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## ***RAISING THE STANDARD!***

*- Transport Survey Quality and Innovation -*

Keynote paper



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## INTRODUCTION

In the sixties and early seventies, surveys in the transport sector were characterized by the effort to obtain large data bases of basic travel patterns and traffic flows in the simplest way possible. In the process, more sophisticated methods of empirical social research hardly stood a chance. This led to the use of survey instruments and - as a result - data records of limited quality that could not keep pace with the importance of the consequences which followed from them.

It was only during the course of the seventies that this picture changed. Through many years of basic research, more sophisticated survey procedures were developed which were consistently oriented to the needs of the respondents rather than to those of the researchers. Simultaneously, international interest in and awareness of the specific problems of surveys of mobility behaviour developed. This found expression in the establishment of a series of international conferences. The first was held in Grainau in 1979 (First International Conference on Survey Methods in Transport) (1). It was the impetus for a lively and fruitful discussion that played a decisive role in subsequent years.

At that time, it soon became apparent that the survey designs used previously were again in need of further development. The main causes for this realization were gained from the continuing basic methodological research, the need for additional and more in-depth information, changes in social consciousness and - as a result - respondent behaviour, and changes in the technical possibilities for carrying out surveys. Survey researchers reacted and continue to react to these developments in different ways: Some (far too few) attempt to design their surveys in a way which is more responsive to the (changed) needs of the respondents, others (the majority) concentrate on the increased use of newer technical aids (telephone, computer, etc.). In the meantime, there is a danger - as has happened with many planning projects - that with regard to the design of surveys as well, the transport experts will become intoxicated by the technical possibilities and technical feasibility, and (once again) the needs of the respondents will fall by the wayside.

Since the conference series which was conceived of as an international forum for such problems has led only a shadowy existence, it became obvious that the time had come to make a new attempt in the form of an international conference. The aim of this conference is to critically examine the present state of the practice of mobility

surveys and point out means of clearly improving what has now become the normal standard.

## **I. THE WORLD OF MOBILITY**

As a rule, surveys in the transport field deal with various aspects of the mobility of people and therefore with a type of behaviour that only appears to be simple and easily explained but is, in reality, very complex and sophisticated. Serious empirical studies must adjust to the world they wish to depict and cannot expect that this world will adapt itself to their simplifying methods. For example, even ascertaining the reasons which determine mode choice becomes a comparatively complicated matter which requires reliable information from very diverse data fields. The personal circumstances of a human being will influence and constrain the choice of a certain mode of transport (data field: sociodemography), a reasonable possibility for using this mode of transport must exist (data field: transport systems), the persons involved must perceive this option accurately (data field: perception), and they must also be willing to use this option (data field: attitudes). This means that the existence of an option alone is not enough if people do not perceive it or their personal circumstances prevent its use; a positive attitude towards a mode of transport does not lead to its use when no relevant option is available, etc. However, the starting point for travellers' behavioural decisions is, in any case, the world they perceive, irrespective of how (in-) complete and/or (in-) accurate this perception is. If one wants to understand the behaviour of human beings, logic dictates that not only knowledge of the prevailing (external and personal) conditions for their decision is required, but knowledge of their perceived world(s) as well.

Therefore, even the description - let alone the explanation and prediction - of mode choice becomes a task of considerable complexity. In addition, it is made even more difficult by the fact that daily, weekly, and monthly, every person is confronted by many different decision-making situations with regard to their travel mode choices that involve varying constellations and combinations of the above data fields; simplifying approaches which only deal with the "unit person" are therefore of little help in description, explanation, or prediction of mode choice.

In dealing with such complexity it is good scientific tradition to create a simpler model of the complex reality. But this kind of simplification is only reasonable if it makes

complicated structures more easily comprehensible and traces them back to their essential relationships and dependencies. However, this must not result in oversimplification and in entire data fields (and therefore in some sense "explanatory worlds") being left out of the analysis.

Such models are primarily intended to be frameworks for generating and testing "hypotheses" which can be operationalized in various ways. Mathematical/statistical operationalization is particularly common. But for all the elegance of such mathematical/statistical operationalizations, the model is not the functions derived from it but rather the intellectual structures on which it is based. If these structures are lacking, the model is hollow and its application risky.

Unfortunately, the development of mobility research during the past decades shows that there have been only very few attempts to unite the complex world of mobility in one intellectual concept, and as a rule, these attempts have received little support (2). Instead, the seventies and eighties were characterized by intense and controversial debates concerning various approaches to the explanation and modeling of mobility behaviour. In the process, a wide variety of approaches were discussed, championed and criticized. Much legitimate criticism was formulated and none of the approaches being discussed was spared. But in spite of all the criticism, there is one thing the different concepts could not be accused of: that they did not at least attempt to do justice to some extent to the complexities of mobility behaviour, by taking a relatively extensive framework of variables into account. However, due to the fact that at least one of the above-mentioned data fields was always ignored, these models were only moderately successful in terms of application to everyday (planning, political, or entrepreneurial) practice.

Given increasing pressure to provide reliable planning instruments to deal with a widening range of issues, one would have thought that it was inevitable that the interest in integrated model approaches would have increased as well. However, this was not the case. Reacting with resignation to the conceptual and intellectual challenge of describing the complex world with realistic models, mobility research took refuge in a substitute data field: asserted behaviour.

The methods were borrowed from market research (often referred to as conjoint analysis) (3) where it was believed that they could help, for example, to determine the behaviour of purchasing chocolate bars, were uncritically applied to mobility

behaviour - although under another name (so-called stated preferences) (4). The "model" used was reduced to a technique focused on a microsegment of reality which was presented to respondents in the form of a large number of simplified and fully structured alternatives from among which they were required to choose. The verbal statements of these respondents in a hypothetical situation ("asserted world") was then the critical input for a "model" that one believed would be useful in predicting future behaviour. The reasons behind the formulated preferences, the situational determining factors, and the artifacts of a highly reactive method remained largely unconsidered. To the contrary: the simplification that resulted from ignoring important behaviour-determining influences was even praised by the researchers as being a special advantage of this method. In the end, however, the simplification serves to lead to abandonment of the effort to explain the origin of behaviour, demonstrate relationships, and expose influence possibilities. Instead, the problem is passed on to the respondents.

In the process, major elements of necessary survey techniques are lost. Since the respondents are more or less forced to react to a very simplified version of reality in that they can only choose from among (very limited) alternatives, no place remains for a survey in the true sense of the term. The respondents are barred from expressing opinions in their own words, and exploratory and qualitative elements in the survey process are regarded as disturbances and obstacles rather than additions and enrichments. All connection to the "real world" is lost.

## II. THE MEASUREMENT OF MOBILITY

### - *Random errors and systematic errors*

In addition to content-related or conceptual considerations, there are other important methodological reasons to avoid at all costs applying the kinds of oversimplified methods described in the previous section. Since the consequence of this trivialization of the complex world is a reduction in the sophistication and diversity of survey techniques to a primitive call for verbal reactions to preformulated answers, these surveys are exceedingly reactive; that is, their results are to a great extent dependent on the respective details of the chosen survey design. This survey instrument effect was impressively demonstrated in a large-scale experiment. Using an identical survey content, 25 different design variants of a stated preference method were tested with a total of 5,700 passengers in Swedish long-distance trains (5). In the interviews, price, travel time, train frequency, and vehicle design were varied. The results showed major differences between the design variants; for example, variations up to a factor of four (!) were found with respect to the "value of time". These differences occurred even though the questions were identical and the samples comparable, as far as possible. The results of each individual variant were significant according to the usual calculations, and in the end, there was no means of deciding which values were actually "correct" or "false". This demonstrates that, when one statistically examines the relationship between variables in an analysis, - something which is necessary and appropriate - one must not automatically equate this statistical relationship with the actual one, and thereby virtually replace thinking with calculating.

Problems such as these are particularly important for the assessment of the underlying quality of survey results. Discussions about quality are traditionally dominated by extensive concern with random errors which suggest to the less experienced data user that statistically satisfactory random errors can be equated with the "correctness" of the results. This simplification is just as ill-considered as it is harmful. For, particularly when measuring complex phenomena (like mobility behaviour), the systematic errors caused by the use of an inappropriate measurement method in complex survey designs and a questionable state of practice can exert a disproportionately larger influence on the results than that due to random errors. Moreover, since systematic errors could in principle be anticipated and - up to a certain point - corrected, taking no account of these errors and the

concentration on random errors can only be explained by the fact that as a rule, good statistical knowledge but little real experience with empirical methods are demanded in transport research.

The discussion concerning the last nation-wide behavioural survey in (West) Germany (1989) provides a good example of this. In lengthy considerations, several authors pointed out a number of inconsistencies in the data but, in the end, were forced to admit that they were not able to explain the cause of these inconsistencies (6). Yet the problems found are relatively easily explained if one is familiar with the respective designs of the surveys being compared and understands the systematic errors arising from using them. However, a discussion of these effects - as important and useful as it would be for the further development of the methodology - does not take place.

- *Simplification and reduction*

The above considerations clearly show that simplification and reduction (in some cases up to the point of trivialization) are the most important causes of the present plight of lack of understanding in mobility research. However, rather than being new, these problems have characterized mobility studies for decades.

The best known example of this oversimplification is (still) the so-called "modal split" problem in which non-motorized modes of transport are ignored and motorized private transport is not usually differentiated between car driver and passenger. Another example is the concentration on a portrayal of the mode of transport choice based on distances covered which - because as a rule, people want to carry out activities and not cover distances - leaves little room for the essential analyses of mobility behaviour and mobility needs. A good example are recent surveys (7) which, at great effort and expense, recorded the (mostly covered on foot) trip stages in detail but then allowed these laboriously recorded stages to be reduced to insignificant residual data by the distance-related portrayal of the modes used.

There are, however, a number of other possibilities for describing the transport mode choice: person-related (participation), trip-related (main mode), or stage-related (all modes of transport used); and according to activities, duration (exposure), distance, etc. All of these descriptions make sense; however, the sense they make is defined

by the respective application. Therefore, none of these indices can be applied with equal relevance (more or less "one-dimensionally") for all purposes.

But one-dimensionality is not only a characteristic of mobility analyses, it is a considerable problem in survey methodological research as well. Methodological experiments are carried out again and again in which one or two design variables are changed and the supposed effects are measured (e.g. telephone survey versus mail-back survey). But, knowing that the success of a design for a mobility survey is determined by 50 or more design factors, it quickly becomes clear that such experiments often fall victim to their one-dimensional perspective (8).

The recently aroused interest in researching non-response effects is also threatened with failure due to its one-dimensionality. For if it is true that a survey method is determined by (over) 50 design factors, then so is the non-response effect it produces. Therefore it is neither possible to carry out non-response studies easily using a different methodology to that used in the "main study", nor is it permissible to apply the results from non-response studies with a particular design to studies based on other designs (9).

- *Confusing the state of the art with the state of the practice*

Particularly in transport and mobility research, many principles of empirical survey methodology have traditionally been interpreted and applied rather liberally. One important cause of this is that transport researchers and transport planners have (almost) always regarded it as natural and reasonable that they design and carry out the surveys needed for their research or planning efforts themselves. Since methodologically sophisticated survey designs have always been elaborate and costly, and in addition to methodological know-how, have required extensive experience in the practical planning and carrying out of surveys, such designs were often not used.

The result has been a multitude of survey designs mainly of questionable quality which have been very impressively summarized in commendable diary collections (10). However, this state of the practice must not - as unfortunately happens today - be confused with the state of the art: methodological standards are also necessary and especially necessary when many do not heed them.

### III. THE RESPONDENTS AS CUSTOMERS

Communication is a complex matter even when the special form of communication one calls surveys is involved. Successful communication must meet many preconditions and take many influences into account, of which the most important is summarized as five (main) factors by the famous "Lasswell formula": Who says what to whom in which channel and with what effect. When this process doesn't function, the problem is almost never with only one of these factors: the tendency to readily blame respondents after a few not so successful surveys is totally misplaced (11).

The most important measure for a successful survey is a level of participation which is maximally high with answers that are maximally reliable. But how does one succeed in obtaining the willing, reliable assistance of as many respondents as possible? There are a number of things that can be done to make the survey more "respondent friendly".

For example:

- Instead of engaging in endless debates over the definition of mobility which leads to a trip definition which must then be laboriously imposed on the respondents based on incomprehensible or misunderstood examples, it would be much simpler and more effective to ascertain in direct contact with them how they view such matters (which has the pleasant side effect that the activity approach which is being so vehemently called for today is, in any case, consistent with most people's views).
- Instead of complaining about the (supposedly) low readiness to respond to mail-back surveys, it would be simpler and more effective to design the questionnaires in a type-size that people can read, a clear layout, and understandable questions (after all, one does not use an interviewer for telephone surveys who speaks a dialect that is hard to understand or mumbles badly).
- Instead of cramming all the questions which are necessary to obtain complex mobility data into a single overloaded and overly long questionnaire, it would be simpler and more effective to split up the questionnaire design into clear, individual elements and use the most suitable method for each of them.

- Instead of "compensating" respondents who are being unnecessarily burdened because of the poor design of the survey with money or presents, it would be much simpler and more effective to devote the financial means required for sensible measures of respondent motivation and assistance.
- Instead of burdening and confusing the respondents with complicated - and for them, often irrelevant - filling-out and answering examples, it would be simpler and more effective to offer the respondents a suitable assistance service and deal with the remaining complicated special cases in an additional survey phase, and on and on. In other words, one must treat respondents like customers and not as a nuisance or enemies or even victims. Respondents are human beings not response machines. It is up to the researchers to adjust to the respondents and not to expect the respondents to adjust to the researchers.

There are a number of reasons why this usually does not happen. Most important is the lack of standards and methodological consciousness. Although the principle that "the cheapest survey is always the most expensive" (because it leads to false conclusions and decisions) is often recognized in theory, in practice it is just as often repressed.

This practice of repression is facilitated by a situation that clearly differentiates measurements in the natural sciences from measurements with population surveys: if one wishes to measure at what temperature water boils, one must create the necessary preconditions to do this. If the conditions are not right (for example, if one tries to heat up a ten-litre container with a candle), then the water will not boil and no one would blame the water or the candle. But if one asks people silly questions in a poorly designed questionnaire, some will nevertheless try to answer. Their replies are often not much cleverer than the questions. The researcher will however have the tendency to place the blame for the silly answers on the respondents or the survey instrument, rather than blame himself.

This lack of sensitivity to the respondents is now being reinforced by the fact that traditional systems thinking in mobility research is now becoming established in the area of survey design. For example, the question of how one must design a questionnaire so that a machine can read it arouses much more interest than the question of how one must design it so that it can be read by respondents. And, as a

result of the rapid development of the most varied forms of communications technology, this playground is becoming rapidly larger. The use of computers for surveys, increasingly directly operated by the respondents, the use of new location positioning systems, or the almost universal effort to completely automate data processing/coding (and thereby to eliminate one of the most important checking and monitoring channels) are all examples of a development that is intoxicated by the new technology. This regards it as worthy of application simply because it is technically feasible, and thereby completely overlooks the fact that asking questions represents a form of communication whose main aim is not the use of elegant information processing technology, but rather is to obtain the best possible information from the highest possible proportion of respondents.

This brief account of some major problems with the present practice of empirical mobility research makes one thing completely clear: the lack of standards and the lack of awareness that carrying out surveys requires relevant knowledge and - above all - experience, have led to a detectable decline in the methodological quality of surveys in the transport field. Although the discussion of methodological issues has experienced a revival, opinions are divided as to whether this revival can stop or perhaps even reverse the continuing decline in quality.

### **COMMON SENSE IN A COMPLEX WORLD**

A perceptible raising of the quality standard for mobility surveys is becoming more and more important; for the long struggle of mobility research for recognition as an aid to decision-making in many planning fields is becoming increasingly successful. However, the resulting link to application brings with it the demand for the provision of reliable decision-making assistance. This decision-making assistance needs to be of the highest quality in order to safeguard the investment of considerable financial resources and create prevailing conditions for our everyday life whose consequences may still be felt by our children and grandchildren. Practical mobility research is anything but experimentation without consequences in an encapsulated academic playground. Therefore, our efforts must be directed above all to a constant improvement in our methodological standards and practices.

This urgently-required increase in the methodological quality of mobility research depends upon finding a harmonious synthesis of content-related/conceptual thinking

and mathematical/statistical operationalization. This applies both to the development and application of our explanatory and predictive models and to the development and assessment of our survey methods.

In this connection, it is undisputed that, in the area of the application of all types of statistical methods, enormous progress has been achieved in the past two decades. It is now time to attempt to further develop our content-related concepts in a similar way.

In spite of the complexity of our research topic (mobility), the application of common sense often suffices. It requires no great scientific effort to recognize, for example, that the use of an alternative mode of transport is only possible: if there is no constraint requiring the use of the present mode, if a suitable alternative mode is actually available; if the person involved is also adequately informed about this alternative; if she/he thinks the use of this alternative is possible with regard to travel time, travel costs, travel comfort (and similar usage characteristics); and if she/he has no reservations in principle against this alternative and finally chooses it from all the available alternatives (12).

From this (conceptual) model of mode choice, data requirements can then be formulated. These data requirements will include various types of primary and secondary data. On close examination, it will quickly become clear that even the primary data can only be obtained through a combination of different (partial) surveys. If reliable data is to be collected, different survey methods - with each being particularly suitable for its respective data field - must be used.

Given that the data are collected and recorded, careful analyses must be employed to determine if the conceptual assumptions that have led to the development of the underlying conceptual model can be confirmed or, if necessary, need to be modified. Only then can the mathematical/statistical formulation of this model begin.

Moreover, it also requires no great scientific efforts to recognize, for example, that the result of a complicated communication process like a survey is dependent on a multitude of influencing factors. For instance, basic population, sample, address selection, and survey time period; survey method and survey contents, survey instrument, questionnaire, question formulation, design of the instruments, layout, required respondent time/effort, and comprehensibility; the way respondents are

approached, motivated, and assisted; checking, monitoring, and recording. This list can be continued and presented in greater detail. Therefore, if we want to examine the (lack of) success of a survey, we must examine all of influence factors; the comparison of individual design elements taken out of context does not suffice (13).

And finally, it requires no great scientific effort to recognize that the "research topic" of our surveys is the most complicated "thing" we know: the human being. Whereas land surveying has its own course of study lasting several years, according to current conceptions of mobility research, the "surveying of people" requires no intensive training or experience!

It is therefore particularly important to design the survey process from the point of view of the respondents and not from that of the researchers. Unreadable questionnaires, incomprehensible questions, unrealistic question concepts, too lengthy questionnaires, etc. would not arise if we would regularly put ourselves in the respondents' situation.

Thus, low response rates, imprecise/incomplete answers and unsuccessful surveys are not the fault of the respondents, but rather that of the researchers themselves. The respondents are our customers, and that's the way we should treat them.

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