

Evaluating an Emerging Travel Research Methodology: GPS survey participants speak of their experience

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1 Introduction

This paper presents the findings from a series of focus groups conducted with participants from a travel study which used personal Global Positioning System (GPS) devices. Travel surveys are usually lengthy, burdensome tasks for respondents (e.g., Ampt 2003). The advent of GPS technology makes it possible to employ a passive form of measurement, requiring little input from the respondent while accurately recording travel behaviour. However, very little is known at present about the behaviour of survey respondents as they employ the GPS devices. We conducted a focus group study during an on-going longitudinal GPS travel survey to understand the experiences of GPS users in our surveys, with a view to reducing the burden of the survey task, improving the quality of data collected, and capturing more complete records of travel. The discussions suggested a number of ways to improve the data collection procedure and indicated that more holistic and personal survey implementation could improve respondent retention.

Personal GPS data-loggers (Figure 1) have the potential to capture much longer and more complete records of travel than traditional travel survey methodologies. Activity and travel diaries are known to experience significant measurement error as a result of respondents' under-reporting of trips. This has been shown to be the case for both Computer Aided Telephone Interviews (CATI), (Wolf *et al.*, 2003; Wolf *et al.*, 2004; Zmud and Wolf, 2004; Forrest and Pearson, 2005; Wolf, 2006), ranging from 11 to 81 percent as well as face-to-face interviews by experienced interviewers in the order of seven percent (Stopher *et al.*, 2007). While it has been suggested that some respondents report non-mobility as a strategy to get out of doing the survey altogether, there are many more trips that are simply forgotten, or which do not register with the respondent as significant enough to record. Furthermore, because of the burden of traditional pen and paper surveys, the data collection period is usually limited to one or two days. However, travel is a very variable activity and increasing the length of the data collection period can reduce the variability of many of the travel related measures. GPS technology makes it possible to employ a passive form of measurement, requiring little input from the respondent while accurately recording travel behaviour.

However, while they have the potential to capture more complete records of travel, personal GPS data-loggers may well be subject to their own specific set of systematic measurement error. Very little is known at present about the behaviour of survey respondents as they employ the GPS devices. Our focus group discussions were designed to uncover whether there were particular segments of the population, such as teenagers or the elderly, that struggled with the task of using the device, or whether there were particular types of trips during which respondents deliberately did not carry the device with them. Similarly, we were concerned to explore particular aspects of the GPS survey methodology that were burdensome to respondents and to evaluate the form and functions of the devices currently in use.



Figure 1: The NEVE^{®1} passive personal GPS loggers used by ITLS in comparison to a standard NOKIA[®] phone

2 Background

The GPS survey discussed in this paper is designed to evaluate the impact of a Voluntary Travel Behaviour Change (VTBC) program on household travel behaviour. VTBC is a term used to cover a variety of travel demand management approaches which “seek to find the means for individuals and households to change their travel behaviour – adopting approaches where individuals choose their own method of changing travel behaviour rather than simply acting in response to external policies or pressures” (Taylor and Ampt, 2003, p165). That is, the public is provided with tools to equip them to change their travel behaviour voluntarily. There have been many such programs conducted in Australia (Red3, 2005).

Evaluation of VTBC program initiatives has consistently been identified as somewhat problematic (Ker, 2002; Taylor and Ampt, 2003; Ampt, 2001). The challenge for evaluators is to identify the occurrence of travel behaviour change, quantify it and describe its character. GPS has been recommended (Stopher *et al.* 2005) as a potentially valuable tool for fulfilling these requirements. Furthermore, to reduce the necessary sample sizes for measuring change, a longitudinal panel design has been recommended. The GPS surveys under discussion are on-going longitudinal panel surveys of residents in the western suburbs of Adelaide, South Australia (Figure 2), and include both a one-week survey and a one-month survey. Both GPS surveys are being conducted by ITLS.

The survey is conducted using the following procedure:

1. Residents are posted a letter on South Australia Department of Transport, Energy and Infrastructure letterhead informing them of the study that Sydney University is conducting on their behalf and asking for their assistance.
2. Residents are phoned by a market research company on behalf of Sydney University. If willing, they are recruited to the study.

¹ Neve is the South Australian manufacturer of the devices used by ITLS in this research

3. Recruits are couriered a box containing a GPS device and charger for every household member over the age of 14 and provided with an array of survey forms and instructions.
4. Recruits are phoned to confirm that they have received the package and to remind them to start using the devices the next day.
5. Recruits (ideally) carry the device with them everywhere they go for a prescribed period of time, recharging the device every night or as often as the battery runs out.
6. Recruits are phoned again to arrange for the courier pick-up to return the devices to Sydney University.
7. Recruits return devices as arranged.

At the time of conducting the focus groups, one data collection period (and a pilot study) had been conducted for the one week survey in September-October 2005 from 200 households, whereas two data collection periods had been conducted for the one month survey in both October 2005 and March 2006 from fifty households.

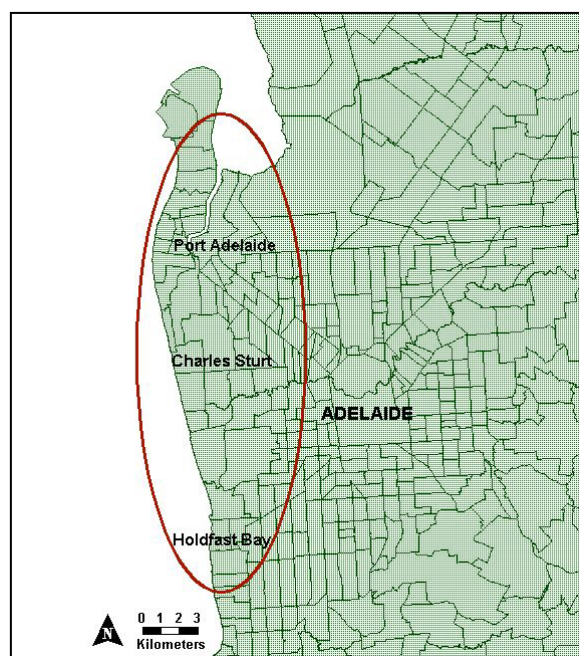


Figure 2: The survey location – Local Government Areas Port Adelaide, Charles Sturt and Holdfast Bay

3 Method

Focus groups are simply “a research technique that collects data through group interaction on a topic determined by the researcher” (Morgan, 1996, p130) in which “interaction between members of the group is a key characteristic” (Cameron, 2000, p84). Within the scope of this broad description of what focus groups are, there are many variations to the design that can be selected depending on the research purpose. This section describes the design decisions in preparing the focus group study as well as reviewing the recruitment outcomes as a measure of quality.

Four focus groups were held, with the population segmented by the length of the survey in which the households had participated and by the level of performance of

the household. The groups were segmented by length of survey, because we expected there to be particular frustrations and coping strategies among the households that had carried the devices for one-month and because, as the survey was on-going, we did not feel it was advisable for respondents to discover other households used the devices for different durations. The four groups are defined in Table 1.

Because participation in the GPS survey was conducted at the household level, performance in the surveys was measured on a household basis. The segmentation was designed to produce as much contrast between the focus groups as possible (see Morgan, 1995), so that some analysis of the differences between good and poor performing households could be conducted. Larger households were prioritised in the recruitment process due to their smaller representation in the overall sample.

Table 1: Composition of each of the four focus groups

	General Description	<i>Specific Definition</i>
Group 1	Good performers from the one-week survey	Households that returned five or more days of data for every household member in the first wave of the one-week GPS survey
Group 2	Poor performers from the one-week survey	Households that returned four or fewer days of data for every household member in the first wave of the one-week GPS survey
Group 3	Good performers from the one-month survey	Households that returned fifteen or more days of data for every household member in the first wave of the one-month GPS survey AND participated in the second wave² .
Group 4	Poor performers from the one-month survey	Households that returned fourteen or fewer days of data for every household member in the first wave of the one-month GPS survey and participated in the second wave OR households that dropped out in the second wave

It is usually recommended that focus groups contain between 6 and 10 participants, with an upper limit of 12 (Asbury, 1995). Morgan (1996, p146) suggests that in previous studies “larger groups worked better with more neutral topics that generated lower levels of participant involvement”. Given the current topic is of a technical nature, and that it is of much greater importance to the researchers than the participants, group sizes at the upper end of the spectrum used in academic best practice were recruited. Elsewhere, Morgan (1995) has noted that one of the common failures in focus group studies is to generate actual attendance and recommends that over-recruitment should be employed in most cases. Therefore, a recruitment target of twelve individuals (from twelve different households) was aimed for.

It was expected that, because participants did not have a significant vested interest in the discussion topic, considerable efforts would be required to follow up participants as well as providing a monetary incentive. Households were first sent a letter notifying them of the study and informing them that they would receive a phone call inviting any one of the adult participants from their household to participate. If there was a willing participant in a household they were recruited and received both written and telephone follow-up between recruitment and the group session. Participants were offered a reimbursement of \$AU70.00 for their time and travel expenses. Table

² The data from the second wave had not been processed at the time of the focus groups and so level of performance in wave 2 could not be determined.

2 displays the recruitment outcomes; ‘active’ numbers’ are those that had not yet been closed out when the maximum number of participants had been recruited.

Table 3 presents the demographic characteristics of the groups, using information from the participants’ descriptions of themselves, as well as selected information from the household information provided to the GPS surveys. While it could appear problematic that there are no single person households represented in either of Groups 3 or 4, it must be acknowledged that the households eligible for recruitment had been close to exhausted (see Table 2). It is perhaps less significant given that both good performing and poor performing households in the one month survey focus groups appear to have similar household profiles.

Table 2: Recruitment and attendance results

	<i>Group 1</i>	<i>Group 2</i>	<i>Group 3</i>	<i>Group 4</i>
Total households	64	42	22	19
Refused to participate	6	7	1	2
Unavailable to attend	5	2	7	4
Active numbers	40	19	3	1
No contact achieved	1	2	0	0
Recruited	12	12	11	12
Attended	11	10	9	7

The room was set up as a round table discussion and all groups were moderated by the Ms Swann. The audio-recording equipment was clearly visible, and the observer sat at the far end of the table with the recording equipment to remain distinct from the conversational group. The discussion roughly followed a standardised question schedule. There were GPS devices on display on the tables to facilitate discussion. In that way, respondents did not always need to find terminology for the various components of the devices but could demonstrate what they were referring to in discussion. The discussions were transcribed and analysed by the moderator, Ms Swann, (due to time and budgetary constraints no additional validation has yet been conducted) with the themes being derived from the data. Due to concerns about respondent burden, and the relatively impersonal nature of the discussions, it was determined that participants would not be supplied with the transcripts for checking, however, there was some feedback on outcomes in the form of a newsletter which is discussed in Section 5.

Table 3: Demographic variation within each of the four focus groups

	Total Group Size	<i>No. of females</i>	<i>No. of males</i>	<i>No. with children living at home</i>	<i>No. of retirees</i>	<i>No. of workers</i>	<i>No. of single person households</i>	<i>No. of licensed drivers</i>
Group 1	11	3	8	3	3	8	5	11
Group 2	10	6	3	2	2	4	3	9

Group 3	9	3	6	3	3	6	0	8
Group 4	7	5	2	3	1	5	0	7

4 Results

Following a close reading of the transcripts the following broad themes were identified:

1. Respondents' understanding of the survey task;
2. The form and functions of the devices;
3. Patterns of respondent behaviour in undertaking the task;
4. Reactions to the survey documents and survey administration;
5. Respondent attitudes and perceptions of issues relevant to the study; and
6. Curiosities about the study displayed by respondents.

While it could be argued that the entire discussion is about the attitudes and perceptions of participants – the penultimate theme identified above – the theme was identified to cater for a significant weight of comments about participants' attitudes to more general research and transport issues than the first four themes allow. This section summarises the findings by theme.

4.1 Understanding the task

Most respondents demonstrated a reasonable understanding of the three key tasks they were asked to perform:

- Carrying the device with them everywhere they went, whenever they left home, whatever mode of transport they were using;
- Whenever convenient, waiting for the GPS light to appear before starting their trip; and
- Recharging the device every night.

However, we did discover in the discussion with poor performing one-week households that two extreme interpretations had been adopted. One respondent was surprised to discover the device was intended for all modes of transport, exclaiming,

Oh! I thought you were only s'posed to take it in the car
Group 2, P1

Whereas another admitted,

Well, I was quite the opposite, I thought you had to carry it around the house and everywhere
Group 2, P9

The group discussions uncovered a great range in the level of awareness among respondents about how the devices work and therefore how to improve the performance of the device with regard to signal acquisition. Some respondents seemed overly concerned about the devices failing to hold signal all the time, and even expected the devices to have signal indoors, while others were confident that the analyst would be able to string together their travel from the points that were

recorded. The level of how well respondents understood the way the devices acquired signal and recorded position seemed to depend less upon the instructions they had received and more upon their level of exposure to technological gadgetry, and specifically to previous experience with GPS.

Most respondents were diligent about charging the devices overnight. In fact, some respondents would charge the devices whenever they were at home to maximise their battery life. While some people would occasionally forget to charge the device there were no participants that failed to understand the necessity of charging the device.

4.2 The form and functions of the device

There were five key elements of the form and functions of the device that were discussed by the respondents: battery life, signal acquisition, size and shape, the indicator lights/display, and the accessories that came with the device.

The single most significant complaint respondents brought to all four discussion groups was that the battery life of the devices was too short to capture a full day's activities. For many people, it was difficult to understand why the battery would expire so quickly when their experience with technology like mobile phones involved much longer lasting batteries. The failure of the device to record all day caused participants some concern over the quality of the data that we received. One exchange even went so far as to suggest that they were concerned for the way the information would then be utilised:

P2 *That's what I found, the night time you wouldn't have got much information 'cause I usually go out fairly late at night all over different places but I never took that [the device] 'cause it was on charge. So a lot of information... would definitely not be recorded. And that's probably for a lot of people here maybe they've gone out at night and left it at home 'cause it's still on the charge. So you're not getting what we're doing for 24 hours; all you're getting is about a six hour cycle in the day. And so we go out wherever we go at night time and nothing happens.*

P3 *They'll say "Adelaide doesn't need public transport at night time" it's OK to finish services//*

– *"Nobody goes out at night"!*

Group 3

Many respondents, particularly the 'good performers', described their endeavours to wait for signal and provide their devices with a clear view of the sky. However, this was not always possible and the failure of the device to record travel caused a few respondents concerns similar to those outlined in the quote above. Knowing that the device wouldn't give planners a complete record caused them concern about the usefulness of the data and the purposes to which those data would be put.

As regards the size and shape of the devices, most people felt the devices were "*not obtrusive*" (Group 2, P3) in their current form and few participants initiated a negative discussion about the form of the device. However, to guide future developments, respondents were specifically asked to offer the design characteristics of their ideal device. In every group the immediate reaction in response to this question was that

participants would like the devices to be slimmer. It was not necessarily important for the devices height and width to alter; the key dimension to the comments from respondents was their preference for slim-line gadgets. Often the desire for a slim-line GPS device was linked to respondents' experiences of other technologies, particularly mobile telephones and iPods; "*Mobiles are getting smaller*" (Group 1, unknown). However, one respondent noted "*I don't necessarily believe smaller's better; it gets harder to use, easier to lose...*" (Group 2, P3).

In three of the four discussions participants made some form of comparison between the Neve devices and commercially available GPS devices. While some of these comparisons dealt with memory or signal acquisition, a number of comments compared the seemingly sophisticated screen displays of commercial devices with the simple four light display on the Neve devices. In particular, it was the poor performing one week households who found it difficult to tell when the device was on and working and they suggested that a more detailed display, indicating that it had satellite signal in the same way that some mobile telephones report the tower they are accessing signal from, would help them to be certain that the device was working.

Even with the instructions provided, some respondents could not tell when the device was working, for example, the exchange below was made in response to a question from the moderator about the most demanding aspects of the study,

Moderator ...what did you find most demanding?
P8 Turning it on to start with//
Several Yeah ... me too
P8 I wasn't sure I'd done it right, being technologically retarded anyway, and I wish there'd been something I could check that it was going all right. 'Cause I thought "am I going to carry this for a week and it's not on or something?" ... so I really think it would be nice if it [the device] said "This is now working" or something

Group 2

Participants were generally satisfied with the form of the devices, and this satisfaction extended to the discussion of the accessories. Respondents were asked both to describe how they employed the accessories and to think creatively about ways to improve them. In describing how they used the accessories many people acknowledged that they used the belt clip, either for its clip function or as a protective casing. However, some individuals found the casing too bulky and chose to remove the case. Some participants who found that they did not wear clothing appropriate for using the belt clip suggested that providing a lanyard might be a more acceptable alternative for helping them carry the device.

4.3 Patterns of behaviour

The focus group discussions revealed both helpful and unhelpful patterns of behaviour for the purposes of GPS data collection. A number of respondents reported that they had made a habit of keeping their house and car keys or mobile telephone with the device at all times to remind themselves to take the device with them. Others chose to charge the device in an obvious and visible location so that they would see it before they left the house as a reminder to carry it with them; for

example, a few respondents volunteered that they had made a habit of charging the devices in the kitchen.

On car journeys, many participants put the device on the dashboard to acquire signal before starting out, although some noted that the device was not secure on the dash. A small number of focus group participants told of the way they opted to leave the device in their vehicles. They did so for a variety of reasons – some understood that to be sufficient (eg Group 1, P5), while others did not bother if they did not think the device would pick up signal (Group 1, P10).

Two participants in the month long survey demonstrated forward-thinking and creativity in the way they would work to get signal before leaving in the morning:

P3 ...I used to have a little game, I said whichever of my kids was ready first, I used to send them out onto the footpath and [waving hand in air as though looking for signal] ... to set it up. But often it took quite a long time and I didn't always have that time to wait I was so busy.

P4 Yeah I had to do the same too. I used to go out and sit it [the device] on the letterbox for about five minutes before I went out of the house and then it had picked up the satellite by the time I went out.

Group 3

The same women, concerned about ensuring signal was held, noticed that the devices would not work in heavy leather handbags (eg Group3, P3) and so would endeavour to clip the device on the exterior of their bag.

Some household members worked co-operatively within their household, reminding one another to take the devices with them, and in many households it appears as though one individual takes charge of the task and co-ordinates other household members. A few participants in the discussions described themselves as the 'household organiser' who charged up their partners' device and made sure they had it with them – for some, this simply involved making sure the device was in their partners' vehicle (e.g., Group 2, P5).

Most respondents denied leaving the devices behind deliberately. Although there were a few instances in which people reported having done so; for example, one participant reported it was inconvenient to take when jogging (Group 1, P2) and two others reported they would leave it behind when going out to night clubs because it was too bulky (Group 4, P6 & P5). A number of respondents also acknowledged that if the battery was flat or if the device was charging, they would deliberately leave it behind.

Sometimes, participants suggested, they would simply forget to take their device with them in the "*hustle and bustle of life*" (Group 2, P7). One participant recounted how he would often dash back to get his device when he realised he'd left it behind (Group 1, P3), but others either were not as diligent, did not have the opportunity to return, or simply did not realise in time. Group 2 engaged in a debate over whether they would use a reminder notice in the form of a sticker on their front door, a notice for the door in the form of a "Do Not Disturb" sign, or a fridge magnet. No consensus was reached about whether any of those forms would actually be helpful.

4.4 Survey documents and administration

Respondents were asked generally about their experiences of the way the survey was conducted, as well as specifically about the survey documentation and to provide feedback on a proposed new survey form. Responses on these issues were expected; however, by allowing respondents to explore some topics more freely we also uncovered some unexpected issues. The two unexpected findings were, first, that there are some respondents who actually want to be able to provide more information about their transport and travel experiences and opinions and, second, that the focus groups themselves were significant in reassuring respondents and encouraging them in their participation.

There is a significant amount of survey paperwork about the household, household vehicles, and regularly visited addresses that respondents are asked to complete in addition to carrying the device. Participants were asked about their opinions on the quantity and content of the survey forms they received. Most participants had no particular objection to the survey material. A couple of respondents noted that it looked overwhelming at first, but that *“there was a lot of it but not much to do”* (Group 3, P1).

A new form was presented to respondents on which they would be asked to record whether they had taken the device with them, forgotten to take the device, or stayed at home all day, for each day of the survey. The new form was received very well by all four discussion groups. Respondents stated they would be prepared to fill in another form and that they would be able to fill in the information required. Somewhat surprisingly, they even explored in the discussions the way it would both help our analysis and help them overcome some of their concerns about supplying us with misleading data when they forget to use the devices.

While the discussion groups were designed to elicit feedback from respondents about the GPS survey, each of the groups engaged in a respondent driven discussion about transport – covering topics such as roads, traffic and public transport – at some stage in the discussion. This is probably indicative of the fact that those people who have shown themselves to be willing to participate in a travel study have some interest in transport issues.

One group in particular – the poor performing one week group – engaged in a lengthy and impassioned discussion of transport. The discussion found its origin in the concern that the GPS devices and the data they collect *“tell you what you are doing, they don’t say what you’d like to do”* (Group 2, P2). One participant was concerned that the results of the study would be used to reinforce the status quo,

I don’t drive so I only use public transport and my habits would be completely different if there was different services available. There’s lots of places I don’t go because it’s too difficult to get there.

Group 2, P6

The participants were committed to the desire to be able to provide feedback on transport issues and suggested providing structural formats – either in the form of additional survey materials or focus group discussions – so that participants could be provided with a voice on these types of issues.

Given the technical nature of the discussion topic, it came as somewhat of a surprise to the researcher to receive positive feedback from the respondents about the focus group discussions in and of themselves. The group discussions reassured many of

the participants that they were using the devices in a satisfactory manner; learning that other people had the same difficulties with the devices was a great encouragement. The discussions seemed to generate a sense of community – that the endeavour of data collection was communal and did not rest on any one person's shoulders alone – and provided them with a real relationship with the researcher. In the words of one participant,

I think it's very good that you had this because it means we can meet each other... there's eye contact; ... it's fine talking over the phone and reading mail, but it is nice to have that more personal interaction.

Group 3, P5

4.5 Attitudes and perceptions

At the opening of the group discussion, participants were invited to introduce themselves, tell the group something about their family or household situation, and share with the group why they agreed to take part in the study. Most participants in the study articulated that they agreed to participate because they perceived that it would help the community and because they felt that the task sounded relatively simple. Often the desire to contribute was linked with an interest in and particular concern for transport issues in Adelaide.

Many participants had strong feelings about public transport, roads and traffic in Adelaide. While participants readily acknowledged how much better off they were than other major Australian cities in these areas, they remained concerned about their own local issues. Some participants wanted to know what, specifically, the data would be used for in future planning. Many wanted to be kept informed as to what results were produced and how they would be utilised.

For some respondents the feeling that they were doing a bad job, or that their devices were not working because they dropped in and out of signal or ran out of battery power, caused a great deal of frustration and even led them to question whether it was a worthwhile activity. Alarming, it was those participants in Groups 1 and 3 – the good performing households – who demonstrated the most concern about the quality of their contribution. This doubt was actually identified by one respondent as the driving factor behind his inclination not to participate in a third wave (Group 3, P9); however, having participated in the focus group, he expressed a willingness to continue in the project.

While many of the participants acknowledged that friends or acquaintances expressed concern over the invasion of privacy incurred by using the devices, participants in the discussion groups dismissed the thought; *"this privacy stuff is fairly much a load of garbage"* (Group 1, P10).

Following recent evidence from the analysis of the one-month GPS study that a period of 15 days may be the optimum duration for GPS data collection (Stopher *et al*, 2006b), respondents who had participated in the one week study were asked how they would feel about doing the study for two weeks. Without exception respondents stated that there would be no change in their willingness to participate in the study if it was for two weeks instead of just one. Furthermore, a number of respondents articulated that they thought that a two week data collection period would be a better idea, because after one week they were only just getting used to the devices; some even intuitively understood that the longer period of measurement would *"iron out some of the discrepancies"* in their travel patterns (Group 2, P3). Interestingly,

participants from the poor performing one-week group volunteered that they might find it helpful to be called at the halfway point through a two week study to check up on whether they are doing everything correctly and to answer any questions they might have (Group 2, P8).

4.6 Curiosities

Many of the GPS survey participants who attended the discussion groups had questions for the researchers about the study. These curiosities demonstrate that the participants care about the research and have invested themselves in its outcome. It may also indicate areas in which our communication with participants can be enhanced. Examples of the curiosities respondents had about the study included questions about who was doing the survey, whether other households dropped out or continued, and over what area the survey was conducted. Some were interested in the devices themselves with questions about how they function and how to protect them. Others were interested in how we analysed and interpreted the data. Still others were searching for feedback, either about the quality of the data or about how the results would be used.

Not only were respondents curious, but a number of discussion group participants reported that friends and acquaintances were curious about the device and what the study was all about; some friends were curious about how the participant had been chosen, while others were concerned that their homes might be pinpointed in our analysis.

5 Discussion

Overall, the findings from the focus group discussions give us confidence in the comparability between GPS survey data and more traditional data collection methods, and even in the improvement GPS offers over methods such as travel and activity diaries. However, there are several important lessons we have learnt from these focus groups about how to make GPS a more effective methodology. This section reviews these lessons in two categories. First, it will discuss lessons learnt that will assist in improving the quality of the data collected. Second, it will discuss lessons learnt about building and maintaining a committed panel of participants by implementing a more holistic survey approach that provides support and feedback, and listens to transport related opinions of participants.

5.1 Lessons learnt about improving data quality

Current technology has so reduced the burden of documenting travel information that it is possible to collect much longer periods of data than ever before. Knowing that respondents would be willing to do the study for longer periods of time is of critical importance to future implementations of a GPS survey methodology; the focus group discussions suggest that respondents would be more than willing to use the devices for two weeks. Evidence from the analysis of the one month data suggests that the variability of the travel data collected decreases as the data collection period increases, but levels off after about two weeks (Stopher *et al* 2006b). Therefore, a two week collection period ought to provide stronger measurements of whether change has occurred than one week of data. This capability, however, also brings with it many new quantitative challenges. For example, we are currently exploring the statistical approaches required in analysing multi-day data (Stopher *et al.* 2006b). It may also be of use to some participants if the researcher were to support households

proactively in the form of follow-up telephone calls to answer queries and check that they've understood the task.

Given the diversity of experiences respondents described, one of the key strategies in developing future methodologies may be providing respondents with a range of tools to choose from that could assist them in the use of the devices. However, providing choice will need to be carefully balanced with the burden decision-making place upon participants. In the long term, ITLS is committed to working on developing devices that suit respondent needs more appropriately. We have recently sourced a new device with a slimmer design, a much longer battery life, and a user friendly interface that provides audible feedback. It also provides multiple options for carrying the device, using a key-ring and lanyard. Producing a device that mimics the types of devices respondents are used to, such as mobile telephones, iPods and commercial GPS devices, is likely to be of even greater assistance to users. The challenge will be keeping pace with new technologies and developments that rapidly make inventory obsolete.

It was interesting to note that respondents had no particular concern about the paperwork that came with the devices. This has meant that a new form has been implemented in current waves of the GPS survey to identify the difference between 'no travel' days and 'missing data' days. It leaves open the further possibility of adding other elements of data collection to the survey – or different elements in different waves – to complement the overall data collection task.

There are some findings that remain ambiguous. For example, we could not determine any unifying characteristic of participants that failed to use the devices well except that they all seemed *not* to be the primary contact person (that is, the person consenting to the research on behalf of the household). This may indicate that obtaining consent from all household members could improve the performance of participants. However, it could also have significant negative impacts on the response rate and possibly the representativeness of the sample. Further confounding the issue was the discovery that, in some apparently good performing households, the primary contact person took charge of coordinating other household members' use of the devices. Unsurprisingly, different households relate differently and have different coping mechanisms. It may also be that we simply have not probed the issue deeply enough, and that there is some other underlying characteristic that could explain the failure of some people to use the devices.

5.2 Lessons learnt about developing a holistic survey approach

While many of our efforts have been driven by the desire to reduce respondent burden, we found that respondents in some circumstances wanted to be able to contribute more to – and receive more from – the research project. This may, of course, be limited to those types of people willing to contribute to a focus group discussion, but the focus groups represented a large proportion of total respondents and the same themes emerged in groups of both good and poor performing households.

We believe it may help the overall research effort to include qualitative elements that provide respondents with agency and build a sense of community. We have started to try and fulfil this need in a small way by the distribution of a newsletter that reports on the focus group study and provides some answers to the most frequently asked questions. It provided examples of the data that we obtain from the devices as well as profiles of key researchers in an effort to be open about the Institute and build

relationship with participants, as a number of respondents indicated how satisfying it was to know something of us personally.

The insights gained about the benefit of the focus groups in and of themselves open new avenues for investigating the way in which we recruit and maintain relationship with participants. For example, it may be possible that the recruitment call invites households to a 'no obligation' training session where participants meet the researchers, learn about the research project and the types of things we can learn and are trained in how to use the devices, after which they can decide whether they wish to participate in the survey or not. It is expected that such an endeavour would garner the support of the kinds of community minded individuals that appear to agree to participate in the survey.

Even if such a plan is too costly or unrealistic, developing an approach to the survey implementation that helps support participants, fosters the very appropriate feeling of community contribution and listens to respondents' concerns about transport related issues, is likely to be key in maintaining a truly long-term panel of participants that are committed to the research effort.

6 Conclusion

The focus group study presented in this paper has helped us to understand the experiences of GPS users in our surveys and improve the quality of data collected by capturing more complete records of travel. Passive Global Positioning System devices hold great promise for improving travel survey methodologies and the quality of data collected and our results give us confidence that participants in these GPS surveys were diligent in their use of the devices. This ought to have produced comparable results to traditional travel survey methods.

The high level of take up of new technologies – at least in Australia – means that survey participants are relatively confident users of the GPS devices. Furthermore, it appears that despite widespread talk of invasion of privacy concerns in the population, relatively high levels of civic or institutional trust mean that there is a reasonable proportion of the population willing to use the devices under the guarantee that the information they collect will be kept confidential and used for research purposes only. The feedback from respondents has guided our search for new devices, which are slimmer, easier to interpret, have longer battery life and are easier to carry.

The focus group discussions made it apparent that more holistic and personal survey implementation would provide benefits to respondents by giving them additional confidence in using the devices and building relationships between respondents and with the researcher. This will be of particular relevance in surveys, like this one, employing a longitudinal panel design.

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