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Towards an European benchmark survey of long-distance travel

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1 INTRODUCTION

The development of the internal market in goods and services requires an efficient and sustainable transport system. The planning of this system has to be based on reliable information about both the travel behaviour of individuals and the shipping decisions for freight. While substantial information is available from various count data, which is being increasingly integrated into a comprehensive GIS-database at the European level (Eurostat, 1994), it is well known for some time, that there is not enough information about the motivations and structures of the long-distance movements (Fabre, Close and Somer, 1988 or Delavelle, Michon and Roger, 1995). This has been stressed again in the deliberations of a DG VII task force on transport statistics (EC, 1997). The *Strategic Transport Research* element of the 4th Framework Programme of the European Union is trying to address this problem and to advance the data availability through a series of research projects. The projects "Methods for European Surveys of Travel Behaviour" (MEST) (February 1996 - January 1999) and "Technologies for European Surveys of Travel Behaviour" (TEST) (January 1997 - December 1998) are part of this group and are aiming to develop survey protocols, designs, technologies and analysis methods for an European benchmark survey of long-distance travel behaviour.

The European benchmark survey is not intended to replace the various national efforts, but to provide a common link between the various other surveys, which are currently essentially incomparable (Youssefzadeh and Axhausen, 1996a). The purpose of this paper is to report briefly the progress made so far in the two projects with an emphasis on the results of MEST, while drawing also on the results of the parallel initiative of Eurostat (Axhausen, 1997a). The next section will report the results of a preliminary aggregate analysis of the response behaviour in the various pilot surveys undertaken so far, which will be followed by a discussion of the project's current suggestion for a benchmark protocol. The final section before the conclusions will discuss the various technological options open to the fields, including those pursued by the consortium.

2 PRELIMINARY PILOT RESULTS

The survey work in MEST and in the Eurostat pilots is based on the results of the discussions of an informal working party, which met between the end of COST 305 and the beginning of the 4th Framework programme (Eurostat, 1995a). The working party defined a number of the relevant content dimensions of a long distance survey, but did not address the issues of the survey protocol or of the survey design, in case of written survey elements:

- *Overall approach:* Stage/journey-based¹.
- *Minimum distance:* 100 km
- *Minimum duration:* None
- *Geographic range of exclusion:* Undefined
- *Temporal range of exclusion:* Undefined
- *Other exclusions:* None
- *Treatment of regular travellers:* Not addressed
- *Treatment of regular journeys:* Not addressed
- *Spatial definition of destination:* NUTS 5
- *Reference location (Current base):* Not precisely defined

It also defined a minimum set of variables to be covered and their coding. Still, the minimum set and the undefined dimensions plus no specifications of the protocol left an enormous degree of freedom, which was used by both MEST and the Eurostat pilot surveys. Table 1 and Table 2 summarize the pilot surveys undertaken by these two streams of work (See Axhausen, 1997a and Youssefzadeh and Axhausen, 1996b and 1997 for further details).

A first aggregate analysis of the response behaviour shows, that a combination of written and telephonic elements performs as well as exclusively telephone approaches, while having the advantage of reaching persons/households, which could not be reached at the phone. Using linear regression of the raw response rates, i.e. not corrected for quality neutral sample losses, of only those surveys adopting the MEST forms for a postal survey some trends become visible²:

- Looking only at the postal returns, only the orientation of the surveys are significant: retrospective surveys obtain a higher return than prospective surveys.
- Looking at the total response (written and telephone), two additional variables become significant: trip based surveys and shorter duration surveys obtain higher response rates.
- There are strong country effects, indicating that the written and the telephone element will have different levels of importance in different countries.

The French Eurostat surveys showed in addition, that the style of recruitment has a strong interaction effect with the method of survey administration: the best response rates were obtained with fresh random samples interviewed on the phone and with postal surveys of persons recruited from an existing stock of self-identified survey respondents.

¹ A stage is a movement with one means of transport, including any waiting times. The trip is a sequence of stages connecting activities. A journey is a sequence of trips starting and ending at the reference location, i.e. in most cases the home.

² The aggregate analysis is not the best method to use, as it cannot correct for the socio-demographics and the mobility behaviour for the individual. See for example Axhausen, Köll, Bader und Herry (1997)

Table 1 Summary description of the MEST pilots (Wave I and II)

Country	Survey	Approach	Temporal orientation	Duration	Minimum distance	Survey period	Contact	Non-response interviews	Sample unit	Reporting by	Sample size	Sampling area	Sample type
Austria	Fessel+IFES	Trip-based	Retrospective	Last 14 days	50 km	Fall 1995	Written with personal collection	None	Household	all members over 6 years	6036	Nationwide	Stratified by Bezirk
	Sammer+Herry	Trip-based	Retrospective	Last 14 days	50 km	Fall 1995	Mail-back	Telephone	Household	all members over 6 years	1200	Nationwide	Stratified by Bezirk
	Pilots	Stage-based	Retro- and prospective	Last 4 and 8 weeks	75 km	Spring 1996	Mail-back	Telephone	Household	traveller	1080	Local	Random sample
Denmark		Stage-based (drilling down)	Retrospective	Last month	100 km	11/1996 - 10/1997	CATI	None	Person	Persons (16-74 years)	21600	Nationwide	Random sample
France	CATI	Trip-based	Retrospective	one or three months	100 km	1/1997 - 3/1997	CATI	None	Household	One person (6+ years)	500	Regional	Two methods
	Postal	Trip-based	Retrospective	one or three months	100 km	1/1997 - 3/1997	Mail-back	None	Household	One person (6+ years)	500	Regional	Two methods
Germany	CATI	Trip-based	Retrospective	Two months	100 km	Spring 1996	CATI	None	Person	One person (14+ years)	130	Nationwide	Random samples
	CATI&postal	Trip-based	Retrospective	Two months	100 km	Spring 1996	Mail-back & CATI	None	Person	One person (14+ years)	130	Nationwide	Random samples
	Postal	Trip-based	Retrospective	Two months	100 km	Spring 1996	Mail-back	None	Household	all members	250	Nationwide	Random sample
Italy	CATI	Stage-based	Retrospective	Last month	100 km	Spring 1997	CATI	Telephone	Person	Persons (18+ years)	7000	Nationwide	Stratified by region
	Postal	Trip-based	Retrospective	Last month	100 km	Spring 1997	Mail-back	Telephone	Person	Persons (18+ years)	1000	Local	Random sample
Portugal		Trip-based	Retrospective	4/1996 - 6/1996	100 km	7/1996 - 8/1996	CATI	None	Household	all members over 15 years	5694	Regional	Stratified by fregusia
Spain		Trip-based	Retrospective	Two months	100 km	1/1997 - 4/1997	Postal with CATI retrieval	None	Household	all members over 15 years	1500	Regional	Stratified by district
Sweden		Trip-based (drilling down)	Retrospective	One/three months	100/300 km	1996	CATI	None	Person	Persons (6-84 years)	9882	Nationwide	Random sample

Table 2 Summary description of the Eurostat pilots

Wave	Country	Approach	Temporal orientation	Duration	Minimum distance	Survey period	Contact	Non-response interviews	Format	Detail of movement
First	Sweden	Stage-based	Prospective	6 weeks	100 km	Winter 1997	Mail-back	Telephone	Column-based	Small
	Sweden	Stage-based	Prospective	6 weeks	100 km	Winter 1997	CATI	-	-	Large
	Sweden	Stage-based	Retrospective	6 weeks	100 km	Winter 1997	Mail-back	Telephone	Column-based	Large
	Sweden	Stage-based	Retrospective	6 weeks	100 km	Winter 1997	CATI	-	-	Small
	Portugal	Stage-based	Prospective	6 weeks	100 km	Winter 1997	Mail-back	(Telephone)	Column-based	Large
	Portugal	Stage-based	Prospective	6 weeks	100 km	Winter 1997	CATI	-	-	Small
	Portugal	Stage-based	Retrospective	6 weeks	100 km	Winter 1997	Mail-back	(Telephone)	Column-based	Small
	Portugal	Stage-based	Retrospective	6 weeks	100 km	Winter 1997	CATI	-	-	Large
Second	Portugal	Stage-based	Retrospective	4 weeks	100 km	Summer 1997	Mail-back	Telephone	Page-based	Middle
	Portugal	Trip-based	Retrospective	8 weeks	100 km	Summer 1997	Mail-back	Telephone	Column-based	Middle
	UK	Stage-based	Retrospective	8 weeks	100 km	Summer 1997	Mail-back	Telephone	Column-based	Middle
	UK	Trip-based	Retrospective	4 weeks	100 km	Summer 1997	Mail-back	Telephone	Page-based	Middle
	France	Trip-based	Retrospective	8 weeks	100 km	Summer 1997	Mail-back	Telephone	Page-based	Middle
	France	Stage-based	Retrospective	4 weeks	100 km	Summer 1997	Mail-back	Telephone	Column-based	Middle
	Sweden	Trip-based	Retrospective	4 weeks	100 km	Summer 1997	Mail-back	Telephone	Column-based	Middle
	Sweden	Stage-based	Retrospective	8 weeks	100 km	Summer 1997	Mail-back	Telephone	Page-based	Middle

3 SUGGESTED PROTOCOL

The experiences reported above indicate, that the use of the stage as the basic unit for a survey of long-distance travel does create problems in terms of quality and response. Still, the need for the stage information remains in a number of policy areas (access to long-haul modes, landside capacity questions at airports and stations, route choice etc.). The protocol of a benchmark survey has to accommodate this in an intelligent fashion, building on the experience of daily mobility surveys, where such mixtures have been identified as the way forward³. With the proviso of the change to a trip-based survey, the range of contents tested in the various pilots is feasible and could even be enlarged in certain respects, although the Austrian pilots might have to be considered the upper limit (See also Axhausen, 1996 or Axhausen, forthcoming for a discussion of more extensive sets of items and their problems).

The crucial question for the design is the division of labour between the written/postal and the telephone survey elements. CATI surveys have now a tradition in Europe for travel surveys (see for example the pilots from Sweden, Denmark, France reported here), but the different levels of market penetration of the telephone in the various member states, plus the problems arising from unlisted numbers/answering machines and from mobile phones, for which there are currently no directories, make a CATI only survey problematic. The experiences with the pure postal surveys included here are not promising in terms of their written response rate. Clearly those, which involved either some form of personal contact by phone or sample selection from a panel of willing respondents, achieved sufficient response rates. Still, postal surveys can reach highly mobile persons, which cannot be reached by phone, and they can serve as an interview guide for CATI surveys. A protocol mixing the two approaches plus personal face-to-face interviews, where telephones are not available, is required, although it should be pointed out that such mixed source surveys raise a large number of still unanswered research questions about our ability to join the data collected by these different approaches.

Retrospective surveys have consistently improved response, but their quality drawbacks are equally well known. It seems therefore worthwhile to alert the respondent early to his task, but to keep the initial load small.

A possible protocol could have the following form:

³ W. Brög (Socialdata) and G. Moritz (CBS) personal communications

- Announcement letter and simple memory-jogger at the start of the reporting period of e.g. eight weeks before the survey pack is sent
- Survey pack (cover letter, form, explanatory booklet, material explaining the survey) and a telephone call explaining the form and asking for support.
- Reminder letter
- Second motivation call with opportunity for a CATI interview, if requested by respondent
- Reminder letter
- Third motivation call and offer of CATI interview (change of reporting period)
- Reminder letter
- CATI interview to retrieve data (change of reporting period)

Households answering in writing are scheduled for further calls for error correction, the probing for missing/forgotten trips or journeys and for additional questions about the stages of the journey.

Persistent non-responders should be approached for face-to-face CAPI interviews. Where no telephone is available to reach a household, face-to-face interviews should be attempted earlier in the protocol.

The exact sample size for an European benchmark survey of long-distance travel depends on the spatial resolution of the results. A sample in the low 10000's persons/year should be enough for good European level results, but larger samples would be required, if individual countries wanted detailed results for their population. Without a competitive tender it is impossible to say, what the costs for such a survey would be, but based on the experiences of MEST and the Eurostat pilots ECU 35-40/person is a reasonable start for further calculations. These figures do not include overhead costs for final development of the survey, the central quality control or the coordination of a survey in fifteen member states (See Axhausen, 1997a for a more detailed discussion). Cost savings could be achieved, if the field work infrastructure is shared with the already mandated surveys of tourism behaviour (Eurostat, 1995b). A merger in the contents is neither fully feasible, nor necessarily desirable.

The third wave of MEST is testing a protocol similar to the one suggested here, but due to the budget constraints of the project not the full one. The experiences will be reported in the fall of 1998.

4 TECHNOLOGY OPTIONS

A number of technologies have recently become so ubiquitous, that it possible to consider them as tools to support and complement travel behaviour data collection: geographical information systems (GIS), the world-wide-web (www), palm-top computers (hand-held personal computers or H/PC) or different forms of artificial intelligence approaches, in particular neural networks. The project TEST is exploring these technologies for various elements of the survey process starting with collection all the way to presentation of results following an initial review of possible options.

The initial review (Haubold, Jackson, Axhausen and Polak, 1997) has shown that in addition to the traditional data collection methods new methods for and new sources of data are being established. On the one hand there is a strong interest in computer, in particular web-based surveys of (travel) behaviour, for which new tools are rapidly being provided by the software industry, although the samples which can be reached and surveyed with them are relatively small at this time. On the other hand, it becoming clear that travellers are leaving ever wider voluntary electronic traces of their movements through credit cards, billing cards or smart cards. At the moment the owners of these card systems are not fully exploiting the possibilities opening up. Accounting systems for business travel expenses are the highest use to which the data is currently put. It is clear, that these sources cannot replace surveys of individuals, but that they can only supplement them through information, which individuals are known to have difficulties remembering, such as dates, monetary expenses etc. It is equally clear, that these sources can be of great help to the Commission in its regulatory work, as they can provide information about the real prices paid for travel.

The aims of the work packages within TEST are:

- the implementation and test of a H/PC-based survey of long-distance travel (Haubold and Axhausen, 1997). H/PC's, such as the Phillips Velo or similar machines from Hewlett-Packard, Casio, Hitachi etc, running under WinCE⁴ offer a familiar interface to most computer-literate travellers. A prototype is nearing completion and testing will start in January of 1998.
- the implementation of a www-based survey of long-distance travel behaviour (Plaxton and Polak, 1997). Using the web to deliver customized and information rich surveys is an important development direction. It is becoming possible to draw information from time tables, price-lists and electronic maps to generate customized surveys, which the web can deliver and display world-wide using Java or derived specialized products.

⁴ WinCE (Windows Consumer Edition) is a subset of Windows 95 retaining the same look and feel, while being limited in some of its functionality.

- the further development of GIS-technologies to enrich existing data sets of long-distance travel behaviour. INRETS (1997a) is expanding its tools to locate destinations and to calculate the routes taken during the stages reported by the respondents.
- the implementation of intelligent data correction tools (INRETS, 1997b and Lothaire and Toint, 1997). AI-techniques and neural networks are explored as means to correct the intricate errors in the recall and recording of journeys by respondents and survey staff. Initial systems have been set up, which are being tested with data generated in the project.
- the implementation of a www-based interface to travel surveys (Reginster and Toint, 1997). Travel surveys are expensive enterprises and it is necessary that the data produced can be used by the largest possible number of interested persons. The world-wide-web provides the technology to give this access, while maintaining the integrity of the data and of the analysis of the data (Axhausen, 1997b). The necessary statistical sophistication in terms of weighting and estimation is hidden from the user, who is provided with correct tables as and when needed. A test site has been implemented, which is employing data generated within the project (<http://sturm.math.fundp.ac.be/~test>)⁵. See Figure 1 for the variable selection page and Figure 2 for a typical result.


The efforts undertaken here will benefit the work undertaken in MEST by providing the tools to improve the survey administration and data coding and analysis. Two interesting technologies cannot be pursued in TEST: global positioning systems (GPS) and GSM-mobile phones. Both have recently been used or proposed for surveys of daily mobility (Battelle, 1997). Both can be used to measure the exact position of the vehicle of the respondent at nearly arbitrarily small intervals, which can be stored locally and retrieved later or transmitted immediately using cheap short-message-services and stored centrally. The combination of H/PC and GPS or GSM would be extremely powerful, in particular the H/PC and GSM combination would allow regular prompting of the respondent.

5 CONCLUSIONS AND WAY FORWARD

The work undertaken so far has identified the most promising direction for the development of an European benchmark survey of long-distance travel behaviour: a trip-based household survey, which protocol combines postal and CATI/CAPI elements. The stress of the suggested protocol is still on the written element with telephone/personal contact designed to motivate the respondents to reply at his/her leisure in writing, but CATI/CAPI systems are in place to recover the information from people willing to participate, but unwilling or unable to do so in writing.

⁵ For similar sites see <http://www.mtraf.scb.se> (Swedish Travel Survey), <http://www.bts.gov/programs/ats> (American Travel Survey) or <http://www-cta.oml.gov/cgi/npts> (American National Passenger Transportation Survey)


Figure 1 TEST-www-site: Selection of variables




Technologies for European Surveys

of Travel behaviour

Introduction

 Help

 Form

Counting

Statistics

Crosstables

Classes

Crosstables


Please, choose a variable for the row and one for the column.

To choose a row variable, click on the first radiobutton beside the variable.

To choose a column variable, click on the second radiobutton beside the variable.

People	Vehicle
<input type="checkbox"/> Sex	<input type="checkbox"/> Vehicle type
<input type="checkbox"/> Marital status	<input type="checkbox"/> Catalytic converter
<input type="checkbox"/> Mobility disabilities	<input type="checkbox"/> Year of purchase
<input type="checkbox"/> Highest education	
<input type="checkbox"/> Drivers licence ownership	
<input type="checkbox"/> Employment	
<input type="checkbox"/> Selfemployment	
<input type="checkbox"/> Working hours	
<input type="checkbox"/> Hours spent in education	
<input type="checkbox"/> Ownership of a frequent flyer card	
<input type="checkbox"/> Ownership of an airline privilege card	
<input type="checkbox"/> Ownership of railway discount cards	
<input type="checkbox"/> Year of birth	
Journeys	Stages
<input type="checkbox"/> Day of departure	<input type="checkbox"/> Day of departure
<input type="checkbox"/> Month of departure	<input type="checkbox"/> Month of departure
<input type="checkbox"/> Hour of departure	<input type="checkbox"/> Hour of departure
<input type="checkbox"/> Minute of departure	<input type="checkbox"/> Minute of departure
<input type="checkbox"/> Day of return	<input type="checkbox"/> Day of arrival
<input type="checkbox"/> Month of return	<input type="checkbox"/> Month of arrival
<input type="checkbox"/> Hour of return	<input type="checkbox"/> Hour of arrival

Figure 2 TEST-www-site: Example results page



Technologies for European Surveys

of Travel behaviour

TEST : Crosstables result

* - Sex
** - Marital status

* \ **	Single, divorced	Married or with partner	Non-response	Total
Male	94	108	0	202
Female	120	110	0	230
Non-response	0	0	1	1
Total	214	218	1	433

If you want to merge some values, select them and write a name for the merger. Then click on the 'Submit' button.

Name for the row merger:

Name for the column merger:

Allez à: FUNDP / Faculté des sciences / Département de Mathématique / Groupe de Recherche sur les Transports

For any comment : sabelle.souster@fundp.ac.be

The technologies being developed in the companion project will support the survey effort by providing tools to automate certain elements of the survey process: data entry, data correction and checking and, especially important data publication.

The recent policy requirement and ensuing data needs of the EU have increased the likelihood of the Commission embarking on a long-distance travel data collection effort. It is hoped that the work reported here and the work still to be undertaken in the two projects will improve the quality and timeliness of that European survey of long-distance travel behaviour.

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