The Swiss Microcensus 2005: An International Comparison on Travel Behaviour

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Abstract

Several different methods exist internationally for the collection of data on the travel behaviour of populations. This study sets out to compare these methods and highlight their relative strengths and weaknesses. Particular attention is devoted, among other things, to the problem of logging stage co-ordinates. The study's findings will be used in preparing the next Swiss Microcensus on Travel Behaviour.

Keywords

Microcensus on Travel Behaviour – Comparison on Travel Behaviour Survey – National Travel Survey – Geocoding – 4th Swiss Transport Research Conference – STRC 2004 – Monte Verità

1. Introduction

National surveys on travel behaviour are regarded as the key instrument for monitoring trends in traffic volumes. In Switzerland, as elsewhere, surveys of this kind are conducted on a regular basis. The next microcensus on the travel behaviour of Switzerland's permanent population is scheduled for 2005, preparations having started at the end of 2002.

A new concept has been drawn up for the next microcensus based on experience gathered from previous Swiss travel surveys and comparisons with their international equivalents.

Apart from presenting a broad comparison of the national travel surveys, this paper also sets out to describe the different methods for logging stage location co-ordinates. Three principal alternatives emerge: post-survey geocoding of stage locations, use of equipment (e.g. GPS) during survey, and on-line geocoding (using databases with co-ordinates, integrated in CATI system).

Does the use of different survey methods have any impact on the determined mobility indicators or do the Swiss really walk more than the Germans (Holz, 2002)? To answer this question, key mobility indicators, such as trip distance, trip count and degree of mobility of the population, are compared by survey type. The extent to which geocoding, once introduced, will impact mobility indicators is also investigated.

Chapter 2 compares the main features of the national surveys on travel behaviour. The new concept for the 2005 Swiss Microcensus on Travel Behaviour is described in the second part of this section. Chapter 3 underlines the importance of geocoding in achieving an integral view of transport and physical planning and outlines different geocoding methods. This section closes with a preliminary assessment of the insights gained from post-geocoding the 2000 microcensus data. The impact of different survey types – including geocoding – on mobility indicators is described in Chapter 4. The study ends by drawing conclusions about the different survey types and predicting ways in which travel surveys may evolve.

2. Surveys on travel behaviour

Travel surveys chiefly serve to monitor traffic volumes and to permit analysis of the population's travel behaviour. They play a key role in determining public policy in the passenger transport sector. Considerable importance is attached to modelling longer-term trends to enable early recognition of possible shifts in behaviour.

Surveys on travel behaviour may assume different forms and, as yet, no particular method has established itself as the acknowledged international standard. This prompted Stopher, Wilmot, Stecher and Alsnih to put forward their Standards for Household Travel Surveys (2003), applicable to North America, Australia, New Zealand and Europe. The proposals embraced both the means of performing surveys and the coding of survey data. Specific recommendations were given on 14 points. Their study is not yet finished.

This chapter first compares the major national surveys on travel behaviour, then proceeds to describe the concept underlying the 2005 Swiss Microcensus on Travel Behaviour.

2.1. International comparison

National surveys on travel behaviour are conducted in some 10 countries. These are supplemented by various regional and local surveys, which are, however, only touched upon in this study in relation to co-ordinate logging.

The national surveys differ in terms of both execution and content (see Table 1).

- **Execution of survey**: Here, interest focuses on the frequency or regularity with which surveys are conducted. While, in some countries, censuses are carried on an annual basis or at other regular intervals, the intervening periods are more or less random in others.
- **Methods**: There are essentially three survey types (written, face-to-face and telephone interviews). Telephone interviews are now used in nearly all countries. The switch to telephone interviews may, however, not yet have occurred in those countries where the last survey dates back some time. One exception in terms of method is the GB survey, which, for reasons of content, has retained the combined face-to-face/written interview.
- **Duration of field period**: A one-year field period is even more widespread than the use of telephone interviews. The Austrian census excepted, all surveys are conducted over the period of one year.

- **Sample size**: The sample size is influenced by a wide range of factors, including survey frequency, survey type, financial resources and population size. The resulting widely divergent sample sizes should not, however, be viewed as indicative of survey quality.
- **Reporting period**: In practically all countries, interviewees are invited to report their behaviour on one specific day ("travel day"). The only exception is the GB survey, which investigates behaviour over a one-week period. This long reporting period is one of the reasons for the use of face-to-face/written interviews in Great Britain.
- **Long journeys**: In almost all countries, the details of behaviour on the travel day are supplemented by information on long journeys. Here, however, major differences can be observed – both in the definition of a "long journey" and the associated reporting period.
- **Reporting unit**: Data is gathered on trips in roughly one half of the countries and on stages in the other. One key advantage of the stage concept is that it yields more detailed information on individual transport modes.
- **Trip purpose:** Data on the purpose for journeys are collected in all countries, though the number of categories distinguished varies. Only five categories are defined in Denmark, for example, compared to 36 in the USA. All surveys accommodate the following trip purposes: work, shopping, leisure and official/business.

Apart from highlighting differences between countries, this outline also suggests a degree of convergence in certain features. A one-year field and one-day reporting period are now the international standard. Furthermore, an increasing number of countries are gravitating to telephone interviews and annual surveys. Yet substantial differences persist with regard to long journeys and the unit *(i.e. trip or stage)* adopted in reporting mobility on the travel day.

Despite the above-mentioned convergence between survey types, no specific type appears to have emerged as the standard. The implications of the different methods for the mobility indicators are examined in greater detail in Chapter 4.

Table 1: International comparison of surveys on travel behaviour

	Denmark	Germany KONTIV	Germany Panel (MOP+ INVERMO)	France	GB NTS	Netherlands NTS	Norway RVU	Austria	Switzerland Microcensus on Travel Behaviour	USA NHTS
Execution (1980-2002)	1993-2003	1982, 1989, **2001/02**	1994 -2002	1981/82 **1993/94**	1985/86 1988-2003 (**1999-2001**)	1978-2002 (**2000**)	1984, 1991, 1997, **2001**	1983, **1995**	1984, 1989, 1994, **2000**	1983, 1990, 1995, **2001**
Method (current)	CATI	CATI/post letter	Written, face-to-face	Face-to-face	Face-to-face, questionnaire	Questionnaire by post; by tel.: purpose	CATI, written for holiday trips	Written, tel., face-to-face	CATI, letter	CATI, letter, diary+50-mile map
Field period	continuous	1 yr	Autumn	1 yr	continuous	1 yr	1 yr	10 wks	1 yr	14 mos.
Age groups	10-84	14+ (under 14 kids' questionnaire)	10+	6+	all (kids' diary)	all	13+	6+	6+	5+
Sample size (effective)	2,100 persons (P)/mo	50,000 house-holds (HH) 130,000 P	750 HH/yr 1,500 P/yr	14,200 HH	10,000 HH 23,000 P (in 3 yrs)	64,200 HH 146,500 P	20,000 P/yr	12,800 HH	28,000 HH 29,000 P	66,000 HH
Population	5.4 m	82 m	82 m	61 m	58 m	16 m	4.5 m	8 m	7.3 m	285 m
Reporting period	1 d.	1 d.	7 d.	1 d. (M-F) weekend Car: 1 wk	7 d.	1 d.	1 d.	1 d.	1 d.	1 d.
Rep. period for long journeys	None	3 mos.	8 wks (INVERMO)	3 mos. + 3 mos.	4 wks	None	1 mo.	2 wks	Last journey	4 wks
Definition of "long journey"	None	1 night	100 km (INVERMO)	100 km	50 miles	None	100 km	50 km	1 night	50 miles
Stages	Transport mode (TM)	TM	TM	TM	TM, time, distance	TM, time, distance (+interactive modal split)	TM, time, distance	None	TM, time, distance	TM, time (+interactive creation of tables)
Trip purposes	Going home, work, o/b (official/business), shopping, leisure	Work, o/b, shopping, private errands, escort, leisure, going home, return trips, other	Work, o/b, education, leisure, errands and service, going home/to 2nd residence/ other	From/to home, private (22 categories), official (4 categories)	Commuting, o/b, education, escort education, other escort, other personal business, leisure	Commuting, o/b, social life, shopping, education, recreation, other	7 categories	Commuting, education, o/b, private errands/shopping, leisure, other	Work, education, shopping, business activities, official trips, leisure, service, escort	36 categories

2.2. Concept behind 2005 Swiss Microcensus on Travel Behaviour

The next microcensus on the travel behaviour of Switzerland's permanent population will be conducted in 2005. Preparations have been underway since the end of 2002 and the new concept, based on experience gathered from the 2000 survey and comparisons with surveys in other countries, has already been drawn up (Swiss Federal Statistical Office and Federal Office for Spatial Development, 2003). Like the 1994 and 2000 surveys, the 2005 Swiss Microcensus on Travel Behaviour will adopt the CATI (computer-assisted telephone interview) method. The stage concept will be retained.

As in 2000, the survey will target some 30’000 persons, with 13’000 interviews forming the national sample and 17’000 with a regional focus. The extent of this regional component will depend on the participation of the regional partners (cities, towns, regional associations, cantons etc.).

The general aim for 2005 is to enhance survey quality by specifically addressing various shortcomings identified by a comprehensive review in the wake of the 2000 microcensus. In terms of survey content, this means that, apart from everyday mobility, so-called special mobility (long-distance journeys, slow transport modes, opinions on transport issues etc.) will be recorded. This was only partially covered in the 2000 survey (reporting of last major journey and flight, views on transport).

Apart from content-related refinements, the 2005 microcensus is set to benefit from methodological advances. First of all, efforts will be made to improve the reporting of stages (in particular short stages) by ensuring that every single stage is logged by interviewers and no gaps are left in the trip chain. However, the prime innovation compared to 2000 will be the introduction of address-specific geocoding (georeferencing of stage locations), which has been necessitated by newly emerging needs in the transport and regional planning sectors. These demands also prompted the post-survey geocoding of stage locations in the 2000 microcensus. More will be said on this subject in Chapter 3.

The introduction of co-ordinate logging during interviews in the 2005 microcensus will necessitate the integration of databases with point files in the CATI system. The feasibility of this still requires investigation; should only limited on-line geocoding be possible, a system of subsequent co-ordinate assignment will be adopted. In practical terms, this may mean, for example, that household locations, workplaces and stops/stations are geocoded during the interview while the other stage locations are geocoded afterwards. A geocoding feasibility test is scheduled for the summer of 2004.

In addition to this test, a survey pretest in autumn 2004 will investigate the practicability of the concept developed for the 2005 Swiss Microcensus on Travel Behaviour. The survey itself is scheduled to be conducted throughout the year 2005.

2.3. Summary

National surveys on travel behaviour are conducted in several countries and recent years have seen a convergence in their main features. At the same time, three distinct methods are still in use: the CATI method (in most countries), the written survey and the combined face-to-face/written interview. Some countries opt for a combination of these. Given advances in technology (e.g. Internet), the next few years could see a shift in the methods adopted. An American study has demonstrated the potential of CASI (computer-assisted self-interviews) and Internet surveys (Resource Systems Group, 1999).

The adoption of these new techniques depends on the extent to which this new technology gains currency among the general population. The CATI method will be used again for the 2005 Swiss Microcensus on Travel Behaviour. The main innovation will be the attempt to georeference stage locations during the interviews.

3. Geocoding

For the purposes of the microcensus, geocoding involves the assignment of spatial co-ordinates from existing geodata to at least the origin and destination of each stage. This chapter discusses the importance of geocoding, describes the different methods of logging co-ordinates and summarizes some of the insights gained from the post-geocoding of data from the 2000 Swiss Microcensus on Travel Behaviour.

3.1. Significance for integral transport and spatial planning

Geocoding is generally defined as the referencing of address data in terms of co-ordinates. Most importantly, the geocoded information will allow plausibility testing of the reported stage and trip distances and facilitate any necessary adjustment. Other survey data, e.g. speed and travelling time for stages and trips, may also be validated.

In the Swiss microcensus, geocoding also plays an important role in the full reconstruction of trip chains. Given that trips are not directly monitored in their entirety in Switzerland, but subsequently pieced together using the reported stages (ARE/SFSO, 2000), geocoding permits the inclusion of missing stages (e.g. stages travelled on foot between neighbouring (bus/tram) stops or between car park and office). This process presupposes a high degree of accuracy in mapping stage locations.

Apart from its significance in the plausibility testing of survey data, geocoding is also crucial for analyses in the transport and regional planning sectors. Geocoded data may be used to better pinpoint and demonstrate correlations between travel behaviour and the spatial environment, e.g. public transport links, neighbourhood, settlement type, choice of shopping facilities etc. The detailed logging of stage locations paves the way for a wide variety of in-depth studies on different issues, e.g. commuting or leisure travel. This potential has yet to be fully harnessed, mainly due to the limited resources available.

A preliminary study on the impact of spatial factors on travel behaviour has been prepared by the Swiss Federal Office for Spatial Development (ARE) using the geocoded data from the 2000 microcensus. Initial results show that relationships between the physical environment and travel behaviour may be established using the georeferenced stages (Simma, Cattaneo, Hilber, Marconi and Schad, 2003).

3.2. International comparison of different co-ordinate logging methods

Three standard methods of co-ordinate logging have emerged to date: post-survey geocoding, on-line geocoding (during survey) and the use of equipment to capture co-ordinates. CASI (computer-assisted self-interviews) or Internet surveys with interactive geocoding constitute a fourth option (Resource Systems Group, 1999), although, as mentioned above, this method will only establish itself when the use of new technologies such as the Internet becomes more widespread and transmission capacities are expanded. The CASI method closely resembles on-line geocoding (which uses GIS databases to capture co-ordinates), with the major difference that the CASI and Internet interviews may be performed by the respondent alone. This section will examine the different geocoding methods in greater detail.

Post-survey geocoding

This has been the method most frequently employed to date. In Switzerland, the data on household locations and stage locations in towns/cities gathered in the 2000 Microcensus on Travel Behaviour were subsequently geocoded to an address-specific level (see Chapter 3.3). In Germany, a feasibility study was conducted on the post-survey geocoding of trip origin and destination in preparation for the Continuous Survey on Travel Behaviour (KONTIV). Both a written and a CATI survey form were investigated. It was possible, in the automatic post-survey geocoding process, to assign co-ordinates at district level[1] to 51.4% of trip addresses reported in the written survey and to 64.6% of those in the CATI survey (infas, 2001).

The feasibility study revealed the major problems thrown up by post-geocoding. Most difficulties are caused by the incomplete or flawed address data sometimes provided by interviewees, as non automatically geocodable addresses require manual processing. This procedure also proved very time-consuming in the post-geocoding of the 2000 microcensus data (Jermann, 2003).

In Germany, the feasibility study led to improvements in the recording of address data in the main survey. Some 75% of the address data were amenable to geocoding at either ward, street section or building level (infas and DIW, 2003).

The chief drawback of post-survey geocoding is the lack of any opportunity to amend flawed data by soliciting more exact information from respondents.

Geocoding during survey (on-line)

The logging of stage location co-ordinates during interviews is one goal of the 2005 Swiss Microcensus on Travel Behaviour. This procedure will allow the on-line plausibility testing of data, for both direct (distance) and indirect (travelling time, speed) data components (see Chapter 3.1).

Moreover, interactive geocoding offers the chance to amend flawed address data during the interview. This may, however, have the drawback of substantially prolonging interviews. Apart from inflating costs, protracted interviews might compromise the overall quality of the survey given the declining precision of answers as the interview proceeds.

Provided that current technology allows the integration of GIS databases in the CATI system, a procedure is required for dealing with imprecise address data. Interviewees are unlikely to be able to provide addresses for all visited locations. Such cases need to be accommodated by lower levels of accuracy, e.g. streets, districts or, at worst, municipalities.

Proper on-line geocoding would permit the calculation of distances using route planners[2], though these are unable in all cases to indicate the distances effectively travelled. It would therefore be useful to record, during interviews, the chief locations visited along the route. Here too, some margin of error is inevitable given that only external equipment, such as GPS, can precisely model routes.

[1] The KONTIV feasibility study defines six accuracy levels: building, street section, ward, post code, municipality and non-geocoded. Only the first three exhibit satisfactory geocoding quality.

[2] The term "route planner" here denotes software used to determine the distance between two geocoded points.

Co-ordinate logging using external equipment

On 1 May 2000, the American government announced the immediate removal of GPS (global positioning system) selective availability (SA), thereby boosting the accuracy in pinpointing locations from 30-100 m to 5-10 m. This policy shift has significantly enhanced the precision of GPS-based analyses.

In the run-up to the California Statewide Household Travel Survey, a study was conducted on the integration in travel surveys of routes logged by GPS. In particular, GPS data were used to plausibly test car trip data collected in a CATI survey (though trips were not always comparable, above all due to the different times at which they were made). The CATI trips were directly matchable with the GPS data in only 43% of cases; 13% had to be matched manually, while, in the other cases, trips were missing either in the CATI survey (32%) or the GPS survey (Zmud and Wolf, 2003).

GPS allows the logging of all trips and stages together with the automatic capture of the associated co-ordinates and thereby ensures accurate mapping of the selected routes. This advantage makes GPS the most suitable solution for geocoding.

The drawbacks of using GPS include the relatively high cost, the lack of information on trip purposes and the difficulties in matching data with those from CATI surveys. The cost of national travel surveys would be inflated through the provision of GPS equipment for respondents. While equipment would not, of course, have to be bought for every single interviewee, the use a single device by several persons would push up the organizational costs.

The findings of the Californian survey underline the difficulties in matching GPS data with those collected in CATI surveys. The problems chiefly stem from the imprecise results delivered by the CATI method. The inaccuracy of time recording (estimated starting times for stages/trips not equal to effective starting times) poses one problem as the GPS data are not directly transferable. Missing stages and trips in the CATI interview – which need to be subsequently added – cause further difficulties. In such cases the function of the GPS data would principally be to test plausibility.

The use of systems other than GPS for direct co-ordinate logging is also conceivable. Alternative satellite technology aside, mobile phones, for instance, could lend themselves to this purpose, provided the captured data exhibit an adequate degree of precision. Given the present state of technology, however, no other systems seem likely to outperform GPS.

3.3. Insights gained from post-geocoding the 2000 Swiss Microcensus on Travel Behaviour

Geocoding was not initially planned for the data collected in the 2000 Swiss Microcensus on Travel Behaviour. New demands that emerged after conclusion of the survey prompted the post-geocoding of the data in a separate stage. This work proved extremely laborious due to the relative imprecision of the stage location recording. Furthermore, urban and rural areas exhibited varying degrees of precision for the logged stages: while, in urban areas, all stage locations were captured at building level (post code + locality + street + house number), only the locality (post code + place) was recorded in rural areas. Household locations were, in all cases, logged at building level (post code + place + street + house number) (Jermann, 2003).

Initial comparisons were made between the reported and calculated stage distances. Given the low precision levels of stage locations in rural areas, this was confined to the city of Zurich. The selected stages were travelled by persons resident in Zurich, with Zurich as the starting point. Stages with zero linear distance were omitted as these were round trips (origin = destination) or journeys for which the separate geocoding of starting point and destination was unfeasible (e.g. at transport interchanges). All distances reported as zero by the interviewees (mainly transport interchanges) were also ignored.

Stage distances were calculated as the crow flies and using a route planner. The network used by the chosen route planner is not particularly detailed – which, for the city of Zurich, is something of a disadvantage, especially for short trips. This explains why a value of zero was determined for 1,684 stages. To remedy this, the linear distances were measured, multiplied by a factor of 1.15[3] and matched with the datasets calculated by the route planner. In addition, the ratios (expressed as percentages) of the various distances to the distance calculated by the route planner were determined.

Initial results yielded a very high value for the distances estimated by interviewees for stages of less than 300 m (321 m was the average estimated stage length and 548% the mean value of the associated ratio). Some stages that were round trips (origin = destination) had calculated distances greater than zero as the co-ordinates of starting point and destination did not coincide. These inaccuracies resulted from the faulty geocoding of data. To rectify this error, calculated distances of less than 100 m with an estimated distance exceeding 1,000 m were excluded. Table 2 shows the results broken down into five groups by stage distance.

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[3] As a rule, the difference, for short trips, between actual and linear distance is corrected by a factor of between 1.15 and 1.2. In this case, it was decided to multiply the linear distances by 1.15.

Table 2: Comparison between estimated and calculated distances

Magnitude of calculated distance (m)	Stage count	Mean estimated distance (m)	Mean linear distance (m)	Mean distance 1.15 (m)[4]	Mean calculated distance (m)	Ratio for estimated distance (%)[5]	Ratio for linear distance (%)[6]	Ratio for distance 1.15 (%)[7]
< 300	1070	263	139	160	160	224	87	100
301 – 1000	759	875	427	491	566	163	79	90
1001 – 2000	918	1,109	705	811	1,504	74	47	54
2001 – 5000	1,899	2,508	1,637	1,883	3,307	76	48	56
> 5000	1,337	11,149	8,541	9,822	13,136	81	60	69
Total	**5,983**	**3,616**	**2,615**	**3,007**	**4,316**	**114**	**62**	**71**

Source: 2000 Swiss Microcensus on Travel Behaviour (5,983 stages travelled by persons resident in Zurich, with Zurich as starting point)

A number of initial conclusions may be drawn, subject to the qualification that the distances calculated by the route planner cannot be assumed to be 100% correct. The column with the ratios for estimated distance clearly shows that, for short stages, the estimated distances far exceed the calculated values. This is partly due to the practice adopted in the 2000 microcensus of automatically rounding up stages estimated at between 25 and 100 m to 100 m; for example, a stage estimated at 30 m (rounded up to 100 m) with a calculated distance of 25 m yields a ratio of 400% (= (100/25)*100). With regard to estimated distances, it should be noted that interviewees tend to round their estimates up or down – hence the agglomerations at round figures.[8]

Despite being rounded up, distances for short stages still appear to be overestimated, while, with longer stages, the opposite occurs. Figure 1 illustrates this phenomenon – which is hard to explain. Yet what can be established is the number of flawed estimates. Only around one quarter of the reported distances are within 25% of the calculated distances.

[4] Distance 1.15 = Linear distance * 1.15

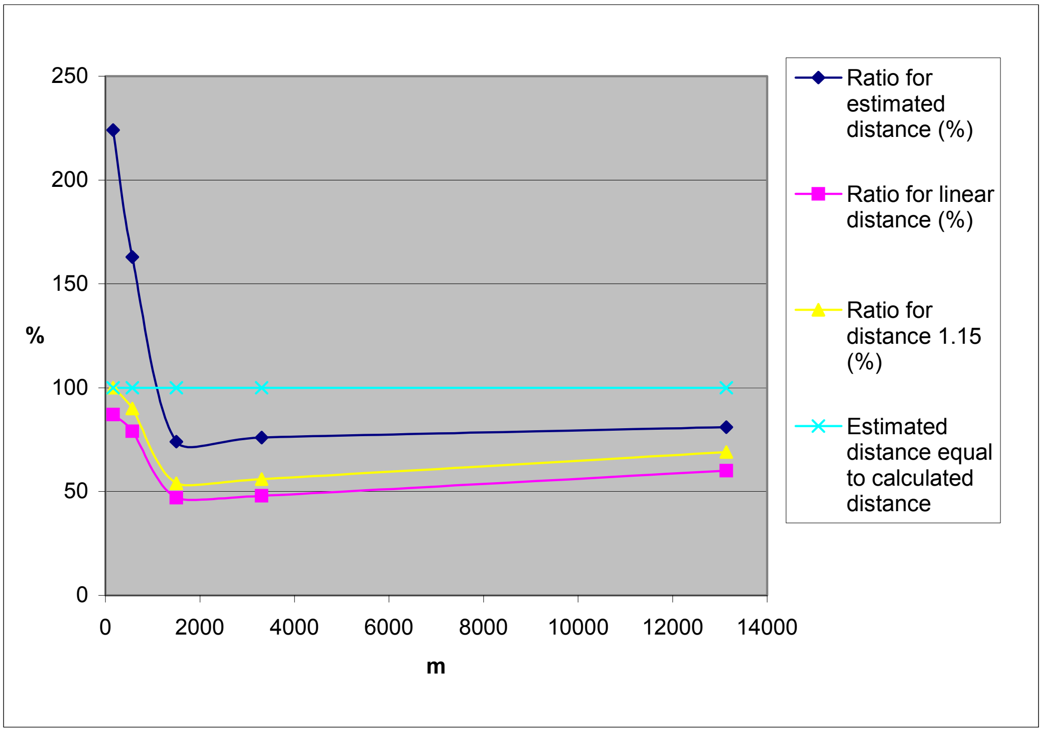
[5] Ratio for estimated distance = (estimated distance / calculated distance) * 100

[6] Ratio for linear distance = (linear distance / calculated distance) * 100

[7] Ratio for distance 1.15 = (distance 1.15 / calculated distance) * 100

[8] The breakdown of the 5,983 stages by distance is as follows: 100 m = 13.5%, 200 m = 8.7%, 300 m = 7.2%, 500 m = 7.3%, 1 km = 11.8%, 2 km = 8.2%, 3 km = 6.7%, 5 km = 5.0% und 10 km = 3.0%.

Figure 1: Distribution of mean ratios for various distances by stage length



Source: 2000 Swiss Microcensus on Travel Behaviour (5,983 stages travelled by persons resident in Zurich, with Zurich as starting point)

Similar comparisons were performed in Germany as part of the geocoding feasibility study. The results showed that, for roughly half of all geocoded trips, the reported distances are within +/-25% of the calculated (shortest) distances (infas, 2001).

Analysis of the data from the 2000 microcensus and the KONTIV feasibility study underlines the substantial error margins of the distances previously collected using the CATI method. This in turn illustrates the difficulties experienced by interviewees in estimating distances. The full-scale logging of stage co-ordinates and use of a route planner appears to be one possible approach in remedying these errors. Nonetheless, a comparison between respondents' details and the calculated distances would allow the quantification of probable error margins in previous surveys – which have obvious implications for the time series – as well as the integration of round trips in the survey.

3.4. Summary

The use of geocoding in travel surveys represents a major step towards improving the quality of the captured data. Co-ordinate logging is important both for plausibility testing the data and for calculating stage and trip distances, given that interviewees' estimates of distance tend to be grossly inaccurate.

The search for the best technique of georeferencing data focuses on three methods: post-survey geocoding, on-line geocoding and the use of GPS equipment. The latter delivers the best results as it permits the mapping of entire routes in addition to co-ordinate logging for origin and destination. Its drawbacks include the relatively high cost, organizational effort and problems in matching GPS data with CATI data.

Post-survey and on-line geocoding solely allow georeferencing of origin and destination irrespective of route, which has to be mapped using alternative methods (route planner or additions to questionnaire). One particular handicap with post-survey geocoding is the lack of any opportunity to request missing information from respondents, which is to a certain degree possible using the on-line geocoding method.

Given the present state of technology, on-line geocoding currently seems the best proposition from both a financial and qualitative viewpoint. However, the use of GPS equipment to log trips is likely to become standard in future.

4. Comparison of different methods

The selection of a particular method for national travel surveys is generally dictated by the needs and financial resources of the relevant country. This chapter endeavours to show how the captured data are influenced by the survey type and whether it is legitimate to compare the findings of different survey types.

4.1. Do different survey types have an impact on indicators?

The history of the Swiss Microcensus on Travel Behaviour to some degree shows how conceptual and methodological shifts can affect mobility indicators. What remains unclear is the extent to which differences are traceable to natural trends in travel behaviour among the Swiss population or changes in survey methods (Simma, 2003).

On the assumption that travel behaviour in Germany and Switzerland is similar, Holz (2002), in a comparison of mobility indicators from the two countries, found discrepancies in the results produced by different survey concepts, which explained the wide divergence between Germany and Switzerland in terms of average daily walking distances (1.01 km compared to 1.72 km).

The trip concept applied in Germany covers only the main transport modes used for a particular trip, e.g. where a person travels to work by public transport, no data are collected on the walking distances to and from the bus/tram stops or stations. The Swiss stage concept, by contrast, embraces all stages, including trips on foot. This explains the vast discrepancy in daily walking distances.

The following table compares three mobility indicators from national travel surveys, which are grouped by method.

Table 3: International comparison of degree of mobility, trip count and mean trip distance[9]

	CATI surveys				*Written surveys*		Face-to-face/written surveys[10]	
	CH	D	USA	NO	*NL*	*A*	GB	F
Degree of mobility (%)	90	86	-	85	-	*82*	-	-
Number of trips(n)	4.0	3.9	4.1	3.6	*3.1*	*3.0*	2.8	3.2
Mean trip distance (km)	10.4	11.1	17.9	11.9	-	*9.5*	11.3	22.9

Only limited conclusions may be drawn from the comparison of mobility indicators given the differences in travel behaviour between the populations in question.

Yet, certain trends emerge: the trip count recorded by the CATI method tends to be slightly higher than the figure for written and combined face-to-face/written surveys. On the one hand, people feel more obliged to take part in telephone interviews. On the other hand, more trips are likely to be recorded by telephone as computer entry is generally more efficient than oral/written communication. Protracted interviews and the need to complete forms (in written surveys) compounded by a certain laziness among respondents impair survey quality. It can happen that some trips – especially short journeys viewed as insignificant by interviewees –

9 Most data were taken from the Internet and relate to the last survey year (see Table 1).

10 The GB and French surveys were not conducted solely on a face-to-face basis. In both cases, respondents were visited twice by interviewers. They were asked to complete forms for the survey between the two visits.

are omitted. This is likely to push up mean trip distances as long trips are overrepresented and short trips underrepresented. While the French survey seems to corroborate this theory, the GB census does not. Among the CATI surveys, only the USA records an exceptionally high mean trip distance – though this is probably a reflection of socio-cultural rather than methodological factors.

4.2. What impact will the introduction of geocoding have on indicators?

The use of geocoding in surveys on travel behaviour has a greater or lesser effect on mobility indicators, depending on the type of geocoding.

In Section 3.3, the 2000 Swiss Microcensus on Travel Behaviour was used to illustrate the errors made by interviewees in estimating distances. The future use of georeferenced data to calculate distances would lead to inconsistencies between the new indicators and the values recorded in previous surveys – a factor with implications for the preparation of time series. Moreover, any changes in distance would naturally affect trip speed.

Predictions on possible changes in the trip count are more difficult. Any form of geocoding improves the plausibility testing of the trip chain (missing trips are conspicuous). In the next Swiss microcensus, geocoding will play a crucial role in the full reconstruction of stages.

The use of geocoding with GPS would allow detailed mapping of all stages and trips. Apart from having the same impact on mobility indicators as the other geocoding methods, GPS data would also allow the reconstruction of trip duration – which is not fully possible with post-survey and on-line geocoding.

4.3. Summary

In any comparison of mobility indicators from different countries, attention must be paid to the underlying framework. Different survey methods can substantially influence the value of indicators, as witnessed by the survey data on daily walking distances in Germany and Switzerland.

The CATI method allows more accurate recording of the trip count and has therefore gained currency. With written and face-to-face interviews, the reporting of short trips tends to be unreliable.

The use of geocoding is likely to affect the magnitude of indicators, especially distances, in comparison to previous surveys. The introduction of geocoding would also have implications for the recorded stage and trip numbers.

5. Conclusions

Surveys on travel behaviour have been conducted in a number of countries in recent years using a variety of techniques. Of the three chief methods (combined face-to-face/written, written and telephone survey), the computer-assisted telephone interview (CATI) is gradually becoming standard.

After comparing the different survey types, this study outlined the new concept for the 2005 Swiss Microcensus on Travel Behaviour. The main innovation involves the georeferencing of stage and trip locations, which, subject to technical feasibility, will be performed on-line.

A closer look was taken at the three most common methods of logging co-ordinates (post-survey geocoding, on-line geocoding and the use of GPS equipment). Geocoding is particularly useful for plausibility tests on data collected by CATI and for more accurate reporting of certain mobility indicators, e.g. stage and trip distance. The data collected using geocoding may therefore differ substantially from figures recorded in previous surveys.

Comparisons of travel behaviour in different countries should take account of the particular survey types used in each case. More trips are recorded by CATI surveys, for instance, than with written or face-to-face interviews.

This initial analysis has identified recent trends in surveys on travel behaviour. It is conceivable that there will be a growing need, in future, to tailor such surveys to the respondents. It is clear, even today, that some sections of the population are hard to contact using "traditional" methods and that others will be consequently overrepresented in surveys. As in the past, people who spend much time at home will be easily reached by telephone, while those frequently on the move will be harder to contact. In tackling this problem, the role of modern technology needs to be investigated. In particular, interviews conducted by e-mail or directly via the Internet, which are free from time constraints, may offer a solution to the problem of contacting respondents.

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