

Transport Surveys: Considerations for Decision Makers and Decision Making

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This book provides an international perspective on improving information to support transportation decision-making. It comprises papers and workshop syntheses from the 9th International Conference on Transport Survey Methods in Chile in November 2011. The conference was organized into fourteen workshops with both paper presentations and discussions in the workshops forming the majority of the conference activity. The papers reported primarily on research pertaining to continuous improvement in transport survey methods – the backbone of the transportation data pipeline in most countries. But some papers also addressed the new ways in which innovation – notably technological innovation – is being applied to the capture and analysis of data to produce necessary information faster, better, and less expensively. The conference program built on a rich legacy of intellectual pursuits spanning the past two decades, and it is anticipated that the conference will continue into the future. Thus, the contents of this book represent a 5-10 year view through a moving window on the international state of the practice and concerns in transport survey methods.

1. Introduction

In today's difficult global economy, governments are struggling with demands to increase basic services and to do so with fewer available resources. Governments must ask themselves where the marginal dollar of expenditure will have maximum impact. This is true across all sectors of private and public economies but particularly so in the transportation sector. Regardless of country, transportation infrastructure is in a critical state. Bridges are load-restricted, closed, or falling down from lack of maintenance; transit systems endure unending cycles of maintenance interruptions; congestion wastes commuters' time and impedes logistics. Most governments' statistics have shown that transport has become worse for just about everyone. In most major cities, journey times by all modes of transport have lengthened. On the other hand, there are efficiencies to be gained. As the Chilean Transport Deputy Minister Gloria Hutt reflected upon in the opening plenary, in the last decade there has been an enormous change in the access to communication technologies (e.g., satellite TV, mobile phone, internet access). Such technologies have had impact not only on the functioning of the transportation system and on the ways in which individuals organize their travel, but also, these have had impact on the ways in which data are obtained and analysed.

In hard economic times, policy makers are looking for every opportunity to spend less and get more "bang for the buck." It is a time for smarter decisions – especially transportation investment and policy choices based on objective information. That takes data – and good data are getting increasingly harder to come by. How do we get the robust data needed for sound decision making? The answer lies in the collection of good passenger and freight transportation data on volumes, origin and destination flows, costs of travel, impacts of travel, influencers on demand, and substitutes for travel.

The papers contained in this book illustrate how travel behaviour research is addressing the need for good data and better information about passenger and freight travel to support decision making. The papers span fourteen different topics that contend with stepwise improvements in mainstream transport

survey methods, technology applications that support new types of data collection and analysis methods, or innovative methods to address new policy or planning challenges. The ground covered (see Table 1) is worth noting, as these themes were not predetermined but were derived from more than 140 extended abstracts that were submitted to the ISCTSC in response to the Call for Papers – almost double the number submitted to the previous conference. The themes are thus in themselves an expression of contemporary priorities from the international community of transport survey researchers, and of the lively current interest in the field.

As Table 1 indicates, the types of improvements deal with survey and sampling design, the use of non-survey data sources, data processing, and interpretation. While household travel behaviour surveys were often the methodological focus of the papers in this book, the primary objective of most papers is to provide approaches to improved measurements of critical data regardless of the specific type of survey or other method employed.

The terms “data”, “information”, and “knowledge” are frequently used in this book, often interchangeably. But in reality, there are distinctions that are important to make and keep. Most of the papers in this book focus on data; that is, numbers, words, images that have yet to be analysed to produce information or statistics. Information is produced through processing, manipulating and organizing data. Transport statistics are an important subset of information. Knowledge is attained by interpreting information received. All three concepts (data, information, knowledge) are prerequisites for good decision making. Taken as a whole, the papers in this book touch on improvements in all three areas and comprise an international perspective on best practice for decision making.

Table 1: Workshop Topics at the 9th International Conference on Transport Survey Methods, 2011

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| <ol style="list-style-type: none"> 1. Bringing Location-Aware Technologies into the Travel Survey Mainstream: Complement or Stand-Alone? 2. Cognitive and Decision Processes Underlying Engagement in Stated Response Surveys 3. Methods for Capturing Multi-Horizon Choices 4. Designing New Survey Interfaces and Front-End Software 5. Exploring and Merging Passive Public Transport Data Streams 6. Validating Shifts in the Total Design of Travel Surveys 7. Survey Methods to Inform Policy: Environment, Energy, Climate and Natural Disasters 8. Measuring the Influence of Attitudes and Perceptions 9. Longitudinal Methods: Overcoming Challenges and Exploiting Benefits 10. Post Processing of Spatio-Temporal Data 11. Comparative Research into Survey Methods 12. Multi-Method Data Collection to Support Integrated Regional Models 13. Alternative Approaches to Freight Surveys 14. Collecting Qualitative and Quantitative Data on the Social Context of Travel Behaviour. |
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This Introductory Chapter provides the relevance of and context for the papers that comprise this book. The relevance is discussed in the next section, considerations for decision makers. It addresses why decision makers should be concerned about data for decision making. Then, a section on considerations for decisions is presented. This section provides an overview of the cross-cutting themes and key issues represented by the papers in this book.

2. Considerations for Decision Makers

When the international transport survey community gathered in Chile in November 2011, which was more than four years after the beginning of the financial crisis, “uncertainty” continued to remain high. The United States was limping out of an economic recession, the Euro Zone was dealing with several member economies near collapse, and financial distress continued to be increasingly widespread throughout the world. Regardless of country, conference delegates faced the same concerns about budget cuts for transportation survey programs. This “state of the world” was seen as unfortunate because modern economies run on statistics. Businesses, governments and households base their decisions on them. All developed countries have some method of generating timely statistics on basic social, economic, and demographic attributes. Most have the same capability for generating transport statistics. In this era of tight budgets, such data are often under-valued and not considered to be the information assets that they really are.

Transport data can inform decision makers about what really works; for example, how best to relieve congestion and improve supply-chain connectivity to make freight transportation more competitive. Good data can enable people and businesses to use the transportation system more efficiently and so contribute to a goal of universal mobility. Freight transportation volumes can be an early indicator of the state of the economy. There is plenty that decision makers can learn from good data thoughtfully used. As the 2003 Special Report 277 of the Transportation Research Board, *Measuring Personal Travel and Goods Movement*, noted “without good data, decisions will be arbitrary, options overlooked, and solutions misguided” (National Research Council, 2003).

It has always been the case that a balance needs to be achieved between the importance of the information needs and the cost of collecting and supporting data with the necessary accuracy, detail and timeliness. To achieve a balance, decision makers need to determine their information priorities and put in place arrangements to secure the quality of the data to satisfy these needs. Undervaluing data, and the surveys and other methods used to obtain them, is imprudent at a time when our world needs good information and rich statistics. The issues that politicians and policy makers face have become more and more challenging and nuanced. In this context, policy decisions need to be based on careful and rigorous analysis using sound and transparent data. Such data are essential to issue recognition, program design, policy choice, and accurate forecasting, as well as to monitoring and evaluation.

Transport surveys collect data that can be processed into information to make decisions. Data can be descriptive (i.e., the “what is” condition of the system) or diagnostic (i.e., “what is wrong” condition, where “what is wrong” is measured as the disparity between “what is” and “what ought to be”). The processes by which information is derived from these data may take many forms (qualitative and quantitative): research, analysis of data, economic and statistical modelling; cost/ benefit analysis; and the aggregation of opinions and beliefs. The methodologies that are used to gather and synthesize the information are just as significant because they impact the quality of the information. Transport surveys are not one-time expenditures. Data are dynamic not static. Updating of information is required as

people's understanding changes, as new research produces new results, as issues intrinsically change, and as new methods, approaches or technologies become available to obtain necessary data. This is particularly important to ensuring adequate coverage of current and emerging data needs, while maintaining comparable indicators of transport demand and other indicators over long periods of time. The conference organizers recognized the tension that is often present between methodological innovation on the one hand, and protecting the comparability of survey results over time on the other, having adopted *scoping the future while staying on track* as the conference theme.

Research such as that contained in this book is important for future decision making. There is a clear imperative for the development of increasingly creative and complex approaches to survey design, execution, and analysis. Smarter transportation decisions require comprehensive, accurate and timely data about travel demand, infrastructure condition, travel time reliability, the equity of access, and environmental impacts. With such information, decision makers can better understand where and what the needs are, what works and does not, and where the payoffs are greatest.

3. Considerations for Good Decisions

We argue above that good decisions require quality data and sound information, yet funding constraints limit the ability of public agencies to fund quality data collection efforts. As a result, transportation data users and suppliers are consistently pressed to find better, faster, and cheaper ways of collecting data. Thus, continuous improvement in transport survey data methods, procedures, and tools is an imperative, not a luxury.

The first paper in the book, the keynote paper by Goulias *et al.* (2011), goes beyond the notion of continuous improvement to present a new conceptual model for data to inform decision making. It presented a unabashed exploration of a “data collection paradise” that enumerated and explained the type of data needed for travel demand modelling and simulation related to the new generation of models for large scale regional policy analysis. In doing so, the authors described an “ideal” total design data collection method that sought to obtain individual and group behaviours embedded within their spatial, temporal, and social contexts. This was done through an approach that uses core and satellite survey components that can inform current and future model building.

The remaining papers contained in this book address this concept of continuous improvement of existing data collection methods, while blazing a trail towards an ideal of total design that is sensitive to the future. They are organized into eight themes:

- Mainstreaming mobility-aware and online technologies
- Improving respondent interfaces
- Comparing survey modes and methods
- Facing up to sample attrition in longitudinal surveys
- Understanding the social context of data collection
- New challenges in dealing with time: environmental peaks and planning horizons
- New perspectives on observing choice processes: psychological factors
- New types of data streams: opportunities and challenges.

These eight themes do not represent the contents of all of the papers presented at the conference or of all of discussions. But taken as a whole they represented a well-balanced treatment of the state of practice in transport survey methods.

3.1 Mainstreaming Mobility-Aware and Online Technologies

Three workshops and six of the papers addressed the mainstreaming of new technology supports for transport surveys. These papers were related to use of mobile phones, global positioning satellite (GPS), and the Web to support interviews, and provided a good representation of the types of new technologies that are considered state-of-practice for travel surveys. The growth of interest in them has been substantial as the weaknesses and limitations of conventional survey practices, such as low response rates due to high respondent burden, have been well documented. Best practice and professional protocols dictated that survey managers and developers continually seek to reduce respondent burden through many mechanisms, including technology applications. The current financial climate also required cost savings of survey managers and developers to be identified wherever possible. So the discussions in many, if not all, of the workshops took technological applications into account.

The papers under this theme focused on extending and documenting the mainstreaming of mobility aware devices. The Gould (2011) paper on cell use of cell phones explored the types of travel information that are likely to be inferred from text surveys and from cell phone traces, recognizing that a passive GPS traces might change the level of measurement and the inferences that can be made about travel behaviours. The Wolf *et al.* (2011), Stopher *et al.* (2011), and Sneade (2011) papers all looked at the mainstreaming of GPS technology. The first two of these GPS-focused papers discussed the opportunities and challenges with conducting GPS-only household travel surveys, which both sets of researchers point to as a likely future direction for household travel surveys. The Sneade paper (2011), on the other hand, considered the ramifications of using GPS technology for a long-standing national travel survey in place of the travel diary. The conclusion was not to replace the conventional methodology at this time. The Christensen paper (Christensen, 2011), likewise analysed the effect of adding a web survey to a traditional telephone based national travel survey by asking the respondents to check in on the web and answer the questions via the web. In this case, the conclusion was more optimistic.

In related workshop discussions, a point of criticism levelled at the current state of the practice was that in application and use of GPS and other devices there is the tendency to “replicate old methods with technology” rather than seek new designs that optimize the advances of the new technologies. This tendency is driven, in part, by fear of rupture in the comparability over time of established repeated cross-sectional, continuous, or longitudinal surveys. This is certainly the case in the research conducted by Sneade and Christensen (Sneade, 2011; Christensen, 2011).

However, as the Wolf and Stopher papers (Wolf *et al.*, 2011; Stopher *et al.*, 2011) highlight there is the desire to push the envelope in terms of how much of the data are collected via technology devices – from small subsamples, to larger subsamples, to 100 per cent of data collected. Also seen was the promise of using mobility-aware devices to observe travel behaviour over longer periods of time than are covered by most established travel surveys. These longer periods may extend to weeks rather days. Some improvements in what might be called “intelligent passive” observation show promise for reducing the respondent burden associated with seven-day diary methods, while the major use of web-based tools in such surveys may possibly shift from validation (as in prompted recall) to keeping respondents engaged and interested. Web-based prompted recall techniques are also being used more readily. This development has much to do with the availability of ancillary data, such as GIS layers of road and transit network characteristics and the ability of survey designer to manipulate and integrate

these data into their survey approaches so as to collect more accurate information on amount of travel as well as travel origins and destinations.

Notwithstanding these examples of continuous improvement, the papers and workshop syntheses point to numerous examples of the survey methods work that remain to be done in technology-based travel surveys. There are new classes of selection bias and response bias associated with such surveys that have yet to be suitably addressed. What will be the future trade-offs between achieving probability samples and attaining coverage of the survey population? Should social networks be used to implement snowball sampling? The workshop syntheses focus on important issues in understanding the implications of implementing changes in survey design, such as the use of GPS devices or the development of online survey systems. What are the implications in terms of the validity and reliability of the resulting information and its utility for transportation planning and policy-making?"

3.2 Improving Respondent Interfaces

Improving transport survey data depends to a large degree on attracting respondents to participate in transport survey activities and maintaining their interest over the course of the survey period. Transport survey methodologists are increasingly turning to information technologies and geomatics to change the way in which respondent interact with a survey, enhance respondent interest in surveys, to decrease respondent burden, to lower costs and, eventually, to design continuous self-administered surveys that are predominantly passive. There are still considerable challenges to understanding the usability and relevance of these new survey interfaces. Good interfaces depend on a strong understanding of web technologies and an excellent sense of graphic design, layout and style to build high performance front-end user-interface components that engage the users. The conception of survey user interfaces does not seem to be going through a sudden paradigm shift, but rather a steady growth of the role of technology through the addition of multiple modes and their continuous evolution. Three papers and two workshop syntheses examined the current state of the practice for improving respondent interfaces.

In Thériault *et al.* (2011), researchers evaluated a new set of functionalities deployed in a Web survey interface to collect personal travel behaviour data. This interface used applets developed in Java, and Google Maps in order to assist recording of activity places (geocoding) and the reporting of actual trips into a relational database, while using e-mail to recruit and support respondents. In Bourbonnais and Morency (2011), researchers demonstrated the usability of the web to conduct a large-scale household travel survey in metropolitan areas and for large trip generators like universities. It presented the development and implementation process for a web-based tool as well as various statistics on the way respondents interacted with the tool. Cavalcante and Roorda (2011) investigated the impact of the new survey interface in the context of a web-based stated preference (SP) survey to estimate a modelling system of shipper carrier interactions in the logistics services market.

These papers and the discussion on this topic at the conference pointed to the need for a better understanding of the potential for negative impact of new user interfaces on bias as well as possible positive impacts on response rates and accessibility. The challenge is to add new interactive platforms while making an effort to stay compatible, or equivalent, with previous survey efforts. This latter need is important in order to generate datasets that are comparable with historical data, which enable longitudinal analyses and the understanding of changes that occur over time.

3.3 Comparing Survey Modes and Methods

Surveys are currently the main method for collecting essential transport data. Survey methods, however, evolve constantly. In the 1970s, the debate among survey researchers was over the acceptability of random digit dial phone surveys, compared with the much more expensive face-to-face interviews of randomly selected households and mail surveys. In the 1990s and 2000s the debate was over the acceptability of computer-administered interviews. Today, advances in communication technology continually alter the most effective ways to reach people, requiring researchers to decide which approaches to sample selection and survey administration will yield data appropriate to answer important questions. Meanwhile, advances in information technology have altered the most effective ways to obtain and process geo-located information.

As already noted, there is considerable interest in and uptake of new technologies in the conduct of transport surveys. Given the potential practical benefits associated with technology-supported surveys, as well as the expected wider application of these technologies in future survey research, it is important and indeed necessary to understand the benefits and limitations these newer methods bring to transport data.

The workshop discussion on this topic at the conference noted that comparative research is needed because the best method to collect any kind of data depends also on the purpose of the study, namely the way the resulting data will be used. In some cases, data are collected only to study availability and use in transport, in other cases they may feed trip-based, activity-based or micro-simulation models.

Three papers reported on research that compares survey modes and methods. Kagerbauer *et al.* (2011), compared three household travel survey methods PAPI (paper pencil interview), CATI (computer assisted telephone interview) and CAWI (computer assisted web interview) on survey participation rates. Kohla and Meschik (2011) compared PAPI, passive GPS-tracking, active GPS-tracking and prompted recall interviews in terms of the accuracy of the data reports. Papon (2011) compared biographic surveys with traditional cross-section travel surveys to assess impact on response rates and survival bias. All three papers conclude with differential impacts by survey mode.

Today the challenge is how to conduct surveys in a world where the modes of communication have proliferated, where cell phones are as prevalent as land lines, where market research is common over the Internet, but where no one mode is likely to cover all people in the population equally well and no two modes can be said to have comparable impacts on data reports. Accordingly, the synthesis of the workshop on this theme focuses on the need for additional survey research.

3.4 Facing up to sample attrition in longitudinal surveys

In past decades, we have observed continuous increases in travel demand along with economic growth. Under such circumstances, infrequent travel surveys were often sufficient for monitoring travel demand. Since the 1990s, as per capita growth of everyday travel has leveled off significantly in many industrialized countries, we have observed very heterogeneous development in travel demand among different population segments – such as continuing growth of car use among elderly people, while there are signs of decreases of car use among the young. In addition intrapersonal behavioral variation is growing, with escalating variation in mode use. In light of these new developments, the requirements for data on personal travel have changed. As a way to meet these new travel data requirements, there is rising interest in longitudinal, continuous and panel surveys. A special problem of longitudinal surveys

is sample attrition. Generally there is a relationship between the complexity of a survey and the resulting respondent burden and its affect on response rates.

Two papers in this book address this challenge. Chikaraishi *et al.* (2011), examine how to design smaller surveys while minimizing the loss of necessary information. The study extends previous studies on sampling designs for travel diary surveys by dealing with statistical relations between sample size, survey duration for each wave, and frequency of observation, and provides the numerical and empirical results to show how the proposed method works. Then, Chlond *et al.* (2011), look at how to assess the completeness of reported mobility in longitudinal surveys. They find that reporting behaviors are different depending on the number of repetitions. These effects positively influence the quality and completeness and therefore the reliability of recorded mobility figures in multi-period mobility surveys.

3.5 Understanding the social context of data collection

Interest in understanding the social context of travel behavior is recent – surfacing only within the past decade. Interest stems from both questions about the quality of data that have been collected and from the policy concerns that have prompted new data collection activities. The scope of these questions requires research using innovative techniques that are derived from the diversity of methods employed in the social sciences, both qualitative and quantitative. Understanding the social context of the data collection enables the designer of the survey or the user of the data to understand the inherent challenges in elicited participation and problems that might arise in using the resulting data. A discussion of the papers in this book that focus on the issue will shed additional clarity on the topic.

Carrasco *et al.* (2011), investigated the role of social networks in travel behaviour through a new data collection effort that uses social networks to collect a wide array of information about the social, urban, and temporal context where social activity-travel behaviour occurs. A special focus was on how these techniques help to understand the role of income and access to amenities on those spatial and temporal patterns. Lucas (2011) took a different approach to research on the social context of data collection. She explored how “action research” can be used in transport research in resolving major transport policy challenges, such as the mitigation of climate change and environmental impacts, transport-related social exclusion and intergenerational equity issues. The method is specifically designed to support and actively engineer behaviour change *as an integral part of the research process*. A unique distinction is that the process is inherently collaborative and involves repeated exchanges between the researcher and the ‘researched’.

As the workshop report on this topic illustrates, there is much future research needed on this topic. The workshop discussion raised more questions than could be answered about what is social context, the utility for including it in transport research, and the best approaches for collecting information about it.

3.6 New challenges in dealing with time: environmental peaks and planning horizons

Many of the topics of the conference workshops were extensions of issues and discussions from previous conferences. But two topics raised new methodological interests and questions. These were done from the context of specific policy questions. One looked at multi-method survey packages and the other at collecting data on the interaction between day-to-day tactical decisions (such as destination

and travel mode) and longer-term strategic decisions (such as residence location or vehicle access). A finding of the multi-method workshop was that transport and land-use models will be progressively embedded in a comprehensive system of integrated urban models that also includes population demographics, markets for education, jobs, and houses, the demographics of firms, and flows of energy, water, waste, and pollution, much like that advanced in the keynote paper by Goulias *et al.* (2011). This will bring both challenges (e.g., the interoperability of data methods), and opportunities for the exchange of data. As these challenges are in the context of specific policy questions, the methods brought to bear must be at their most flexible and creative.

Three papers provided a current snapshot of representative research in terms of these new challenges. LeVine *et al.* (2011), examined methods for capturing choice preferences that had different time horizons but were linked in a strategic-tactical structure: purchasing ‘mobility resources’, which include commitments such as car ownership and subscriptions to carsharing services, and choosing a mode of transport for a particular instance of travel. Methodological innovation was brought to the task in that respondents were asked to indicate their choices in the context of giving advice to a demographically-similar ‘avatar’. Arellana *et al.* (2011), also focused on innovations in the capture of choice data – specifically departure time choice. Departure time choice depends on the desire to carry out activities at certain times and places, influenced by travel conditions, congestion levels, activity schedules, and external trip factors. The paper reports on a complex data collection procedure allowing the researchers to obtain detailed input data from different sources and at different time periods. Wilmot and Gudishala (2011), also look at time-dependent stated choice. Here they develop and present hypothetical storms in a video, employing a sequence of scenarios showing prevailing conditions at discrete points in time as each storm approaches land, in order to develop more accurate evacuation demand models.

As the workshop synthesis covering this topic explains, multi-horizon choices are made within a context that changes over time. Thus, representation of context is crucial in multi-horizon decisions because many choices are highly constrained. Some of the critical dimensions of the context identified in the workshop include economic, time, and space constraints and considerations. The context of decision-making develops as an interaction between the larger environment (built environment, regional economy, culture, technology) and the state of the individual decision maker (their own economic and physical resources, social network). It is within this context that processes and outcomes then interact and survey methodologies must adapt and change.

3.7 New perspectives on observing choice processes: psychological factors

Surveys sometimes fail to meet expectations because respondents are disinterested or disengaged. This can be easy to explain. For example, respondents are often expected to distinguish between genuine telephone surveys and sales calls that are disguised as surveys. Having been deceived once, a respondent may refuse to respond to any call that announces their selection to participate in a survey. In other circumstances, respondents may have accepted to take part in a survey, and be totally convinced of its bona fide, but their pattern of responses defies any reasonable logic, and this may (or may not) indicate disengagement with the survey task. This is particularly problematic in stated response (SR) surveys, i.e. those used to assess expected behaviour in hypothetical situations, and especially those employing Stated Choice experiments in which respondents are expected to trade off alternatives whose attributes (e.g., travel time, travel cost, comfort, etc.) are varied in accordance with an experimental design.

Apparent disengagement may manifest itself in a variety of ways, such as over-rapid responses to questions that require some deliberation, high levels of incomplete responses, or unlikely patterns of responses. For example, is a respondent who simply picks the cheapest alternative in every question telling us he is bored, that he didn't understand the instructions, or that he uses that simple heuristic to make choices in real life? Although these problems have long been discussed in relation to decision theory, we picked this issue as a priority because, recently, survey designers are increasingly looking for tools to explain dubious response patterns and modify survey designs accordingly.

This is in fact quite a complex problem area, and it was addressed in the conference in three ways.

The first way was through a workshop that dealt specifically with cognitive processes underlying disengagement in SR surveys. It concluded that a sweeping assumption that any inexplicable response patterns simply replicates the respondents real-life approach to decision-making, tempting as it may be, does not survive serious scrutiny. A series of experiments were recommended to improve the detection of low engagement with the SR survey tasks, including background logging of response times and patterns in the case of computerised choice experiments (Weis *et al.*, 2011) and to identify causes of low engagement and explore correlates of those causes with personal and contextual characteristics (Bonsall *et al.*, 2011).

The second way was through a review of the measurement of perceptions and attitudes, treating such variables both as influences on various dimensions of travel choice, and as potential explanations of aspects of the choice process, as noted in the papers of Donoso *et al.* (2011), and Tudela *et al.* (2011).

The third way was part of deliberations of the workshop on the social context of data collection, already discussed in Section 3.5, above, in particular regarding an iterative procedure in which qualitative data provides relatively simple stories that explain quantitative findings and lead to a more complex analytical understanding. This too throws light on the psychology of responses to surveys, notably because the greatest challenge to instrument designers is dealing with *framing*, which translates to the context that respondents assume is "behind" the questions posed. Once again, this is particularly problematic for SR surveys, especially if some of the hypothetical choices are perceived to be socially desirable or undesirable.

3.8 New types of data streams: Opportunities and challenges.

Six of the papers and two workshop syntheses address new data streams in both the realm of public transport surveys and for travel behaviour capture. In the area of public transport data we find several papers that examined the alignment of surveys with administrative data. Administrative data are in the form of information coming from fare systems, on-line travel planners, network inventories, or financial transactions.

Chu and Chapleau (2011) used data from transit smart card automatic fare collection (AFC) systems to synthesize individual-level attributes of users by summarizing multi-day validation records from each card. The new dimensions were then transposed to various levels of aggregation and studied simultaneously in multivariate analysis. They discuss the limitations, biases and strategies of doing so. Beltran *et al.* (2011), explored the possibility of automatically generating level of service indicators from processing of raw Vehicle Location (AVL) and Automatic Fare Collection (AFC) data that are used for

operation planning and monitoring of the public transport system of Santiago, Chile. The advantage of doing this was that these measurements and estimates were found to be reliable because they were obtained from large samples, and cost-effective because the analysis was executed at nearly no cost. Likewise Devillaine *et al.* (2011), used AFC data to estimate highly representative, although not bias-free Origin-Destination (OD) matrices. The researchers applied two methods of validation: endogenous and exogenous validation. As the workshop synthesis pertaining to this theme suggests, smart card systems and other passive data streams offer promising avenues for operational, tactical and strategic planning of transportation networks – meeting the criteria of obtaining data quicker, better, and at less cost.

In the area of travel behaviour capture, an important element was best practice for post-processing of spatio-temporal micro-data. Although there is much work left to do, important strides are being made in areas such as automatic mode detection and the interpretation of short dwell periods (including mode transfers). Interestingly some of these strides are being made without the provision of ancillary data, such as GIS layers of road and transit network characteristics, a promising development in parts of the world where such data are incomplete, inaccurate or absent.

Greaves and Ellison (2011) described the system set-up and processing requirements for a long-duration longitudinal GPS/Prompted-Recall survey conducted in Sydney, Australia, using an in-car GPS device within a prompted-recall interface accessed over the Internet by participants. Their approach includes an important assessment of participant burden and cognition by analysing the respondent's prompted-recall activity and comparing his/her responses to information inferred from the GPS data. Smoreda *et al.* (2011), on the other hand, tested several alternative methods of collecting data (active and passive localization) from mobile phones for personal mobility analysis. They define active localization as being akin to a personal travel diary, while passive localization is based solely on phone network data, which are automatically recorded for technical or billing purposes. Smoreda's work begins to fill the promise of future directions that surfaced in the workshop discuss related to this theme. Workshop members expressed the hope that longer-term research will lead to mode detection that is independent of user feedback. It was also hoped that the ability to link spatio-temporal data to Smartcard and other data sources would become possible.

It is probably fair to say that a majority of the international transport survey methods community assume that advanced technology supports will play an inevitably increasing role in the next 5 – 10 years, especially in surveys of personal travel, and that they may well transform some stages of the transport data collection “supply chain” radically.

4. Summary

The editors of this volume observe, from successive conferences in the ISCTSC series, that differences around the world in mainstream transport survey methods are slowly diminishing. For example, the recent developments and experiments in technology-aided surveys, including Web-based methods, have widened a debate that not so long ago was confined to the relative merits of personal interview, telephone interviews and postal questionnaires, each of which had their national champions. Most of the major country players in that debate have seen response rates decline, and all have been engaged in survey research that includes technologies. At the same time, Dillman's notion of “quality at every stage” has become orthodox. However, so has the imperative to be efficient in the wake of the

international financial crisis that accelerated dramatically just a few months after the previous conference in Annecy in May 2008.

The emphasis in most of the Annecy workshop discussions was on developing practical, achievable and affordable strategies for the collection of essential transport data that would be less contingent on shifting political and funding priorities. At the conclusion of the 2008 conference, cross-cutting goals were identified focussing on stable, continuous national surveys that take full advantage of technological developments in collection, analysis, and visualisation.

The 2011 Chile conference ended on a rather different consensus. While recognising the methodological progress consolidated in the conference, the consensus was summed up by co-chair Johanna Zmud and (for the LOC) by Juan de Dios Ortúzar as a need for serious self-examination. They translated this into the following eight questions for which the conference outputs could provide some, but not necessarily complete, responses.

1. Are we doing our job properly?
2. Can we really capture “the universe”?
3. Are we generalizing about new methods from biased information?
4. Are we still too focused on “what” or “how” and not enough on “why”?
5. Are we exploiting our understanding of decision-making processes?
6. Are we asking the right questions?
7. Where we are in understanding what we are trying to improve?
8. Are we chasing response at the expense of scientific rigor?

Accordingly, one of the central messages of the Chile Conference is that innovation, and the thorough testing of innovations, should be our main preoccupation for the immediate future if we expect to produce the data that wise transport planning decisions and policies require.

5. References

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