

10th International Conference on Transport Survey Methods

## Workshop Synthesis: Improving methods to collect data on dynamic behavior and processes

Regine Gerike<sup>a\*</sup>, Martin Lee-Gosselin<sup>b</sup>

<sup>a</sup> Technische Universität Dresden, Chair of Integrated Transport Planning and Traffic Engineering

<sup>b</sup> Université Laval, Québec, Canada, Centre de recherche en aménagement et développement (CRAD) and Imperial College London Centre for Transport Studies

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### Abstract

This paper summarizes the findings from the workshop “Improving methods to collect data on dynamic behavior and processes”. This workshop focused on the scope, strengths and weaknesses of traditional and innovative survey methods used to capture dynamics in travel behaviour and on the identification of future research priorities. This paper gives an overview of the process followed by the workshop, presents the definitions of technical terms adopted to facilitate the spoken exchanges in the workshop, describes the current state of research on topics that were selected for discussion by the participants, and looks ahead to future research

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### 1. Purpose and introduction

Advanced methods in modelling and planning increasingly require longitudinal information for capturing the dynamics of travel behavior and underlying decisions. Activity-based models represent the activity patterns of individual agents over at least complete weeks (Goulias et al, 2013), incorporating multiple attributes and determinants such as influences of social networks on the agents’ travel behavior (Hackney and Axhausen, 2006).

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\* Corresponding author. Tel.: +49 351 463 365 01; fax: +49 351 463 365 02.

E-mail address: [regine.gerike@tu-dresden.de](mailto:regine.gerike@tu-dresden.de)

Strategic visions and policy packages in transport planning are becoming more complex. Goals such as smart, sustainable or multi-modal cities require a multitude of information for their implementation and evaluation. For example, many cities make substantial efforts to promote travel by the active modes walking and cycling: longitudinal data about walking and cycling trips and stages help to design interventions that reach the chosen goals efficiently.

For decades, improving panel, pseudo-panel and repeated cross-section designs have been central to the methodological discourse and to the ISCTSC-conference publications (see e.g. Ampt 2013, Golob et al. 1997, Murakami et al. 2007, Zumkeller and Ottman 2009). The toolkit of methods is expanding: in particular, recent developments make it possible to extend the period of observation, where useful, to months and even years (Moutou et al. 2014). Mobile data collection technologies are more and more appropriate for observing behavioral dynamics and processes, and they are increasingly ready for real-world applications (Kopp et al. 2015). The proportion of persons and subgroups in the population that own mobile devices such as smartphones and/or are familiar with these technologies is high and growing. Concerns about selection bias are therefore declining. Representative samples might even be recruited more easily when technology-aided options for data collection are offered to respondents. Moreover, various new passive data sources such as mobile phone data or data from ticketing systems are available, and many stakeholders support open data policy so that data availability is improving.

Overall, on the one hand, data needs are high and include data that have been collected only rarely in past travel surveys, such as longitudinal patterns, stages, subjective behavioral determinants or routes. On the other hand, opportunities to implement data collection are also increasing.

Building on the findings of previous ISCTSC conferences, this workshop focused on the scope, strengths and weaknesses of both traditional and innovative survey methods used to capture dynamics in travel behavior, and to identify future research priorities. In particular, it addressed the challenges and opportunities of evolving strategies to capture the dynamics of travel behavior over different time horizons, including reducing data limitations from classical designs, and issues, such as burden, that are related to data quality.

Intra-personal dynamics was chosen as the main focus, but inter-personal dynamics were included in the discussions.

The second section of this paper summarizes the process of the workshop. Section 3 presents the definitions of technical terms adopted to facilitate the spoken exchanges in the workshop, and summarizes the main findings from the workshop discussions on the strengths and weaknesses of the different survey types. The current state of research, open questions, challenges and opportunities are discussed in Section 4 for four research topics that were chosen for in-depth discussion within the workshop. A concluding section focuses on the outlook for future research on the improvement of methods to collect data capturing the dynamics of travel behavior.

## **2. The workshop process**

The workshop discussions were initiated by four paper presentations. Streit et al. (2014) presented the approach and results from adaptations in the survey method for the German Mobility Panel (GMP). New methods for recruitment were tested and for the first time, respondents were offered online questionnaires as one alternative in addition to the written diaries. Olde Kalter et al. (2014) gave an overview of the new Mobility Panel for the Netherlands (MPN) that started in 2013. The respondents in the MPN report their trips over three diary days in contrast to the GPM where they are expected to fill out weekly diaries. In addition to the standard travel survey questions, the MPN includes various questions that are meant to give a more complete picture of travel behavior and its determinants including motivations, barriers and attitudes. Moutou et al. (2014) described work on the influence of life-change events on daily travel patterns. They used a unique GPS-dataset collected by the Institute of Transport and Logistics Studies (ITLS) of the University of Sydney for four Australian cities between 2005 and 2012 for this research. Aultman-Hall et al. (2014) introduced a web-based one-year longitudinal panel survey of overnight travel with a focus on the lessons learnt from recruitment and survey design.

After the presentations, the terminology, strengths and weaknesses of different survey types and data requirements were discussed. The main results of this discussion are presented in Section 3. In the next step, the workshop participants split and two rounds of group work followed.

The first round of group work aimed at identifying, classifying and voting by “sticky note” on priorities for future research into methods of observing the dynamics of travel behavior. This resulted in the following nine topics, four of which (the bolded ones) were chosen for in-depth discussion in the second round of group work with the goal to develop research agendas for the chosen topics:

- Mixing longitudinal methods: Building on existing approaches, new methods are emerging constantly to capture the dynamics in travel behavior. In particular, some technology-based solutions, including big-data approaches, are highly promising. Research can contribute by designing new ways of combining the different approaches in order to create efficient and informative tools.
- Living lab, real world experimentation: In the future, surveys may increasingly take place under a type of experimentation sometimes called a “Living laboratory”. In the context of transport, the main characteristics of such labs are continuous or frequent monitoring of real-world conditions such as infrastructure condition and traffic flows, prices, atmospheric emissions, weather, or demand for travel information, together with the human and technological resources to collect data on travel behavior. The labs may be associated with a territory, possibly an entire urban region, and are well placed to develop and manage longitudinal surveys because of the richness of their contextual information, and because they offer ideal conditions for observing the effects of both anticipated and unanticipated changes in transport supply or intervening factors. The optimal design and use of Living labs is a timely topic for survey researchers.
- **Recruitment**: Recruitment for travel surveys is challenging. The usage of commercial consumer panels is tempting because samples that are representative e.g. in age, gender or other variables can easily be obtained. Research is needed on the biases of those samples and on strategies on how to overcome problems that might result from specific characteristics of panel participants besides the standard socio-demographic variables.
- **Longitudinal panels to observe processes of behavioral change**: Although it is not easy to identify causal relationships that help explain behavioral change, longitudinal panels are particularly useful to track the factors that the decision processes employed by respondents use as input when deciding if, how, where and when to travel. Research can throw light on how these decision processes emerge and mature.
- Confounding factors affecting observed changes: “We cannot freeze time and we do not want to freeze time.” This was a recurring theme in the discussion of this topic. Longitudinal panel surveys, but also continuous cross-sectional surveys, always measure the combined effects of external and person-related factors (Zumkeller et al. 2007). Research into the best ways of monitoring relevant external variables increases the chances of disentangling these effects.
- Treatment of panel participants: Incentives may lead to increased response rates and thus higher representativeness of usable samples. But incentives might differ in their attractiveness for specific person groups and this can affect their propensity to respond in particular ways. Intensive nurturing of survey participants is a key issue in the design of longitudinal panels: it may lead to high response rates without incentives for the same response burden. Research on these issues can help to better understand the biases inherent in different approaches to the “care and feeding” of participants within the survey process.
- **Panel conditioning**: There is always a learning process when respondents participate in more than one wave of a longitudinal panel survey. Research can contribute to better understand these conditioning effects, whether to subject them to statistical controls, or to accept them as behavioral phenomena worthy of observation and find ways for using them beneficially.
- Measuring respondents’ perception of behavioral and contextual change: Most travel surveys provide data on contextual changes and shifts in behavioral outcomes, but few attempt to observe respondents’ perceptions of these changes. Comparative research into survey instruments intended to measure perceptions seems to be a promising starting point.
- **Timing and duration of change in travel behavior**: The rhythms of travel patterns differ depending, for example, on trip purposes, seasons or life-cycle changes. Profound knowledge on the timing and duration of these changes helps to design efficient survey methods, be they longitudinal panel surveys or cross-sectional surveys, in either case possibly complemented by external data sources.

The four chosen topics (the bolded ones) were discussed in detail in the second round of group work. These are presented in Section 4. The workshop ended with reports from the group work and a general concluding discussion.

### 3. Methods for surveying dynamics in travel behavior: definitions, strengths and weaknesses

Table 1 shows definitions of technical terms adopted to facilitate the exchanges in the workshop.

Table 1. Definitions (based on the 2014 workshop discussions and Ampt 2013, Zumkeller and Ottman 2009, Zumkeller et al. 2007).

Survey attributes	Description
Cross-sectional (CS) survey	A fresh sample reports mobility for the chosen period of observation, typically at a fixed interval.
Continuous survey	A special case of a survey, usually cross-sectional, that runs throughout the year for one or more years
Longitudinal panel survey	The same respondents participate more than once, in the same survey or a set of surveys. Longitudinal panels are usually administered with long intervals between waves.
Rotating panel	A longitudinal panel survey for which the sampling incorporates pre-determined refreshment – see below.
Pseudo-panel	A repeated cross-sectional survey with similar or matched individuals.
Retrospective/prospective survey	A survey in which responses are elicited about behavioral outcomes and/or constraints under circumstances that existed at a specified juncture or during a given time period in the past, or are projected to exist at a specified juncture or during a given time period in the future. By the alignment of retrospective, current and prospective instruments, it is possible to generate panel-like data.
Panel refreshment	Optionally, new respondents are recruited at each wave of a longitudinal panel survey to replace respondents who have dropped out (attrition) or who have been rotated out on a planned basis.
Panel conditioning	Respondent learning effects from one survey wave that affect subsequent waves. Conditioning may be a target for statistical control or analyzed as part of the behavioral response.
Consumer panel	A bank of respondents recruited for an extended period and who are called up as needed for specific topics/surveys usually because of specific interests or characteristics. Consumer panels are not generally designed for longitudinal analysis.
Survey cohort	A sub-sample that enters a longitudinal panel within the same period of time.
Cohort study	A study comparing cohorts or attempting to separate cohort effects from other effects.
Attrition	Loss of individuals in between waves of a longitudinal panel survey.
Mortality	Special case of attrition: death of individual, dissolution of household, long-term loss of access to a vehicle.
Fatigue	Progressive diminution of respondents' willingness to participate, leading to gaps in data collection, increased item non-response, or reduced data quality.

The discussion of some of the terms in Table 1 raised a number of questions about ambiguities, including:

Q: Can a cross-sectional survey with an observation period of one week be treated as a 7-wave longitudinal panel survey?

A: *Arguably, such a survey qualifies as a longitudinal panel only under unusual circumstances: where the object of study is dynamics, and where behavioral change is observable within a very short timescale (i.e. in this case < 8 days). An example would be a survey of travel behavioral response to a short-lived event, such as the closure of a city centre for some hours during a state funeral. If 7 days is merely the period of observation within a cross-sectional survey, that does not make it a longitudinal panel.*

Q: What does “typically at a fixed interval” mean? (see cross-sectional survey)

A: *In a repeated CS travel survey design, the interval (i.e. the length of time between field deployments of the survey) can vary but it is usually fixed and long, such as every 5 years. The period of deployment at each*

*interval is most often fairly short, such as two months. In the continuous variant of a CS survey, data collection is performed, without stopping, on frequently drawn fresh samples. In a longitudinal panel survey, the interval between observations of each panel participant and the periods of deployment must be chosen. For example, panel participants may be observed at 12-month intervals, but the dates of participation in the first wave may be staggered over the whole year so that, for example, all seasons are covered. The intra-respondent interval can be approximate, but in this example it might be considered important to manage deployment so as to observe a given respondent always in the same season. In a longitudinal panel survey design, the length of time between waves of deployment is often fixed but it can vary, particularly if the focus is evaluating the impact of an event or a change, such as the opening of an HOV lane, in which case stable behavioral baselines (the “before”) can take more or less time to observe than the period during which behavior changes (the “after”). In a CS survey, such considerations are dealt with only in the aggregate e.g. by doing the whole survey always at the same time of year, or by using a continuous design.*

**Q:** Do we need the qualifier “longitudinal”? Do panels exist that are not longitudinal?

**A:** *The answer to this question is “yes” – because the term “panel” is more popularly understood to refer to a “Consumer Panel” (see definition in Table 1).*

**Q:** Can longitudinal panels be used to observe hypothetical behavior?

**A:** *As noted in Table 1, retrospective, current and prospective surveys together can be used to generate limited panel-like data, but relying on a respondent’s memories and imagination is sometimes problematic. To address this, the methods and techniques of Stated Response surveys (such as Stated Adaptation, Stated Preference, etc.), may be useful, notably in prospective surveys (see Ampt 2013, Zumkeller et al. 2007)*

Table 2 summarizes the discussion on strengths and weaknesses of cross-sectional and longitudinal survey approaches to capture travel behavior. Cross-sectional surveys show some clear advantages over longitudinal panel surveys, especially if the survey period is extended beyond the standard one diary day and if they are designed as continuous surveys (Zumkeller and Ottman 2009, Zumkeller et al. 2013). Cross-sectional surveys can answer various relevant questions for research and practice (Brög et al. 2009, Raimond 2009). But by definition there are some questions that they cannot answer.

A well-known application of panels is the detection of turnover (also known as “churn”): for example, public transport use might involve a stable percentage of a population over time, but whereas a cross-sectional survey could not tell you to what extent this percentage comprises the same individuals, a longitudinal panel would allow you to estimate, from wave to wave, how many people became public transport patrons, how many dropped out, and how many maintained their patronage (Goodwin, 2008). Longitudinal panel surveys are needed for determining the *developments* in the lives of persons, households or person-groups and their effects on travel behavior. Only longitudinal panel surveys are able to capture the dynamics and processes of change in sufficient detail for research on what these changes actually mean for policy and planning (Ampt 2013).

Before-and-after-analyses can be done with longitudinal panel surveys and pseudo-panels from cross-sectional surveys. Panel ageing is an issue for these analyses with longitudinal panel surveys if the period between the before-survey and the after-survey gets longer (Brög et al. 2009).

The high response burden, low response rates and selectivity issues are particularly challenging in longitudinal panel surveys. Sophisticated methods for the field work and participant treatment are therefore of special importance for longitudinal panel surveys in order to keep participants in the panel and to get high quality data (Chlond et al. 2013).

Table 2. Strengths and weaknesses of longitudinal panel survey versus cross-sectional survey methods (based on 2014 workshop discussions and Golob et al. 1997, Zumkeller and Ottman 2009, Zumkeller et al. 2007, Goodwin 1997).

	Longitudinal panel survey	Cross-sectional survey
Strengths	Allows for analyses of the effects of change in levels of causal factors	Allows for analyses of the effects of differences in levels of causal factors
	Provide greater statistical reliability for a given sample size because of multiple observations of the same respondent	Lower response burden, limiting fatigue Larger sample sizes and possibility of higher response rates Representative samples are easier to achieve
		Data suitable for answering most of the relevant questions in transport research and practice, especially if the survey period is extended to one week or longer
	Can provide the basis for a quasi-experimental design for before-and-after evaluation of interventions	Continuous cross-sectional surveys and pseudo-panels can support limited control group strategies for before-and-after analysis of interventions
	Data directly usable for observing the effects of unexpected events	Data from continuous cross-sectional surveys and pseudo-panels are directly usable for observing the aggregate effects of unexpected events
	Panel ageing can be avoided and attrition reduced by rotating panels	Not subject to ageing or conditioning
	Funding for further waves appears easier to obtain because of survey continuity	Funding for a target sample size can be easier to obtain because the per-respondent costs are lower and because of survey continuity for repeated and continuous surveys
Weaknesses	Decreasing marginal costs from wave to wave thanks to increased competency and efficiency in survey work	Decreasing marginal costs thanks to increased competency and efficiency in survey work for continuous cross-sectional surveys
	High response burden, possibility of low response rates, greater selection bias	Limited intra-personal variation, but one-week survey periods sufficient for many analyses of intra-personal variation
	Recruitment and maintenance of the panel sample is challenging because of high response burden	Limited opportunities to distinguish between inter-personal and intra-personal variation
	Small and decreasing sample sizes (in second and following waves)	Questionable assumption of reversibility of effects: e.g. persons who have just sold their car assumed to behave the same as persons who never had a car
	Attritions, fatigue, panel ageing	
	Conditioning (can be also a source of valuable data on learning)	
	Privacy issues (easier to uncover the identity of individuals in panels; patterns of locational data may reveal addresses, etc.)	
	Difficulty to change the survey method without creating artefacts	Continuous and repeated surveys: difficulty to change the survey method without creating artefacts

#### 4. Future research issues

This section discusses the research issues and challenges that the participants voted to treat as high priorities for the workshop deliberations. Most of the recommendations adopted by the workshop were reported out from the second round of the small breakout groups.

##### 4.1. Recruitment: How to achieve representative samples in changing framework conditions?

The choice of appropriate recruitment methods and high response rates are key success factors for travel surveys in general. These are of special importance for surveys that aim to capture the dynamics in travel behavior and that



often have a high response burden. In many countries, the traditional recruitment methods based on postal solicitations lead to falling response rates. The decreasing availability of telephone numbers for postal addresses diminishes the opportunity to motivate respondents via telephone from the very beginning of the survey process. On the other hand, various new opportunities for recruitment emerge, such as commercial consumer panels or social media. Samples generated with these recruitment methods might be representative in terms of core socio-demographic or socio-economic indicators, but they may produce biased estimates of travel behavior and other variables.

Streit et al. (2014) show from the German Mobility Panel how the effects of different recruitment strategies and survey methods interact: they find more trips and longer daily travel distances for some age groups in the online sample when compared to the trips and distances reported in paper diaries within the same age groups. The reason for this effect seems to be an interaction between the two recruitment methods (landline or mobile phone numbers) and the two types of diaries offered (paper, online). Persons recruited via mobile phone numbers chose online questionnaires more often and seem to be systematically more mobile compared to the persons recruited via landline phone numbers. Different effects interact and more work is needed to disentangle them.

Research can contribute to better understand the potential biases resulting from the different recruitment methods, and to develop combined recruitment strategies for achieving samples that are suitable for extrapolation and forecasting – for the whole population and not just for the sample.

#### *4.2. Longitudinal panels to observe processes of behavioral change*

With standard travel surveys, observed behavior can be analyzed (Armoogum et al. 2014), but observed behavior is the result of decision processes that we rarely ask about in surveys. Information about these processes helps to better understand observed behavior and behavioral change. A number of research projects have focused data collection on spatio-temporal planning and (re)scheduling processes. Prominent examples are the computerized household activity scheduling elicitor (CHASE, see Clark and Doherty 2010, Doherty and Miller 2000), OPFAST (see Lee-Gosselin 2005), EXACT (see Rindsfuser et al. 2003) or REACT (see Ruiz and Timmermans 2006). Aultmann-Hall et al. (2014) included retrospective and prospective questions into their survey on overnight trips by asking for the overnight trips completed in the last month and new travel plans for the upcoming month. They are able to explore planning processes by comparing planned and completed overnight trips.

Beyond this research, it appears that much remains to be understood about decision processes, notably the role of intra-household and inter-household interactions in an age of social media, and about the suitability of various quantitative and qualitative survey methods for capturing these processes. A promising direction for research into the use of longitudinal panels to observe change processes involves reflexive methods (Turrentine and Kurani, 1998), which inspired some of the instruments listed above. A key characteristic of such methods is the comparison of externally-observed behavioral outcomes (in this context, notably the spatio-temporal organisation of activities and travel), to respondents' perceptions of those outcomes, and the involvement of respondents in interpreting the results.

#### *4.3. Panel conditioning: Problem or opportunity?*

Among the major design challenges for longitudinal panel surveys is the phenomenon of conditioning, whereby the experience of participants in the initial wave(s) of the survey may influence their responses in latter waves. This can be a nuisance for surveys that are used to estimate parameters such as trip rates, particularly if conditioning involves a heightened awareness of response burden, perhaps leading to future fatigue and item non-response. On the other hand, conditioning can increase the completeness of responses in second and subsequent waves if the first wave provides a needed opportunity to practice with the instrument. Chlond et al. (2013) reported that respondents in their second wave of a panel report systematically more trips than in their first wave. Conditioning may also relate to the content of the survey and the policy context. For example, respondents may infer the “real purpose” of the survey from their initial participation and this can lead to response biases such as social desirability in latter waves. Panel surveys have a long history in a number of fields other than transport, for example public health, and these issues have received substantial attention from survey methodologists over the past several decades.

Nevertheless, the workshop participants gave high priority to further research into detecting the mechanisms of conditioning and the effectiveness of remedies for use in the quantitative analysis of transport panel survey data. This was seen as particularly timely given the recent evolution of the policy agenda of transport and the environment.

In addition, the workshop discussed conditioning treated as a valuable source of data — as an opportunity to understand how respondents build their initial mental representation of the subject matter of the survey, and how they update this in subsequent waves. Under these circumstances, conditioning is built into the survey design, requiring a close collaboration with respondents to jointly discover what they are learning from participation and feedback, and how such learning affects short, medium and long-term choices that change behavior. Such an approach may also involve identifying the sources of information from which respondents learn about the (changing) attributes of alternatives, and about the social, political, economic and technological contexts as they evolve from wave to wave. The workshop noted that such use of longitudinal panels is as yet relatively unusual, but merits research and experimentation, particularly as it would be very complementary to the recommended research into the mechanisms of conditioning in conventional panel designs. It was also noted that both these dimensions of research into conditioning would greatly benefit from international collaboration between survey designers and the sharing of data and other resources.

#### *4.4. Timing and duration of change in travel behavior: What are appropriate observation periods?*

A joint strategy is necessary to determine, on one hand, the duration of each wave in longitudinal panels, and on the other hand the interval between the waves (Chikaraishi et al. 2013). The suitability of each combination depends on the specific questions that should be answered by the collected data. The German Mobility Panel (GMP) and the Mobility Panel for the Netherlands (MPN) use the interval of one year. They aim at capturing respondents' travel behavior in similar seasonal conditions three times. With this approach, they capture the effects of life-cycle changes or changes in external factors such as infrastructure supply, prices or public transport services. They do not systematically detect inter-seasonal effects that are, for example, highly relevant for understanding bicycling patterns. At one week, the duration of each wave is longer in the GMP than in the MPN, which has three diary days per survey wave. One week seems to capture the intra-personal variation for most activity types (Chalasani and Axhausen 2004, Susilo 2005). It comes with a high response burden but is very informative even as a single wave within a longitudinal panel survey.

Aultmann-Hall et al. (2014) focus on long-distance travel. These are rare events for most persons. The authors chose an overall survey duration of 12 months with monthly surveys.

The project “Physical Activity Through Sustainable Transport Approaches” (PASTA 2015) is an example of an innovative survey design focusing on the interaction between transport and non-transport physical activity. Intra-personal variation is high for trips with the active modes walking and cycling but also for other types of physical activities. The survey was therefore designed as longitudinal panel survey. Participants are asked to fill out different types of questionnaires with a constant interval of 13 days in between. Participants are expected to stay at least six weeks in the survey; they are invited to stay also longer. Recruitment is done on a rolling basis over a period of two years.

The workshop participants concluded from different examples that no general recommendation about the duration of each survey wave in longitudinal panels and the interval between the waves can be given. Each study pursues specific goals and thus requires specific survey designs. However, the workshop concluded that good practice examples exist, and that a meta-analysis of methodological findings from surveys with different durations and intervals would be a useful first step to developing guidelines for appropriate and also efficient survey designs.

## **5. Conclusion**

Insights about the dynamics of travel behavior are of high and increasing relevance. This workshop's participants contributed insights into the state of the art, challenges and opportunities. High in their priorities was effective sampling and recruitment for longitudinal data collection. The careful definition of the population and recruitment strategy is paramount, and the basis for all subsequent steps. Only random samples can be weighted and



extrapolated so that insights can be transferred to the whole population. But in the context of dynamic activity and travel behavior, data from longitudinal methods offer more than population parameter estimates: they also offer a window into the processes that underlie the trajectories of change. *A striking finding from the workshop was the importance accorded by the participants to the observation of processes of change in three of the four topics that were voted as top priorities for the workshop to discuss in-depth and identify research needs.*

Various other issues related to survey methods were discussed in the workshop, including: mixing longitudinal methods in an era of big data; the enabling of real world experimentation; the need for research to show whether commercial *consumer* panels represent the chosen population well and are thus a suitable basis for recruitment; the “care and feeding” of panel survey respondents; the combined effects of external and person-related factors; research into the best ways of monitoring external variables that may confound the results from longitudinal panels; and measuring respondents’ *perceptions* of behavioral and contextual change as well as recording the changes themselves.

Surveys will continue to be a valuable method for capturing the dynamics in travel to meet the needs of analysis and modelling. Both cross-sectional and longitudinal panels yield rich data about changes in the patterns of travel and activity participation as well as insights into social, political, economic and technological contexts that are evolving in parallel with those patterns. Currently, the leading task for future research is to better link those surveys with emerging “big data” sources. Data such as those from mobile phones, ticketing or free floating cars are increasingly available and deliver detailed longitudinal behavioral information. Their combination with survey data, and the purposeful coordination and management of both data sources are promising approaches for efficiently capturing the dynamics in travel behavior.

Tim Raimond, in his opening address at Leura, challenged the conference to explore ways for transport surveys to serve a better society, and suggested a number of ways to “understand the why and the when of evidence-based decision-making”. This workshop summed up its response as:

*We should be more open to learning from failures and errors as well as successes. With longitudinal methods, we have the opportunity to sort out, over different time horizons, errors associated with how we observe changes, the processes of change, and the reasons for change. We can contribute to a better society if we mirror and interpret trends over time with honesty.*

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## Appendix A. Papers presented during the workshop

The Challenges and Opportunities of In-Depth Analysis of Multi-day and Multi-year Data. Authors: Claudine Moutou, Peter Stopher and Wen  
Balancing Innovation and Continuity- Experiences with Survey Design Adaptations of the German Mobility Panel. Authors: Bastian Chlond,

Tatjana Streit and Gerhild Abler

Looking for Dynamics in Travel Behaviour: the first results of the new Mobility Panel Netherlands. Authors: Marie-Jose Olde Kalter, Tom  
Thomas, Karst Geurs, Sascha Hoogendoorn-Lanser and Paul Van Beek

Design and Response Quality in a One-Year Longitudinal Survey of Overnight and Long-distance Travel. Authors: Lisa Aultman-Hall, Chester  
Harvey, Jeffrey Lamondia, Chloe Ritter.

## Appendix B. Posters associated with the workshop

- Experts' opinions concerning the minimum content of a national household travel survey. Authors: Mario Cools, Marco Diana and Jimmy Armoogum.
- A Framework for Urban Passenger Data Collection. Authors: Eric Miller, Martin Lee-Gosselin, Khandker Nurul Habib, Catherine Morency, Matthew Roorda and Amer Shalaby.
- The mobility of Rhône-Alpes inhabitants: the construction of a new travel survey protocol, first assessment. Authors: Maria Tebar, Christophe Hurez, Jean-Loup Madre and Jimmy Armoogum.
- Collecting longitudinal data from freight operators: survey design and implementation. Authors: Richard Ellison, Stephen Greaves and David Hensher.
- Quality of address information collected via Origin and Destination surveys and the implications for geocoding. Authors: Houshang Farabi.
- An innovative approach to improve knowledge of regional mobility: application to the territory of Picardie region (northern France). Authors: Fabrice Hasiak, Mathieu Rabaud and Aymeric Egea.
- Mobility-Activity-Diaries: A new survey design for capturing travel and non-travel activities. Authors: Regine Gerike, Reinhard Hössinger and Verena Rauscher.
- Data collection issues for travel behaviour surveys: past, present and future. Authors: Tim Riley.
- U.S. Household Travel Surveys: Trials, Tribulations and the Future. Authors: Stacey Bricka and Elaine Murakami.
- Estimation of the overall mobility in France: taking into account short and long distance trips. Authors: Quang-Nguyen Nguyen, Jimmy Armoogum, Laurent Hivert and Zehir Kolli.

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