and particularly the contribution expected from participants were explained in detail. No incentives were offered. If the person refused participation the reasons for doing so was recorded whenever possible. If the person agreed to participate the one week survey period was scheduled.

In the original design, a time and location chosen by the participant was scheduled to deliver the survey equipment. In the alternative design, the equipment was sent by mail. The survey equipment included the GPS logger, a charging device, a self-addressed postpaid envelope (original design), access information for the survey website and a brochure again explaining the motivation of the survey and the handling of the website elements.

The pre-survey meetings usually lasted 30 to 90 minutes depending on the interest of the participant. During the meeting, the handling of the GPS logger and the different parts of the website were introduced. The focus was on the usage of the GPS-based prompted recall diary that was demonstrated using an artificial example created for every participant. The example contains common errors like missing signal during rail trips or tunnels where stages have to be merged, wrong mode identification that have to be corrected and randomly occurring wrong points that were not filtered by the post-processing. At the end of the interview, the participants were given a phone number and an email address where they could reach the survey team in case of any problems or difficulties. From the side of the survey team they were only contacted again if necessary.

Our experience showed that the artificial example, even though constructed from real data, only helped participants partly in understanding their own tracks. Further, many participants had only little time and did not want the assistants to introduce them to the web-survey in depth. This was one of the reasons why the in person meeting was postponed to the end of the survey in our second design. Without the preliminary instructions participants fully relied on the information in the brochure. Further help was available through the web-site which contained content-related but also extensive technical information on how the survey had to be filled out. Still, the main advantage of meeting after the survey period was, that assistants were able to provide instructions on actual data of participants or they could even help filling out the complete diary. These meetings lasted 15 to 60 minutes, depending on time reserved by the respondent and on the status of the questionnaires. Another advantage was that devices could be fetched directly, especially as originally they were not always sent back immediately. And third, concluding the survey with a meeting resulted in less postponing of the survey period.

To support these changes in survey design, the survey material was slightly adapted as well. On the one hand, a few simple diary pages were added to the brochure and participants were encouraged to take notes. This was a precaution as the transmission of GPS data did not always work as desired. On the other hand, the design of the web-based prompted recall interface was modified as explained in detail in Section 2.3.

## 2.2 Psychometric scales

The development and implementation of the psychometric scales has been extensively described by two of the authors in Rieser-Schüssler and Axhausen (2011) in the context of a pre-study, and is summarised in this section.

Corresponding to the three attitude domains that are investigated in this study, three separate scales have been developed: one measuring the risk propensity of the respondents, one addressing their attitude towards the environment and environmental protection and one quantifying the level of variety the persons seek in their life. Each scale is presented to the respondents with a 5-point agree-disagree scale. To minimise effects resulting from the order of the scale items, their order is determined randomly with three different random orders for each scale.

### *Risk propensity*

There is a growing understanding in risk propensity research that a person's degree of risk taking does not only depend on individual, group and cultural factors but also on the domain in which the risk occurs. While it is still an open research issue whether this is caused by variations in the attitude towards risk over different domains or by varying perceptions of risks, Weber *et al.* (2002) argue that for the modelling and prediction of risk behaviour this distinction is irrelevant and that it is sufficient to observe the person's risk behaviour in the domain of interest. The risk propensity scale used in this study is shown in Table 2. It combines a reduced version of the domain specific risk propensity scale by Weber *et al.* (2002) with seven additional items for transport related risks. Overall, the scale contains 42 items covering the domains social, ethical, recreational, financial, health/safety and transport-related risks.

### *Environmentalism*

Due to the increasing awareness of environmental issues, a lot of work regarding the measurement of environmentalism has been published in recent years. One of the earliest and most well-known studies is the land-use and transport behaviour study by Kitamura *et al.* (1997) who measured environmentalism using a 10 item scale. Subsequently, Schultz (2001) argued that environmental concern has to be differentiated between concern for oneself, other people and the biosphere because different values and awarenesses of harmful consequences are attached to them. Gatersleben *et al.* (2002) investigated the relationship between environmental attitudes and beliefs, socio-economics, social science indicators of pro-environmental behaviour and measurements of direct and indirect energy consumption. Following the theory of planned behaviour (Ajzen, 1991), Anable (2005) developed a 105 item scale to examine the influence of habits, moral norms, environmental attitudes, felt efficacy and perception of other persons' behaviour on mode choice and showed that the mode choice behaviour of different attitudinal population segments is indeed very different. After reviewing, amongst others, the scales of

these authors, the scales used by Gatersleben *et al.* (2002) and Kitamura *et al.* (1997) were judged to be most appropriate for the study at hand. To use the advantages of both scales, they were combined into the 25 item scale presented in Table 3 that takes into account general concern for the environment, awareness of consequences for oneself, others and the biosphere and the evaluation of measures for environmental protection.

### *Variety seeking*

Compared to the variety of studies employing measures for environmentalism relatively little research has so far been directed towards the quantification of variety seeking and its incorporation in models for daily transport behaviour. The few studies aiming in this direction investigate the phenomenon of travel for its own sake, i.e. undirected travel or travel with unnecessary detours (e.g. Mokhtarian and Salomon, 2001). A wider recognition of the influence of variety seeking on travel behaviour can be found in the tourism literature (Bello and Etzel, 1985, Niininen *et al.*, 2004). Since none of the scales reported in the literature was completely satisfactory, we constructed our own scale including some of the questions reported by Mokhtarian and Salomon (2001). The variety seeking scale reported in Table 4 contains 28 questions measuring the desire for variety in the daily routine in general and in shopping, eating, recreational activities and transport behaviour in particular.

## **2.3 Web-based prompted recall interface**

The main parts of the prompted recall interface are visualisation of the collected data, presentation of the travel diary, and editing of activities and stages.

In this section, first, the original prompted recall interface is presented, which is an all-in-one stage-centred approach. Based on our experience with this GUI we implemented some improvements, at the time we changed the survey design. The result was an activity-centred approach that consisted of two consecutive steps.

### *All-in-one survey - stage-centred*

In the all-in-one user interface (Figure 1) participants first choose the day they want to review from a drop-down menu. All GPS points - or for performance reasons every n-th point - of the chosen day are presented on an interactive map; the timestamp for each point can be accessed by clicking on the respective point on the map. GPS points of the same stages are depicted in the same colour, stop points are shown in green. In addition, the diary information is presented in a table below the map. Each diary entry consists of a stage and the subsequent stop point. The attributes for each diary entry contain the start and end time of the stage, the chosen mode, travel costs, the characterisation of the stop point - activity purpose or mode change - and, finally, the

location of the stop point can be chosen from a list of personal locations. Respondents can add locations before or during filling out the diary. A location is defined by a description and its complete and geocoded address. If the address is not known it can be derived using reverse geocoding.

Participants use the table to review and confirm or correct the diary entries and their attributes. They can delete and add diary entries, i.e. pairs of stage and stop points and change all the attributes provided.

#### *Two-step survey - activity-centred*

In the two-step survey, choosing the day as well as the handling of the map is the same as in the all-in-one survey. The diary is still presented as table, but activity and stage variables are not corrected in the same step, therefore, more space is available to provide helpful input and interaction in the two separate steps.

In the first step, participants only correct activities (Figure 2). To help distinguish activities on the map, they are shown in different colours and stages in between are shown in grey. The following improvements were implemented: First, data is presented in a more intuitive way: starting with where the activity took place, followed by what was done from when to when and additionally the duration of the activity is displayed. The duration should help to understand the pre-processed diary e.g. if the duration is 3 minutes one might realise quicker that it is a mode transfer point, and it should also help to detect erroneous time specifications by participants. Second, adding locations was simplified by providing the possibility to create a location for a specific activity, the location pop-up uses the GPS coordinates of the activity as a suggestion for the location coordinate.

In the second step, stages are corrected (Figure 3), therefore stages are depicted in colours and activities in grey. As times and locations are already specified in the first step the trip is presented as text containing the information where the trip started and where it ended, when it started and ended and again duration is included. Participants then only have to specify the travel mode, number of passengers and cost.

## **2.4 Technical details and data flow**

To collect GPS data a dedicated device was used (MobiTest GSL (MGE DATA, 2012)). GPS points are sampled every second. Additional to the three-dimensional position and timestamp, vertical and horizontal accuracy and number of satellites in view were logged. Further, the three dimensional acceleration is measured at 10 Hz by the internal accelerometers. The devices were



equipped with a SIM-card that enabled sending the data over the GSM network.

Figure 4 depicts the data flow detailed below. Participants were instructed to carry the GPS device for one week and charge it every night. When the device was charged transmission of the data to the ftp-server was triggered. Unfortunately, this did not always work as desired. If no data was sent, it was downloaded directly from the device and uploaded on the server. Every four hours, raw data was filtered and smoothed, which is the first step of typical GPS post processing routines, and then stored in a central MySQL database. The automated post-processing routines that were used are published open source (POSDAP (2012)) and are described in detail in Rieser-Schüssler *et al.* (2011) and Schüssler and Axhausen (2008). The three main steps executed are the filtering and smoothing, detection of stop points and stages followed by mode identification. Generation of the travel diary based on the GPS data was done once at night. As soon as post-processing was concluded the diary could be corrected by the participants on the survey homepage.

Apart from the survey homepage two administrative tools had to be developed: the telephone list to facilitate recruiting and a tool to observe the survey status of participants. Both were implemented as OpenOffice™Base user interface with direct connection to the central survey database. At first we worked with a non-central spreadsheet, which got very confusing even though only one person worked with it. It was therefore quickly replaced by the entry mask depicted in Figure 5. The telephone list had two main purposes, first, to provide all relevant information to make a call, and second, to keep track on how often, when and by whom potential participants had been called. The mask consists of the navigation-bar on top, information on when the introduction letter was sent out, recipient information (telephone obviously, age category as well as address, which is important for the assistant when scheduling the meeting) as well as recruitment information (number of calls, date of the last call, last callee, comments about the call or meeting schedule). The mask to track progress of participants simply consisted of some general information on the participant and if he logged in, and information on the completion level for each questionnaire.

### 3 Survey execution

Response burden as suggested in Axhausen and Weis (2010) was calculated to be approximately 1360 points split as follows on the three survey parts: 66 points for the sociodemographic questionnaire, 190 points for the three psychometric scales and the majority of the burden caused by the travel diary with around 1100 points. No incentives were offered and burden is comparatively high, therefore response rate were expected to be moderate.

In total, 1134 persons were contacted by telephone between 6 and 8 in the evening, of those 176 (16 %) agreed to participate, 133 persons (12 %) were not reached. Figure 6 reports, that young people are both less likely to be reached and less likely to participate. From the 176 persons agreeing to participate 156 (14 %) collected data for at least three days, and were therefore classified as valid. Month of data collection is shown in Figure 7. The peaks in October 2011 are due to the highest number of student assistants working for the survey at that point, and the peak in June 2012 is the period where one assistant worked almost full-time.

A comparison of respondents of this survey and the microcensus (Swiss Federal Statistical Office (BFS) (2005)) is given in Table 5. It was expected that GPS devices are more accepted with younger people, this does not seem to be the case as people over 55 are well represented whereas younger people below 25 are highly underrepresented with 1.3 % in this study compared to 20.3 % in the microcensus. The most interested group are the 45 - 54 year olds, who are well reached by phone and over 20 % accepted to participate. At first sight it looks like females were less willing to participate (42 %), but having a look at the addresses revealed that the share of addresses of females was also 42 %, therefore, willingness to participate is very similar. Our respondents were wealthier, better educated and lived in smaller households, than a representative sample of the swiss population. However, this is a common finding in our transport studies. Furthermore, the share of public transport ticket owners is higher than in the microcensus, this could be due to the study area but also because of public transport aspect of the study goal.

## 4 Results

### 4.1 Psychometric scales

In order to examine the suitability of the psychometric scale results for subsequent choice modelling, a factor analysis was conducted for each of the three scales. The results of these factor analyses are presented in Tables 6, 7 and 8. To improve readability, only the factor scores with an absolute value of at least 0.4 are shown. The factor analysis was conducted with SPSS and the best results were achieved using a principal component analysis and a Varimax rotation with three factors for the risk propensity and variety seeking scales and 4 factors for the environmentalism scale.

Since the risk propensity scale covers such a variety of domains, the three main factors identified in the factor analysis explain only about 28% of the variance. They do, to a certain extent, follow the domains specified beforehand. The first factor mainly covers *health related risk* such as engaging in unprotected sex outside of a relationship, rarely wearing a seatbelt or habitual smoking. The second factor is a very mixed factor. On the one hand it entails items that are concerned with *recreation and transport related risks* – e.g. going on vacation without booking ahead or preferring risky public transport connections – on the other hand it contains the two items for taking a risk for a friend. The third factor summarises several of the *social risks* addressed by the scale items.

The four main factors for environmentalism shown in Table 7 explain about 52% of the variance in the data. The first factor describes the respondents' *agreement with measures to reduce car emissions*. The second factor characterises an *awareness of the negative consequences* of environmental pollution and our responsibility to restrict behaviour that is harmful to the environment. The third factor summarises more of an *overall concern about the environment* whereas the fourth factor shows a certain *expectations that others*, e.g. the government and companies, *step in* and provide better circumstances for environmental protection.

For variety seeking, about 37% of the variance is explained by the three main factors found in the factor analysis. The first factor describes a *interest in varying one's daily routine* through small changes such as trying out new routes to familiar destinations or trying out new food when eating out. The second factor is similar but puts a stronger emphasis on the *spontaneity, liking for surprises and for meeting new people*. The third factor captures a *desire for making new experiences* with other cultures but also at a smaller scale such as trying out new sports or music.

The factors identified in the three factor analyses all represent interesting approaches for an attitude based classification of the respondents. They are therefore suitable for the usage in latent variable and class models.

## 4.2 One-week travel diaries

For the analysis of the diaries, information reported by respondents is used. Data was extensively checked and manually corrected if necessary by the survey team. All information is available on stage level. Where a stage is a building block of a trip that is covered by exactly one means of transport. For analysis stages were consolidated into trips, that is consecutive stages which are connected through a mode transfer stop point are merged. Activities without annotated trip purposes are assumed to be mode transfers if shorter than 3 minutes, otherwise they were flagged as unknown. Trip purpose of trips leading home are assigned the purpose in between two home-activities that is carried out longest. Home-home trips without activities in between are assigned to leisure.

The data set consists of 1039 person days. In total 7233 stages are observed that are part of 5284 trips. Figure 8 compares the number of trips per day and person for each trip purpose to the microcensus (Swiss Federal Statistical Office (BFS) (2010)). It can be seen that leisure trips are comparable. There are more work trips in the survey than in the microcensus, this can be explained by the higher share of fulltime employees in our survey (50 % vs. 38 %, Table 5). Underrepresentation of education trips are probably due to the much higher share of young people in the microcensus. Remaining issue are many trips without knowing the purposes (Other and Unknown), one can assume, that these are probably not work trips as such trips could be identified, for participants providing very little information on their diary. It has to be kept in mind, that the sample size of our survey is small. In that perspective results are reasonable.

Comparing the mode shares shows even better results, both for number of stages (Figure 9) and for travel time (Figure 10). Travel time excludes waiting and mode transfer times. As modes are easier identified during manual processing, the share of unknown modes is much smaller than was the case for trip purposes. Most modes have a slightly higher share in the GPS survey. Except for walk stages, where the share of both in number and in travel times is much smaller than in the microcensus. It has to be checked if many access stages were lost due to the cold start problem. Further, the share of tram and bus stages is slightly higher but interestingly their share of travel times is lower, this might be influenced by wrong travel time estimations and by the higher density of the public transport network in the survey area. Overall, mode share results are good.

## 5 Conclusion and Outlook

Conducting such an extensive survey needs a lot of effort and attention. Realisation with part-time assistants and therefore spreading it over a long time period is not ideal. Our main finding, that might be obvious to experts, is that full-time workers are needed, and we consequently recommend to concentrate survey periods to predefined weeks. In such a setting, we assume it to be easier to maintain a hotline and actively attend participants, which sometimes requires trying to contact people every day. Small things like reminder calls are easily lost sight of, if not immediately successful and if other projects are worked on in parallel.

One of the goals when using GPS data is reduction of response burden, achieving this highly depends on the display and handling of the prompted-recall diary. Our prompted recall diary has room for improvement both in design and in performance. For example, the reason for showing individual GPS points was to render it possible for respondents to correct start time and duration of activities. This was also the driving force of having all points of one day on the same map, as points before and after a detected activity or stage are need for corrections. In retrospective, this is too much information for unexercised users. It made the map confusing in several situations, for example if activities outside consisted of many GPS points, or routes that are travelled several times a day covering each other. If the signal is bad, processing routines do not always produce reliable results, information in the diary does not correspond anymore to the diary in respondents' recollection; but unfortunately these are the situations where most input is needed from them.

To simplify correction of diaries several options can be considered. First, it has to be checked if letting people changing start and endtimes is necessary. If not it might be better to show map-matched trips than tons of GPS points. Further, it might be reasonable to present only diaries that are evaluated to be reasonable (e.g. not too many trips), otherwise respondents are asked to reconstruct the diary from scratch, which might be less confusing than a badly prefilled diary. For this, but also in general, extension of our routines with an activity type detection module will be crucial. Stages could then be merged to trips and main activities might help people recognising their day quicker. Finally, the quality of the GPS tracks and the quality of the stage and stop point detection are key to the reduction of response burden. In the future probably more and more GPS data sets will be collected by Smartphones, ensuring good quality will be a major challenge, especially if different Smartphones and therefore different GPS sensors will be used.

Possible effects of the described changes in the survey design (as summarised in Table 1) should be evaluated. First perception is, that the quality was improved by changing the design, but

admittedly, more people just filled in the rudimentary diary of the brochure and the student assistants completed the GPS diary afterwards.

As overall the quality of the corrections was very diverse, all diaries were double checked by us. The majority of diaries needed some additions, which is definitely not cost-effective for large survey samples. Efforts and reminders during the survey period are therefore extremely important. However, with only a few well reported days and maybe some comments from participants a complete diary can be reconstructed manually with high certainty. With no input at all on the other hand corrections are rather uncertain. Especially with immobile days it is unclear if a device was just forgotten at home, or if the respondent actually stayed home. This aspect should definitely be incorporated in GPS-based surveys. A more detailed analysis of the changes made by participants and changes that had to be made by us is planned.

The data set should be used to estimate route choice models incorporating the attitudes towards risk, the environment and change, especially focusing on public transport routes. To conclude, we can now validate and improve the GPS processing routines with this more variable data set compared to the pretest data set which we used before.

## 6 Figures and tables

Figure 1: Stage-based all-in-one GUI

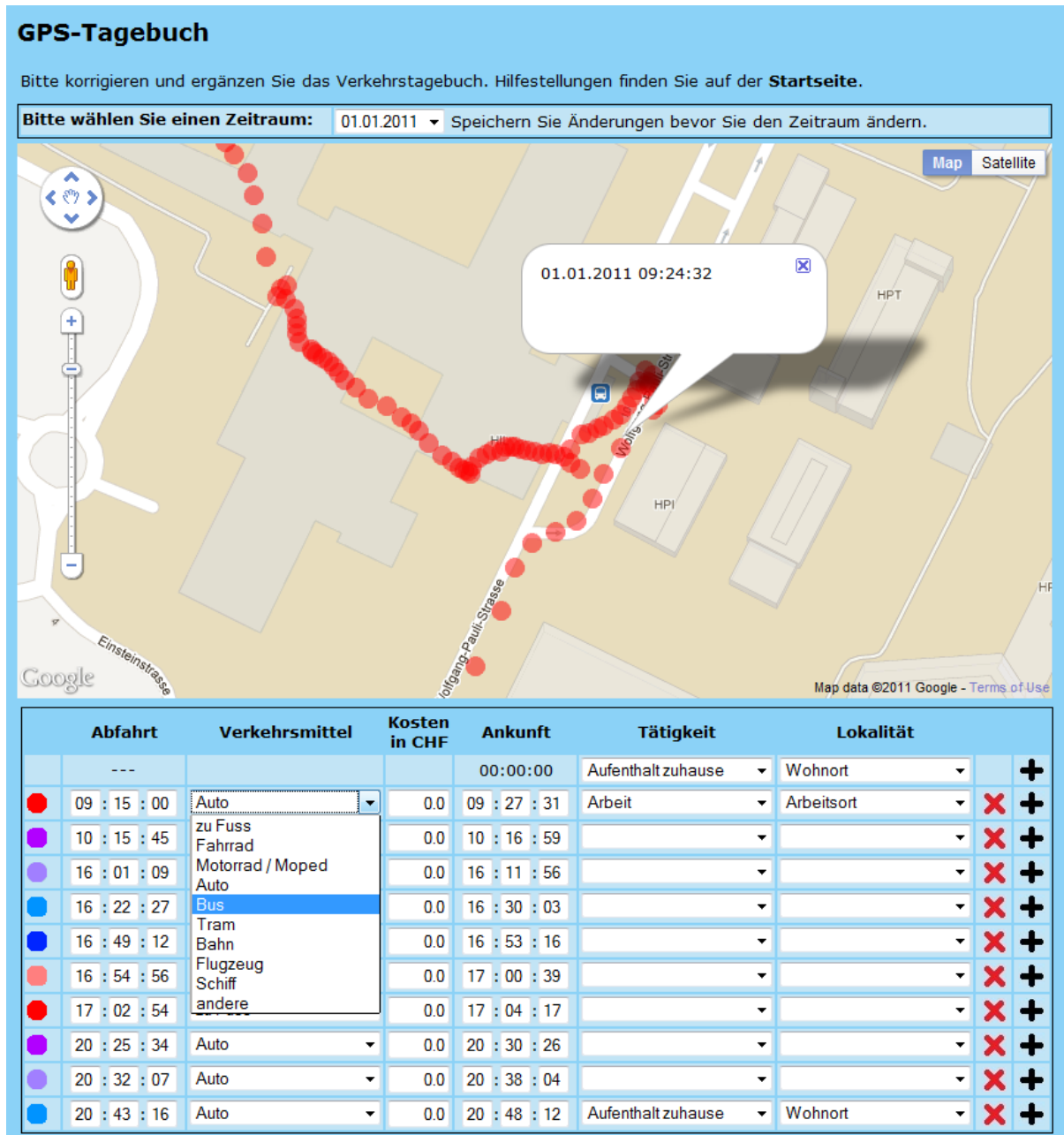


Figure 2: Two-step GUI: activities

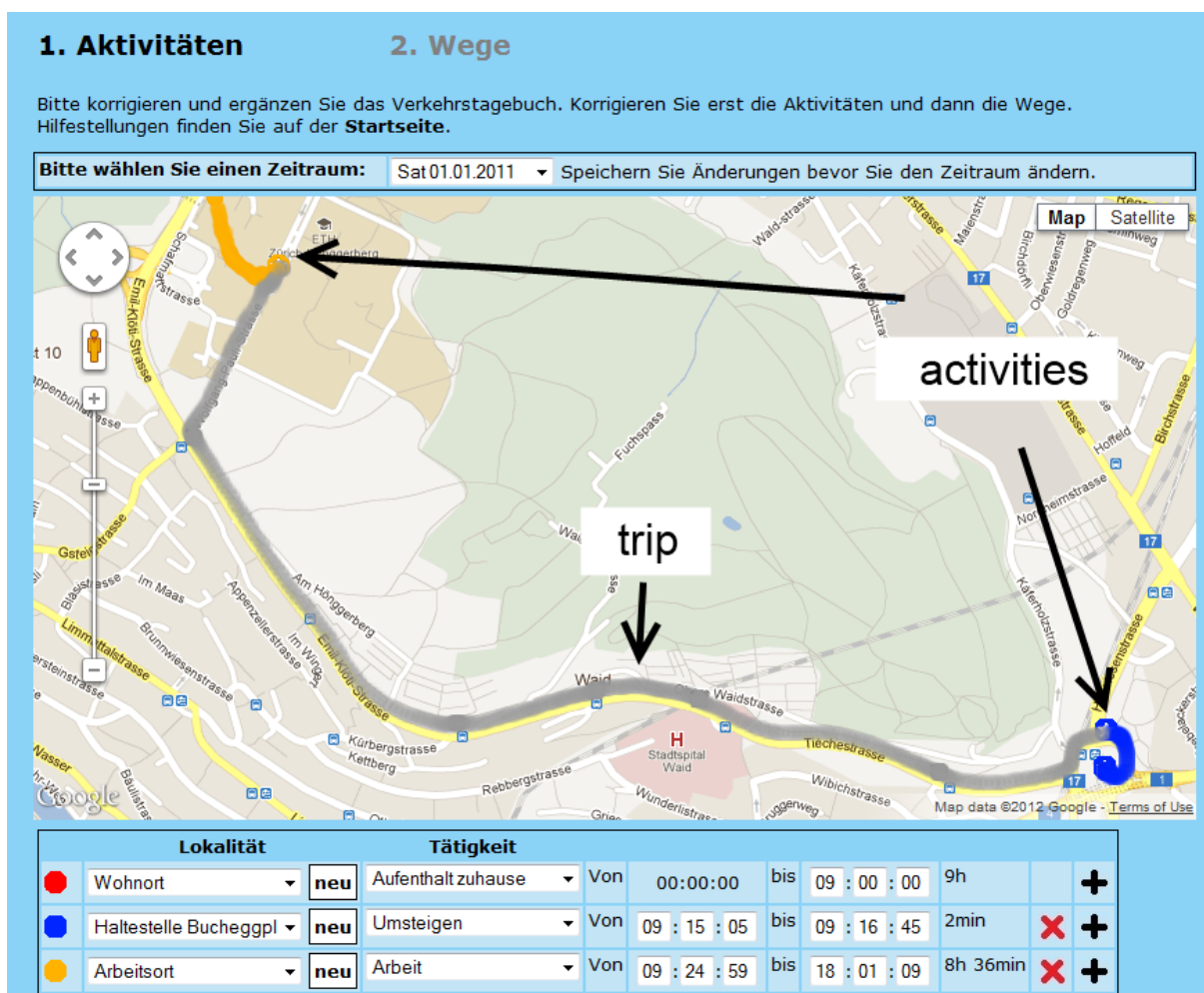




Figure 3: Two-step GUI: stages

**1. Aktivitäten**
**2. Wege**

Bitte korrigieren und ergänzen Sie das Verkehrstagebuch. Korrigieren Sie erst die Aktivitäten und dann die Wege. Hilfestellungen finden Sie auf der **Startseite**.

**Bitte wählen Sie einen Zeitraum:** Sat 01.01.2011 Speichern Sie Änderungen bevor Sie den Zeitraum ändern.

	Weg	Verkehrsmittel	Anzahl Begleiter	Kosten in CHF
●	Von Wohnort nach Haltestelle Bucheggplatz   Abfahrt um 09:00:00 - 09:15:05 (15min)	Bus	0	0.0 Fr
●	Von Haltestelle Bucheggplatz nach Arbeitsort   Abfahrt um 09:16:15 - 09:24:59 (9min)	Bus	0	0.0 Fr

Figure 4: Data flow: Integration of dedicated GPS device, ftp server, homepage and the central survey database.

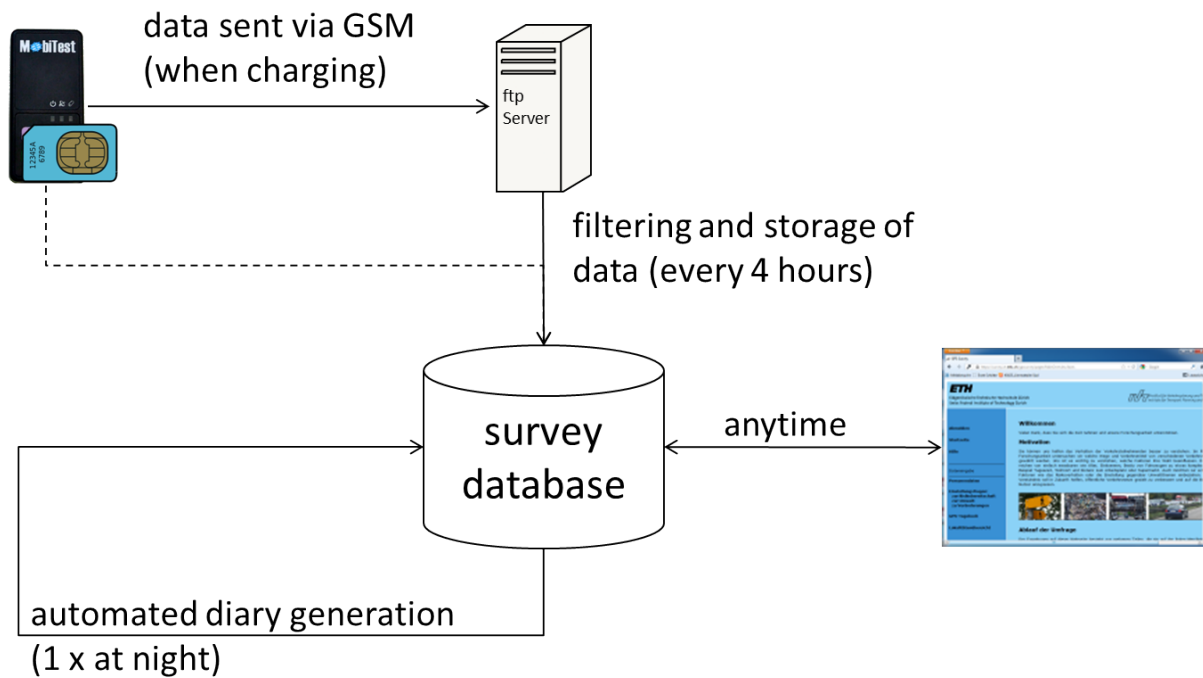


Figure 5: Administration tool: telephone list

SurveyAdministrationGdb - TelephoneList (read-only) - OpenOffice.org Base: Form Design

HiWi Name: laza

Record 11 of 993

Versand Vorwarnbrief	20.07.11	Telefonnummer	044/633 30 88	Adresse	Herr Fritz Muster Wolfgang-Pauli-Strasse 15 8093 Zürich
addressStatusCode	3	Alterskategorie	65-69		
Kommentar:	Vorwarnbrief				

**Rekrutierung**

letzter Anruf: Rekrutierung 25.07.11 06:00 2 Mal

letzter Anrufer: Ilona

Teilnahmestatus: 1 Teilnahme - Termin

Kommentar: Rekrutierungsanruf Hat an ETH studiert und kommt deshalb gerne vorbei.

Kommentar: Termin 26.7.17:00 vor Laden, Höggerberg

E-Mail: muster[at]email.com

Klicken um Link zu kopieren (Clipboard): pu://www.map.search.ch/8039 Zürich

**Erinnerung (für Änderungen Teilnehmer Admin)**

letzter Anruf: Erinnerung 0 Mal

Kommentar: Erinnerungsanruf

**Mögliche Teilnahmestatus**

- 0 leerer Code
- 1 Teilnahme - Termin
- 2 Teilnahme ev. - E-Mail / Telefontermin
- 3 keine Teilnahme: Krankheit
- 4 keine Teilnahme: Tod
- 5 keine Teilnahme: Sonstiges
- 6 Sprach- / Verständigungsprobleme
- 7 Anrufbeantworter (nach 5 Versuchen)
- 8 Fax
- 9 Nicht erreicht (5 Versuche)
- 10 unter 18 Jahren
- 11 keine weiteren Kontaktaufnahmen gewünscht
- 12 keine Teilnahme: kein Computer
- 13 in Bearbeitung / Recherche

Teilnahmestatus	Adresszeile 2 (Name)	Alterskategorie	#Rekrutierungsanrufe
9		40-44	40-44
12		65-69	
13		55-59	
5		60-64	
5		40-44	
5		40-44	
6		30-34	
13		40-44	
12		70+	
1	Fritz Muster	65-69	
0		60-64	
9		30-34	
5		25-29	
1		40-44	
13		45-49	
5		70+	
13		40-44	
2		70+	
0		50-54	
5		50-54	
1		18-24	
0		40-44	
0		30-34	
5		45-49	
0		40-44	
5		25-29	
5		45-49	
5		70+	
0		35-39	
5		40-44	
5		45-49	
0		55-59	
5		30-34	
0		45-49	
5		25-29	
0		50-54	
0		18-24	
13		50-54	
0		65-69	

Record 11 of 993 (1)

Figure 6: Response according to age category as given by address data file

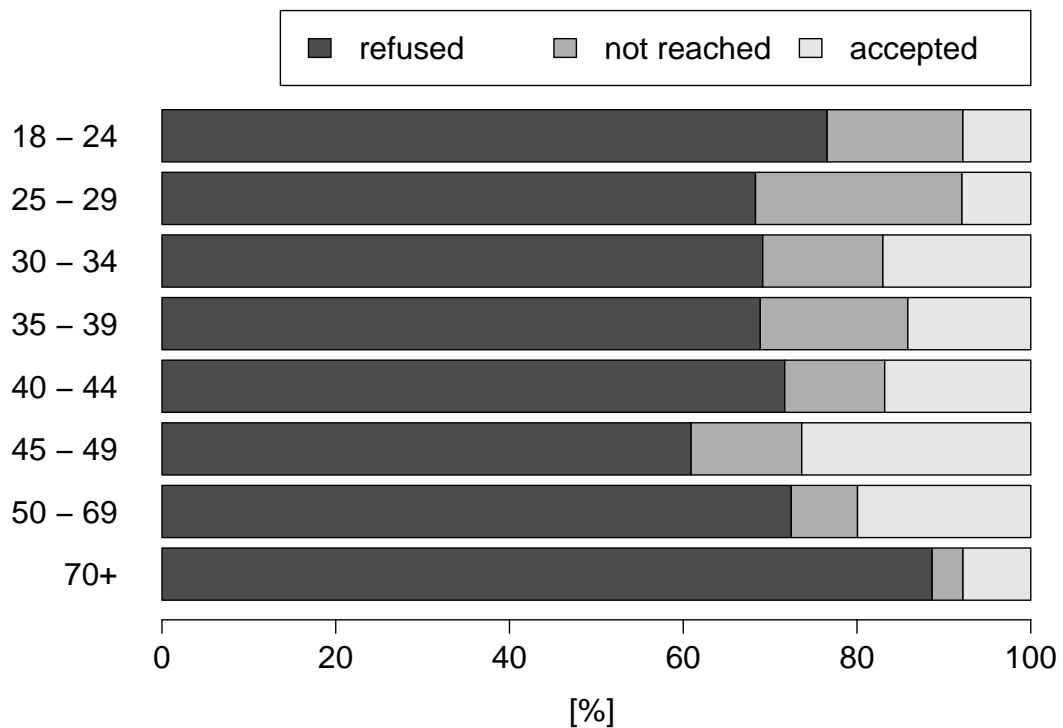


Figure 7: Number of participants starting the survey per month

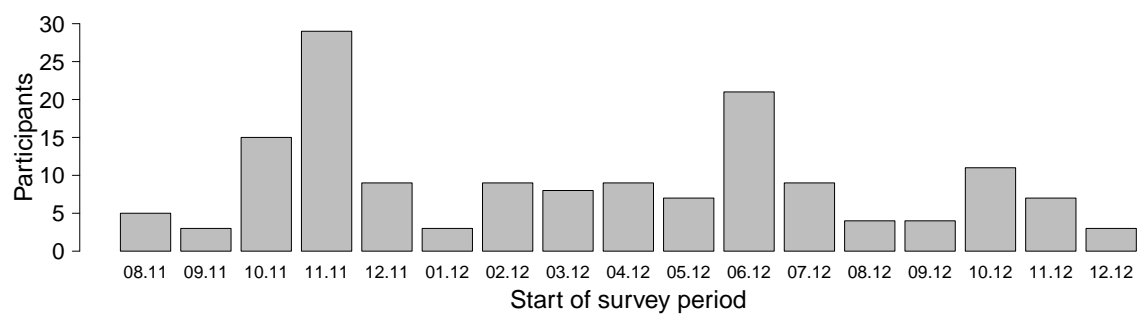


Figure 8: Comparison to the microcensus 2010: Trip purpose, number of trips per day and person

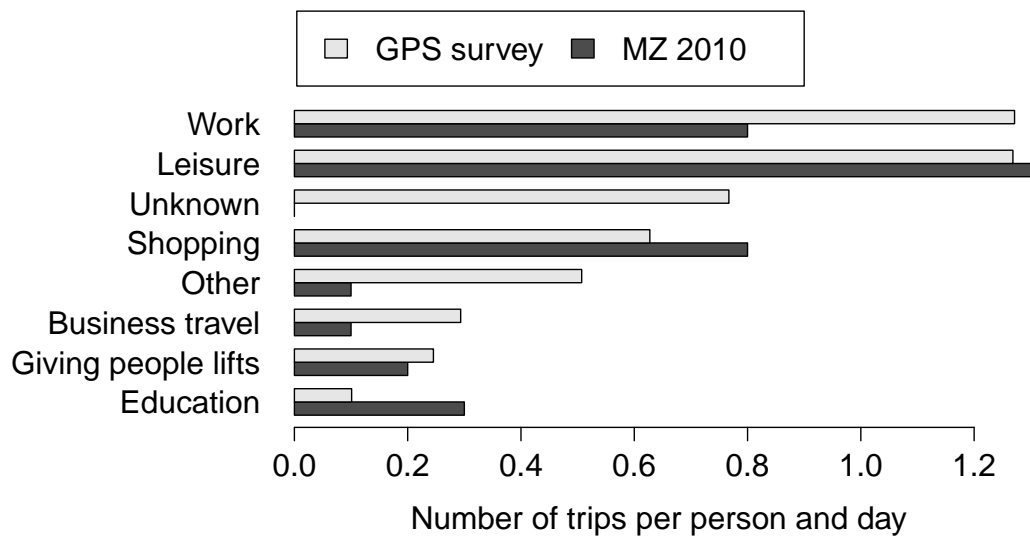


Figure 9: Comparison to the microcensus 2010: Share of stages per mode

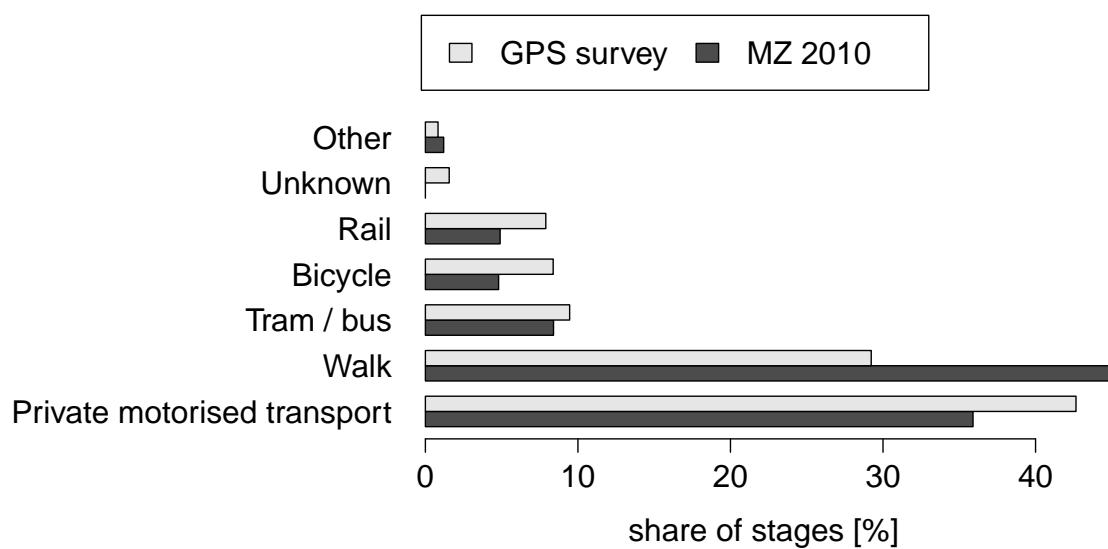


Figure 10: Comparison to the microcensus 2010: Travel time share of modes

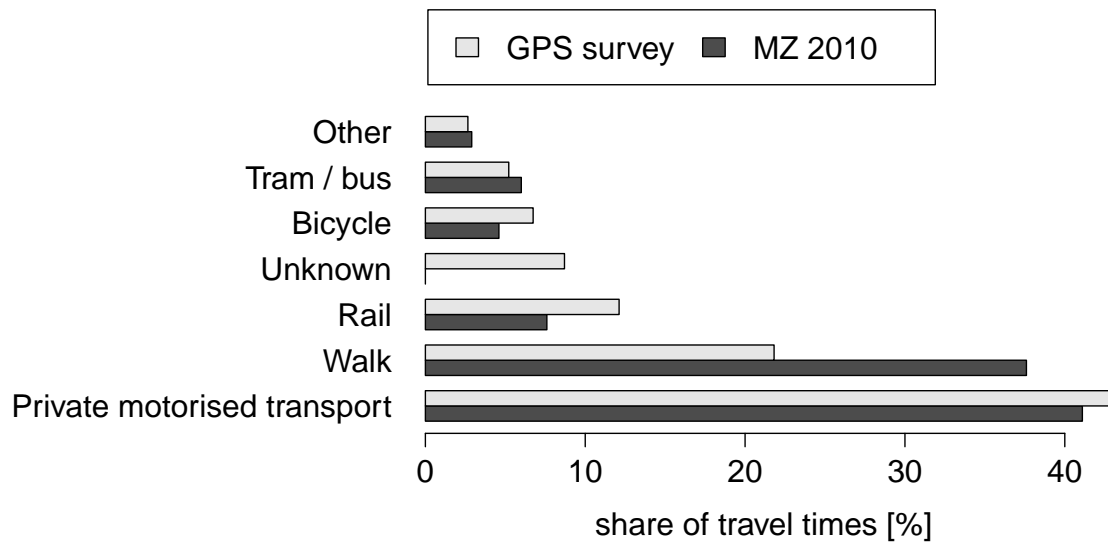


Table 1: Survey process

	August 2011 - January 2012	January 2012 - December 2012
Introduction letter	✓	✓
Recruitment phone call	✓	✓
Equipment delivery	in person	by mail
Introduction to survey	in person	help page and brochure
Assistance data collection	phone / e-mail on request	in person after collection period
Returning equipment	by mail	fetches in person

Table 2: Scale items measuring the attitude towards risk

Code	Question
R1	I admit if my taste differs from that of my friends *
R2	I argue with a friend if we have different opinions *
R3	I ask my boss for a raise when I think that I earned it *
R4	I would date a coworker *
R5	I would openly disagree with my boss in front of my coworkers *
R6	I speak my mind about unpopular issues at social occasions *
R7	I wear unconventional clothes *
R8	I would cheat a fair amount on my income tax *
R9	I still drive home after I had three drinks in the last two hours *
R10	I would forge somebody's signature *
R11	I have used cable TV without paying for it *
R12	I use office materials provided by my employer for private purposes *
R13	I would shoplift a small item (e.g. a lipstick or a pen) *
R14	I have at least once used illegally copied software *
R15	I go camping in the wild *
R16	I ski down slopes that are too difficult for me *
R17	I would like to do a safari in Kenya *
R18	I would go whitewater rafting at high water in spring *
R19	I would go on a 2 week vacation in a foreign country without booking ahead *
R20	I engage in dangerous sports, e.g. paragliding *
R21	I tried out bungee jumping at least once *
R22	I eat food that is beyond its expiration date if it still looks good *
R23	I ignore pain as long as possible before consulting a doctor *
R24	I rarely use sunscreen before sunbathing *
R25	I rarely wear a seat-belt *
R26	I would engage in unprotected sex outside a relationship *
R27	I usually ride my bike without wearing a helmet *
R28	I smoke at least one packet of cigarettes per day *
R29	I would co-sign a loan for a new car for a friend *
R30	I would invest 10% of my annual income in a blue chip stock *
R31	I would invest 10% of my annual income in speculative stocks *
R32	I would invest 10% of my annual income in government bonds *
R33	I would lend my best friend an amount of money equivalent to one month's income *
R34	I would bet a day's income in a casino *
R35	I would accept a job that is paid solely based on commission *
R36	I always take the latest possible public transport connection to the train station
R37	I start earlier if I assume that there will be congestion on my route
R38	I prefer public transport connections with very short transfer times
R39	If I don't know the way I just start into the general direction and search my way step by step
R40	I avoid streets that are occasionally congested
R41	I start earlier if I have to drive an unfamiliar route
R42	I try to be at the airport at the latest possible time

(\*) Source: Weber *et al.* (2002)

Table 3: Scale items regarding environmentalism

Code	Question
E1	I worry about environmental problems *
E2	Too much attention is paid to environmental problems *
E3	Environmental problems are exaggerated *
E4	The attention for the greenhouse effect is exaggerated *
E5	I am optimistic regarding the state and future of our environment *
E6	Environmental pollution affects my health *
E7	Environmental problems have consequences for my life *
E8	I can see with my own eyes that the environment is deteriorating *
E9	Environmental problems are a risk for the future of our children *
E10	Saving threatened species is unnecessary luxury *
E11	We should be careful with our environment because we depend on it *
E12	Vehicle emissions increase the expenses for health care **
E13	Environmental protection starts with myself *
E14	People who do not care about environmental protection avoid their responsibilities *
E15	Behavioural change requires more environmental friendly products *
E16	Behavioural change requires a right example by the government *
E17	Pro-env. beh. is only useful if everybody cooperates and I don't think this will happen *
E18	Environmental protection costs too much **
E19	Environmental protection is good for the economy **
E20	Jobs are more important than the environment **
E21	Stricter vehicle smog control should be enforced **
E22	The price of gas should be raised to reduce pollution **
E23	Using tax dollars to pay for public transport is a good investment **
E24	There should be incentives for using electric vehicles **
E25	Who causes environmental damage should pay to repair it **

(\*) Source: Gatersleben *et al.* (2002)

(\*\*) Source: Kitamura *et al.* (1997)



Table 4: Scale items evaluating the variety seeking tendency

Code	Question
V1	I like to experience novelty and change in my daily life *
V2	I sometimes look for ways to change my daily routine *
V3	I like to have lots of activity around me *
V4	I prefer a clearly structured, repetitive daily schedule
V5	Reoccurring rituals give me a feeling of control and security
V6	I love surprises
V7	A week in which all my evenings are similar bores me
V8	Shops with exotic herbs and fragrances fascinate me *
V9	When eating out I like to try unusual items *
V10	The content of my shopping cart looks pretty much the same all the time
V11	I buy only trendy clothes
V12	I prefer seasonal fruits and vegetables
V13	I actively search for bands whose music I do not yet know
V14	I always shop at the same supermarket
V15	I like to explore unknown towns or parts of my town
V16	I prefer to spend my holidays always at the same location
V17	I prefer having drinks always at my regular pub
V18	I like to try new types of sports
V19	Cultures completely different from my own fascinate me
V20	I prefer to organise my holidays spontaneously
V21	I always keep an open door for surprise visitors
V22	I like to meet new people
V23	I like to explore new places in my town or new towns **
V24	I like to try new routes to familiar destinations
V25	I sometimes take a longer route to see something new
V26	I like to drive around just for the fun of it
V27	When commuting I always take the same route
V28	I like to meet new people while travelling by train

(\*) Source: Mehrabian and Russell (1973)

(\*\*) Source: Weber *et al.* (2002)

Table 5: Socio-economic attributes of the respondents compared to the Microcensus 2005

Attribute		All participants [%]	Valid participants	MZ 2005 [%]
Gender	Male	56.5	57.4	49.8
	Female	43.5	42.6	50.2
Age	< 25	1.7	1.3	20.3
	25 - 34	9.6	10.3	15.5
	35 - 44	11.9	13.5	18.3
	45 - 54	24.3	26.5	15.1
	55 - 64	10.2	11.0	13.5
	>= 65	14.7	16.1	17.2
	No answer	27.7	21.3	–
Education	Compulsory school	1.1	1.3	12.9
	Matur	4.0	3.9	7.0
	Apprentice	19.2	20.6	49.1
	Prof. diploma	24.3	27.1	9.7
	Univ. of appl. sc.	9.6	11.0	7.0
	University/ETH	19.8	21.3	11.7
	Other	3.4	3.2	–
No answer	18.6	11.6	–	
Employment status	In training	4.0	3.9	16.8
	Full time empl.	46.3	50.3	37.6
	Part time empl.	13.6	15.5	16.6
	Unemployed	1.1	1.3	2.9
	Houseworker	3.4	3.2	6.2
	Retired	12.4	13.5	18.8
	Other	0.6	0.6	1.2
	No answer	18.6	11.6	–
Household size	1	18.1	20.0	32.9
	2	31.1	32.9	37.1
	3	12.4	14.2	12.1
	4	11.3	12.3	13.2
	>= 5	4.5	5.2	4.7
	No answer	22.6	15.2	–
Monthly HH income	< 4,000	4.0	4.5	20.6
	4,000 - 8,000	19.8	21.9	46.8
	8,000 - 12,000	20.9	23.2	21.5
	12,000 - 16,000	12.9	13.5	7.0
	> 16,000	7.9	8.4	4.1
	No answer	34.5	28.4	–
Car availability	Always	63.8	71.0	72.7
	Sometimes	10.7	12.3	20.8
	Never	5.6	5.2	6.5
	No answer	19.8	11.6	–
PT subscriptions	Nationwide sub.	10.7	11.0	8.6
	Halbtax	51.4	56.1	26.3
	Other PT sub.	37.3	41.3	17.3
	None	33.3	27.7	38.0

Table 6: Results of the factor analysis for risk propensity

Question	Factor 1	Factor 2	Factor 3
R1 Admit if my taste differs from that of my friends	–	–	0.618
R2 Argue with a friend we have different opinions	–	0.474	–
R3 Ask my boss for a raise when I think that I earned it	–	–	0.496
R5 Openly disagree with my boss in front of my coworkers	–	–	0.545
R6 Speak my mind about unpopular issues at social occasions	–	–	0.507
R9 Drive home after I had three drinks in the last two hours	0.429	–	–
R13 Shoplift a small item (e.g. a lipstick or a pen)	0.583	–	–
R15 Go camping in the wild	–	0.535	–
R16 Ski down slopes that are too difficult for me	0.493	–	–
R18 Go whitewater rafting at high water in spring	0.494	–	–
R19 Go on vacation without booking ahead	–	0.532	–
R21 Tried out bungee jumping at least once	0.412	–	–
R23 Ignore pain as long as possible	0.483	–	–
R24 Rarely use sunscreen before sunbathing	0.408	–	–
R25 Rarely wear a seat-belt	0.695	–	–
R26 Engage in unprotected sex outside a relationship	0.714	–	–
R28 Smoke at least one packet of cigarettes per day	0.537	–	–
R29 Co-sign a loan for a new car for a friend	–	0.553	–
R31 Invest 10% of my annual income in speculative stocks	0.525	–	–
R33 Lend my best friend one month's income	–	0.543	–
R35 Accept a job that is paid solely based on commission	0.533	–	–
R36 Take the latest possible connection to the train station	–	0.589	–
R37 Start earlier if I expect congestion on my route	–	–	0.594
R38 Prefer pt connections with very short transfer times	–	0.592	–
R39 Search my way step by step on unfamiliar routes	0.466	–	–
R41 Start earlier if I have to drive an unfamiliar route	–	–	0.454
R42 Try to be at the airport at the latest possible time	–	0.535	–

Table 7: Results of the factor analysis for environmentalism

Question	Factor 1	Factor 2	Factor 3	Factor 4
E1 I worry about environmental problems	–	–	0.591	–
E6 Environmental pollution affects my health	–	0.683	–	–
E7 Environmental problems have consequences for my life	–	0.502	–	–
E8 I can see that the environment is deteriorating	–	–	0.618	–
E9 Env. prob. are a risk for the future of our children	–	0.630	–	–
E11 We should care for our env. because we depend on it	–	0.708	–	–
E12 Vehicle emissions increase the need for health care	0.664	–	–	–
E13 A better environment starts with myself	–	0.775	–	–
E14 Not caring ab. the environment is avoing responsibility	–	0.494	–	–
E15 Behav. change requires more env. friendly products	–	–	–	0.666
E16 Behav. change requires a right example by the government	–	–	–	0.719
E19 Environmental protection is good for the economy	0.537	–	–	–
E21 Stricter veh. smog control should be enforced	0.583	–	–	0.444
E22 The price of gas should be raised to reduce pollution	0.613	–	–	–
E23 Using tax dollars to pay for public transport is good	0.556	–	–	–
E24 There should be incentives for using electric vehicles	–	–	0.493	0.521
E25 Who causes environmental damage should pay to repair it	–	0.608	–	–

Table 8: Results of the factor analysis for variety seeking

Question	Factor 1	Factor 2	Factor 3
V1 I like to experience novelty and change in my daily life	–	0.592	–
V2 I sometimes look for ways to change my daily routine	0.605	–	–
V3 I like to have lots of activity around me	–	–	0.435
V6 I love surprises	–	0.664	–
V7 A week in which all my evenings are similar bores me	–	0.507	–
V8 Shops with exotic herbs and fragrances fascinate me	–	–	0.591
V9 When eating out I like to try the most unusual items	0.450	–	–
V11 I buy only trendy clothes	–	–	0.500
V12 I prefer seasonal fruits and vegetables	–	0.601	–
V13 I actively search for new bands	–	–	0.643
V15 I like to explore unknown towns or parts of my town	–	–	0.624
V18 I like to try new types of sports	–	–	0.510
V19 Cultures completely different from my own fascinate me	0.440	–	0.452
V20 I prefer to organise my holidays spontaneously	0.402	–	0.470
V21 I always keep an open door for surprise visitors	–	0.576	–
V22 I like to meet new people	–	0.642	–
V23 I like to explore new places	–	0.487	0.535
V24 I like to try new routes to familiar destinations	0.586	–	–
V28 I like to meet new people while travelling by train	–	0.527	–

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