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Das, J.W.M.

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Innovation in online data collection for scientific research: the Dutch MESS project

Marcel Das

CentERdata, and Tilburg School of Economics and Management

Tilburg University, The Netherlands

Abstract

Not many long-running scientific studies in Europe or the United States use online panels. Leading scientific studies mostly use face-to-face or telephone interviews to collect data. However, Internet interviewing is cost-effective and offers various new possibilities for empirical research in the social sciences. In principle, one can measure new or complex concepts in much shorter time frames than is customary in more traditional survey research. Furthermore, the technology allows for, for example, experimentation, follow-up data collection, and respondents' feedback.

Based on earlier experiences with an online scientific panel, an advanced data collection environment for the social sciences was proposed in the Netherlands: 'An Advanced Multi-Disciplinary Facility for Measurement and Experimentation in the Social Sciences' (MESS). The facility creates maximal opportunities for innovation, is fast, and freely accessible for everyone in the scientific community. The core of this facility is a representative panel of households that have agreed to be available for regular interviews over the Internet: the LISS (Longitudinal Internet Studies for the Social sciences) panel. In addition to traditional questionnaire settings, the facility accommodates use of visual displays, preloading of data, and self-administered measurement of biomarkers. The project aims at integrating various fields of study, such as economics, social sciences, (bio)medical science and behavioral science.

Funding for the project was secured in 2006. This paper describes the needs to which the MESS project was responding and the process of setting up the facility. Attention will also be paid to the cost and sustainability of a facility like MESS, and to wider developments (beyond the borders of the Netherlands).

Keywords: Internet panel, longitudinal study, innovative measurement, experiments, multi-disciplinary, open-access

1 Introduction

The majority of leading long-running scientific studies in Europe and the United States still use face-to-face or telephone interviews to collect data. Examples of such studies are the Panel Study of Income Dynamics (PSID), the European Community Household Panel (ECHP), the British Household Panel Survey (BHPS),

Correspondence: Marcel Das, CentERdata, Room T401, Tilburg University, TIAS Building, PO Box 90153, 5000 LE Tilburg, The Netherlands. Visiting Address: Warandelaan 2, 5037 AB Tilburg, The Netherlands. Tel.: +31-13-466 8226 / 8325 E-mail: das@uvt.nl URL: <http://www.centerdata.nl>

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and the German Socio-Economic Panel (GSOEP). However, there are compelling reasons to expect that Internet interviewing will become the dominant survey mode in the social sciences over the next 10–20 years, largely replacing written, face-to-face, and telephone interviewing. Internet penetration is increasing fast in all countries and among all socioeconomic groups. The adoption of Internet surveys has spread faster than any other similar innovation, driven by the promise of faster and cheaper data collection (Couper 2008).

Technological developments not only make Internet interviewing cost-effective but also flexible and forward-looking – emerging technologies and new approaches can be accommodated easily, quickly, and efficiently. This greatly increases the efficiency of scientific research, while also allowing for a quick response to societal developments. Moreover, Internet interviewing creates opportunities for innovative ways of asking survey questions, e.g. exploiting visual tools on the screen or collecting data in ways other than survey questions. This includes various new communication and measurement devices like smartphones with GPS and the ability to read bar codes (like QR codes), as well as devices to measure biomarkers such as weight, bioelectrical impedance, physical activity levels, and blood pressure. These tools allow for much more accurate and cost-effective measurement and experimentation in large representative samples than was possible in the past, leading to richer and better data on many domains of people's lives.

In 2006, the Advanced Multi-Disciplinary Facility for Measurement and Experimentation in the Social Sciences (MESS) was started as one of five large research infrastructures funded by the Dutch government. MESS is an innovative data collection facility intended to boost and integrate research in various disciplines, such as economics, social sciences, life sciences, and behavioural sciences. The core of the facility, the Longitudinal Internet Studies for the Social sciences (LISS) panel, is a representative panel of about 5,000 households based on a probability sample drawn from population registers. Respondents complete interviews over the Internet monthly. Households that could not otherwise participate are given a computer and broadband Internet access. Besides traditional questionnaires, the facility accommodates the use of visual displays, preloading of data, and the collection of non-interview data like self-administered measurement of biomarkers or ecological momentary assessment involving repeated sampling of subjects' current behaviours and experiences in real time, in subjects' natural environments.

Powerful elements of this infrastructure are its open access (to any academic researcher, both in the Netherlands and abroad) and its population-representativeness, providing an environment for cross-disciplinary studies and experiments on a wide array of topics and using advanced measurement devices. Most respondents have been followed since 2007, and rich background information on many aspects of their lives is collected or updated each year and made available when conducting new studies or experiments. Many of the experiments have a longitudinal component, with repeated measurements at intervals varying from a few months to more than a year.

This article presents the motivation and details of the set up of MESS. Section 2 gives some background and describes the main objective and distinguishing characteristics of MESS. The starting point was the existing online panel that CentERdata (Tilburg University, The Netherlands) already administered. The MESS project improved the existing infrastructure and added innovative aspects to it. Section 3 focuses on the core of the facility, the LISS (Longitudinal Internet Studies for the Social sciences) panel. Details are given on how the facility was set up and how it is currently used. Other elements of the MESS project are presented in Section 4. Section 5 briefly explains costs, sustainability and the future development of the MESS project. Concluding remarks are given in Section 6.

2 Why set up MESS?

2.1 Background

In general, Internet surveys suffer from problems of coverage and self-selection bias. Coverage error is a function of the mismatch between the target population and the frame population (Couper 2000). One might expect this type of error to become less important over time, since Internet usage in almost all countries has been rising steadily over the past decade and continues to rise in most countries. In the EU-27, Internet usage rose from 51.3% in 2006 to 67.6% in 2010; in the Netherlands, from 65.9% to 88.6% (<http://www.internetworldstats.com>). Still, coverage errors remain a source of concern since Internet access is low for specific groups, such as the elderly or those with low socioeconomic status. The magnitude of the total bias due to undercoverage is determined by the fraction of those missing in the frame population and differences in characteristics, attitudes and behaviour between Internet users and non-Internet users. Taking into account the combined effect of both factors, there is no guarantee that increased Internet coverage will reduce the undercoverage bias (Bethlehem 2007).

Many Internet surveys are based on self-selection. Through banners, pop-up windows and e-mail messages, respondents are invited to self-select their participation in the survey. Because of this self-selection there is no (longer any) control over the sample selection mechanism. Selection probabilities are unknown, making it impossible to calculate the accuracy of the estimates.

Due to the problems of coverage and self-selection, the academic community is reserved about using the Internet as a mode of data collection, particularly when it comes to general population surveys. However, traditional survey methods are also increasingly showing shortcomings. Scientific surveys using telephone and face-to-face interviews encounter growing problems of undercoverage and non-response bias. Telephone surveys in particular face increasing difficulties as it becomes harder to reach respondents directly, partly because of the increased use of voicemail and cell phones (see for example Berrens et al., 2001), and partly because of the vast growth in unlisted telephone numbers (see for example Piekarski, Kaplan and Prestegaard, 1999). More than a decade ago, Kalton (2000) already questioned the role of telephone data collection in the future because of the decreasing response rates to telephone surveys. The diminishing coverage of (landline) telephone interviews in Western countries adds to the problem of low response rates.

These recent developments have serious effects on survey research methods. On top of the undercoverage and non-response bias, the traditional methods are much more expensive than Internet surveys. And with Internet surveys data can be collected much faster than with the traditional methods. How can the academic community benefit from all these advantages, while also addressing the two serious drawbacks of non-coverage and self-selection?

There are two obvious routes to achieving a sample that is potentially representative of more than just the population of active Internet users. One strategy is to employ several interview modes simultaneously: the Internet for those with Internet access and some other mode, for example, Computer-assisted telephone interviewing (CATI) or Computer-assisted personal interviewing (CAPI) for others. This will reduce costs and all can be based on a probability sample drawn from the population register. However, the use of mixed modes has several major drawbacks: (1) turnaround times between questionnaire design and production of the final data are considerably longer than for one mode alone; (2) it saves costs, but it is still costly and organisationally burdensome, partly because one still has to train interviewers for each interview; (3) to the extent that there are mode effects it may be problematic if not impossible to make results obtained via different modes comparable.

Rather than employing several modes, another route to achieving a sample that is potentially representative of the general population is to draw randomly from this population and provide Internet access to all households in the sample that do not yet have access. This approach was taken in the MESS project.

2.2 Main objective and characteristics of MESS

The main objective of the MESS project is to build an infrastructure for data collection that will boost research in the social sciences using new technologies in survey research. Six distinguishing characteristics motivate the set up of MESS:

1. It is cost-effective. Costs of data collection with traditional modes continue to rise while cooperation rates decline;
2. It takes maximal advantage of newly-available technology and procedures. It is flexible and forward looking in the sense that it can easily accommodate new technologies and new approaches when these emerge;
3. It is open. Many infrastructures are restricted to use by a small group of researchers. Access to MESS is simple and open to every academic researcher;
4. It is efficient. Most surveys have their own focus, but they also have substantial overlap. By combining questionnaires, a number of separate but overlapping surveys can be replaced by one;
5. It is fast. Data become available for analysis much more quickly than with the traditional and more conventional methods of data collection. This greatly increases the efficiency of scientific research and better suits the dynamics of society;
6. It is multi-disciplinary. One can exploit relations between domains that are separate in existing surveys. MESS integrates different academic disciplines, including economics, behavioural and social sciences, biomedical sciences, and law.

2.3 Improving previous efforts

Using the Internet as a mode for data collection was not new to CentERdata before embarking on the MESS project in 2006. The longer-running CentERpanel already moved to the Internet as a mode for data collection in 2000. This panel started in the early 1990s and was based on a probability sample. Households without Internet access were given the use of a set-top box, allowing them to enter data on the Internet using their televisions as screens. If a household did not have a television, CentERdata provided one. The panel was (and still is) used for many scientific projects, resulting in publications in peer-reviewed international top journals (for example Bellemare et al 2008; Guiso et al 2008; Von Gaudecker et al 2011). This panel already demonstrated that the Internet is feasible as a data collection method for scientific research projects. But one could take it a step further and with additional funding it would be possible to extend the possibilities, introduce innovative measurement devices, such as smartphones and self-administered biomarkers, and improve on a number of aspects. These aspects include: size, level of incentives, and accessibility of the facility.

2.3.1 Size

The existing CentERpanel consists of approximately 2,000 households. We wanted to raise that to at least 5,000 households, to make subgroups large enough for a feasible study. We did not intend to build on the CentERpanel. Instead, the existing panel runs parallel with the new facility. Keeping the original panel alive

allows testing for learning effects (do the ‘experienced’ respondents in the existing panel answer differently to the respondents in the new panel?) and it still feeds the long-term existing data series.

2.3.2 Incentives

The CentERpanel uses very modest levels of incentive due to budget restrictions. However, the literature on financial incentives appears to have reached broad consensus on the importance of such incentives. There is evidence that Internet response rates are increased by using incentives (see for example Göritz, 2006; Millar and Dillman 2011). A number of points are noteworthy: (1) prepaid incentives yield higher response rates than promised rewards after interview completion; (2) money is better than gifts; (3) response rates increase with higher amounts of money; (4) incentives give the biggest bang for the buck in surveys where response rates would be low without incentives (see for instance Singer and Kulka 2002). One might worry that the quality of the extra response bought with the incentives may be lower than for other respondents. However, the evidence suggests that incentives actually have a positive effect on quality (see for example Mack et al 1998). We wanted to increase the level of incentives paid to respondents substantially. Clearly, this requires a large amount of money, particularly if one is aiming at sizes greater than 2,000 households.

2.3.3 Accessibility

As with the CentERpanel, collected data should become available to the academic community as soon as possible. But we also wanted to have open and free use of the facility itself. Every researcher at a university or research institute in the Netherlands or elsewhere should be able to submit a proposal to collect data at any time, free of charge. In selecting proposals, the aim is to integrate different academic disciplines. We proposed a fast and ‘light’ procedure to regulate access to the facility. An independent and multi-disciplinary board of overseers considers the applications and makes decisions on accepting the proposals as quickly as possible. Once a research proposal has been accepted, the MESS staff confers with the researcher to coordinate the timing of the fieldwork in the panel. After completion of the fieldwork, data are delivered to the researcher within one month or, in the case of more complex data, within a mutually acceptable period. Two months after delivery, the data are typically made available to academic researchers through a sophisticated data archive (see also Section 3.3).

3 Core of the facility: the LISS panel

The core of MESS is a representative panel of households that have agreed to be available for regular interviews over the Internet: the LISS panel. Panel members complete online questionnaires every month (which takes around 30 minutes) and are paid for each completed questionnaire (15 Euros per hour). One household member provides the household data and updates this information monthly. The panel is based on a probability sample drawn from the population registers, with the help of Statistics Netherlands. Section 3.1 details how the probability sample is drawn. Such a probability sample distinguishes the LISS panel from many Internet panels that use convenience samples. The LISS sample includes households without broadband or even any Internet access but which are provided with broadband access to participate. Section 3.2 describes the recruitment process and Section 3.3 focuses on how the panel is used (detailed information is available at <http://www.lissdata.nl>).

3.1 Drawing the probability sample

The reference population for the LISS panel is the Dutch-speaking population permanently residing in the Netherlands. The sampling and survey units of the LISS panel are independent, private households, thus excluding institutions and other forms of collective households. Households in which no adult is capable of

understanding the Dutch language are not included in the reference population. The sample frame was the nationwide address-based frame of Statistics Netherlands. This address-based frame, consisting of records including an address and a municipality code, was composed by Statistics Netherlands using a random 10% sample from the population registers (Municipal Database) each year. The address-based frame may include situations in which multiple households reside at a single address, as for example in student housing. Information about mail delivery was used to identify these multiple household situations. One address could thus have multiple sampling frame units.

In cooperation with Statistics Netherlands, a simple random sample of 10,150 addresses was drawn from the aforementioned address-based frame. Since letters addressed to ‘the residents of this address’ are likely to be thrown away unopened, at each address a name was selected from the register to be put on the mailed letter and envelope. Note that the selection of a person within a household was for the purpose of addressing the announcement letter only: the sample unit of the panel is the address, and all members of the households at the addresses in the sample are asked to participate.

For each address in the sample, a telephone number was looked up in a contact database containing landline information only. Landline numbers were found for about 70% of the addresses, as was expected since the number of households with a landline connection is falling rapidly. The subpopulation of respondents without a known (landline) telephone number in our sample also included households with secret numbers and households with no telephone at all, in addition to households with cell phones only. These households could therefore not be reached by telephone and were contacted face-to-face instead.

The sample from the population registers naturally included individuals and households who did not (yet) have Internet access. At the time of recruiting the LISS panel, in 2007, approximately 15% of the households in the Netherlands did not have access to the Internet at home. These participants were supplied with a device providing access via a broadband connection, called the ‘simPC’. The simPC is a small and simple device using centralised support and maintenance. It can be operated by large ‘buttons’ for the most frequently-used functions, and has screens that are designed to be readable by elderly people (see also: http://www.lissdata.nl/lissdata/About_the_Panel/Equipment). Sample members with Internet access but without broadband were provided with broadband. The broadband connection facilitates use of visual displays and video. The computer and broadband Internet connection were installed for the panel participants. If necessary, they could also get help at home to show them how to operate the simPC and how to complete the questionnaires on screen.

3.2 Recruitment of the panel

Sampled households were recruited from May to December 2007. Households were contacted in a traditional way: first, an announcement letter was sent in combination with a brochure explaining the nature of the panel study. A copywriting and design agency was hired to create an appealing letter and brochure. The information provided to the respondents at the first contact was tested in several pre-tests and in a pilot study (Scherpenzeel 2009). Budowski and Scherpenzeel (2005) have shown that the persuasiveness of the text in an announcement letter or an information leaflet can be enhanced by incorporating concepts from social psychology, such as reciprocity, helping, constancy of behaviour, personalisation (see also Groves et al 1992). Some qualitative pre-tests with varying concepts in the letter showed that the concepts of authority, reciprocity, and helping were perceived as most persuasive with respect to the panel participation request. Consequently, both partners in the project (Tilburg University and Statistics Netherlands) were mentioned, the incentive offered for participating in the panel was emphasised, and it was stated that participation would really help science and contribute to knowledge about society.

In a pilot study, one half of the sample received a letter informing them about the nature of the panel as well as an explanatory brochure. The other half received a letter that only informed them about the short recruitment interview, with no brochure included. In this latter condition, interviewers introduced the Internet panel only after the interview had been completed. These two information conditions had no significant effect on the response rates. The final letter did mention the nature of the panel study, since the experiment did not show an adverse effect of this information on the response, and the researchers considered it fairer to fully inform the respondents. The letter and the brochure referred the reader to the panel website for more information. A 10 euro bill was enclosed with the letter, based on the pilot study showing that forward payment of a token amount (10 Euros) as an incentive for participation effectively increases the willingness to participate in the panel (Scherpenzeel 2009).

Following the letter, respondents were contacted by an interviewer in a mixed mode design. Those households for which a telephone number was known were contacted by telephone (CATI). The remaining households were visited by an interviewer and thus contacted face-to-face (CAPI). The interviewers were instructed to first try to speak to the person to whom the announcement letter had been addressed. However, if the addressee was not present or not able or willing to be contacted, they could speak to any other adult person living in the same household. Again, the sample unit was at the level of the household or address, not the specific person. When contacting the household, the interviewers referred to the letter and to the enclosed 10 euro bill. If the respondent had neither seen nor read the letter, the interviewer continued to read out the information about the panel and the recruitment from an information screen. This screen also offered links directing respondents to answers to frequently-asked questions (FAQs).

Once contacted, the interviewer asked the respondents to participate in a 10-minute interview, after which the request to participate in the panel was made. The interview consisted of a few questions about demographics, the presence of a computer and Internet connection in the household, and a series of survey questions about social integration, political interest, leisure activities, survey attitudes, loneliness, and personality. Within one to two weeks after the interview, the respondents with Internet access who consented to participate in the panel received confirmation by e-mail, as well as a letter with login code, an information booklet and a reply card. With this reply card they could (formally) confirm their willingness to participate. This could also be done directly via the Internet (with the login code provided in the letter), after which the respondents in the household could immediately start with the first questionnaire. Respondents without computer and/or Internet had to confirm their willingness to participate by returning the signed reply card, after which CentERdata provided them with the equipment and/or broadband connection necessary to participate. The confirmation procedure ensured the double consent of each respondent. In the confirmation e-mail and letter, respondents were promised an additional 10 Euros for logging in or sending back the reply card, to minimise the loss of respondents resulting from the double consent procedure.

The interviewers who recruited the panel members were instructed to focus on obtaining the cooperation of the selected households, rather than on maximising the response/interview time ratio as they would do for commercial surveys. In the telephone recruiting, the maximum number of contact attempts was 15, at regular intervals, spread over several weeks. If a household was not reached after 15 calls, the address was transferred to face-to-face recruiting. In the face-to-face recruiting, a first series of eight contact attempts was made by the interviewer. A second series of seven attempts was made after a few weeks' pause. If respondents refused the full interview, the interviewer would propose to ask only one to three central questions. If this was successful, the questions were followed by the request to participate in the panel. This method was extensively used in the non-response follow-up stage.

A refusal conversion procedure was designed in cooperation with the fieldwork institute that carried out the recruitment. The procedure was tailored to the type of refusal recorded. If the reason for refusal was, for example, feeling too old to use the Internet, the respondent would be visited at home by an (elderly) interviewer with a demonstration video. If the refusal reason was 'no time', the respondent would receive an Internet link to an abbreviated interview.

The intensive efforts to re-contact and motivate respondents to participate resulted in satisfactory response rates. The response to the short CATI or CAPI interview or to the 'central questions' (the first-stage response) was 75% in total (51% completed interviews plus 24% completed central questions). The willingness to participate in the panel among respondents who answered the recruitment interview or the central questions was fairly high: 84% of those participating in the recruitment interview (or 63% of the total gross sample) told the interviewer they were willing to participate in the panel. The pilot study had shown a rather large loss of respondents between the expressed willingness to participate and actual commencement of panel participation. For this reason, the follow-up procedure in the main recruitment effort was prolonged and an extra 10 euro incentive after registration was promised. These measures appeared quite successful, as the final panel membership rate is 48% of the total gross sample.

Papers and research notes on the composition of the LISS panel, including a full description of the original sample, the recruitment process and the recruitment response are available at: [http://www.lissdata.nl/lissdata/About the Panel/Composition and Response](http://www.lissdata.nl/lissdata/About%20the%20Panel/Composition%20and%20Response).

3.3 Use of the panel

Interview time is offered as open access data collection to the academic world. Researchers are invited to submit research proposals that, if approved by a scientific board, can be carried out through the panel at no cost. Many researchers from different fields have used the facility. Up to March 2012, 123 proposals were submitted from a wide range of disciplines, of which 86 have already been accepted. The number of proposals is increasing over time. A substantial number of proposals come from researchers outside the Netherlands, including researchers from top-ranked universities such as Harvard University, Stanford University, and the University of Michigan. The LISS panel has been presented at several international conferences, resulting in considerable interest in using the facility. And there is a wide variety of topics, ranging from nutrigenomics, mental health, and crime victimisation to mobility, time use, and the economic crisis.

All collected data are disseminated to the academic community (see <http://www.lissdata.nl/dataarchive>). This includes data from the proposed studies as well as data from the core study (see Section 4.1). As of March 2012, there were more than 500 registered users. To disseminate data, the IT team at CentERdata developed 'Questasy', a web application for managing the documentation and dissemination of data and metadata for (longitudinal) surveys. It manages questions and variables, including question reuse across multiple studies and longitudinal surveys. It also manages concepts, publications, study information, and more. Questasy is based on existing international specifications, specifically those of version 3 of the Data Documentation Initiative (DDI). The DDI appears to be the most commonly used specification among data archives (for more information see the DDI Alliance website, <http://www.ddialliance.org>).

Version 3 of the DDI introduces a life-cycle approach to documenting survey projects and distinguishes between the metadata of questions (data collection) and variables (dataset). While earlier versions of DDI are widely used, we found no applications that apply version 3 to data as complex as the LISS data, prompting us to build Questasy. While this required a large initial investment, it also enabled us to make a new contribution to international data archiving and dissemination.

Questasy has been presented at several international conferences and workshops of DDI users, attracting considerable interest. Reactions to it appear to indicate a growing demand for this type of application, as more organisations are migrating to DDI 3. The source code is available cost-free for educational, scientific and governmental non-profit organisations.

4 Other key elements of MESS

4.1 Synchronisation with major social and economic surveys

Half of the interview time available in the panel is reserved for the LISS core study. This core study is repeated yearly (spread out over several months) and ‘borrows’ from various national and international surveys. All of these surveys have their own focus, but they also have substantial overlap. By combining the questionnaires of these panels we can (1) compare the results obtained with the Internet panel to results obtained in these more traditional surveys; (2) exploit relations between domains that are separate in the surveys from which we take the questionnaire, but are integrated in the Internet survey. If the comparison with the existing surveys shows sufficient promise, one would expect that in the future new research items could be added to the Internet panel in a highly cost-effective way, rather than requiring new (rather expensive) surveys. More generally, this would suggest an entirely new approach to data collection; instead of conducting several separate surveys, one collects a substantially larger amount of information from the same people, thereby achieving economies of scale and a richer environment for analysis.

The LISS core study follows changes in the life course and living conditions of the panel members and monitors trends in household composition. Respondents can complete online questionnaires at any time during the month and at their own pace, taking breaks as needed.

The complete core questionnaire is split into shorter modules requiring about 20 minutes each to complete and spread over eight months. Thus, the core questionnaire covers about 160 minutes worth of interviewing time in total. The eight thematic modules are: 1. Family and Household; 2. Economic Situation and Housing; 3. Work and Schooling; 4. Social Integration and Leisure; 5. Health; 6. Personality; 7. Religion and Ethnicity; and 8. Politics and Values.

The core questionnaire was developed in consultation with experts in different fields, including epidemiology, economics, psychology, sociology, survey methodology, and political science. Each core module consists of about 100 questions; hence the various domains are covered in more depth than usual. An overview of the underlying concepts of each module and the documentation of all survey items of the core questionnaire are available at

http://www.lissdata.nl/lissdata/Research/LISS_Core_Study and in the LISS data archive:

<http://www.lissdata.nl/dataarchive>. The collection of a large number of respondent characteristics in the core questionnaire also provides an efficiency gain, as it bypasses the need to collect background variables at each questionnaire. Furthermore, the characteristics can be used to stratify the sample and to tailor questionnaires to the characteristics of a respondent.

4.2 Experiments

The MESS team has carried out several experiments on panel maintenance and the innovation of methods. A pilot experiment tested the effects of contact mode, incentives, and information on recruitment (Scherpenzeel 2009). Toepoel et al (2008; 2009) compared trained and new respondents in order to analyse panel conditioning effects. Other experiments include mixed-mode experiments (De Leeuw et al 2010a; 2010b);

experiments to test ways to stimulate participation (in general and for specific questionnaires; Scherpenzeel and Vis 2010); a study of inactive panel members (who they are, why they stop, and how they can be reactivated; Scherpenzeel and Zandvliet 2011); a study of the relationship between questionnaire characteristics and response; and an experiment with personalised questionnaires. Details of the two latter experiments are included in the MESS progress report of 2011 (Scherpenzeel et al 2011). Various new experiments will be conducted in the near future to explore different ways of presenting information and different ways of framing decision problems.

4.3 New forms of data collection

In addition to the online questionnaires, MESS uses various new forms of data collection. The facility acts as a magnet to pioneers of new forms of data collection from very different fields of research.

An innovative experiment explored the feasibility of collecting biomarkers, including blood cholesterol, saliva cortisol, and waist circumference, through Internet surveys. Participants were able to take measures using self-test devices guided by video instructions. The biomarker values corresponded with expected ranges and means. Collecting biomarkers in an Internet survey turned out to be potentially feasible, but future strategies should address how to increase low response and participation rates to this experiment (details of this experiment can be found in Avendano et al 2011).

In August 2010, we started a new pilot project to validate the self-reported weight of the LISS panel members with a more objective measurement of weight and fat percentage. This measurement is taken using a sophisticated scale that transmits the measurements directly to the LISS database via the computer and Internet connection. A random sample of 1,000 households in the LISS panel received a scale. A control group of 385 households that did not receive a scale were invited to answer the same monthly questions as the households in the experimental conditions. First comparisons of self-reported and actual weight showed respondents whose Body Mass Index (BMI) is below a certain threshold level overreport their BMI, while respondents whose BMI exceeds the threshold level underreport. In addition, men misreport more than women, and respondents without a college degree misreport more. An important finding, which can only be shown when weight measures are taken on a daily basis as in this study, is a clear and highly significant weekly cycle of weight, BMI, and fat percentage. On Mondays weight is half a pound higher than on Fridays. All three body measures decline during weekdays, reaching their lowest levels on Fridays and then starting to increase during the weekend. In addition, a decline was found of all three body measures during the first five months of the year, which could be part of an annual cycle. Future analyses will include the effect of the feedback given about weight, BMI, and fat percentage on health-related behaviour, health, and the use of health care.

Another innovative form of data collection that will be used in MESS is the application of new technology for Time Use Research (TUR), which is usually carried out using questionnaires and diaries. Respondents complete, for example at the end of the day, a diary of all their activities of one day, spread over fixed time-slots. With current technology, such as smartphones and applications ('apps'), TUR can be set up more effectively. Respondents carrying a smartphone can record their activities several times during a day. In addition, smartphones enable collection of much additional data, such as the location of the respondent at the time of the activity or photos and videos of the activity performed.

Additional plans include experiments with blood pressure measurement devices and so-called accelerometers – lightweight devices that measure movements and can be worn for days without discomfort. Supplementing self-report data with objective measures based on accelerometry has many advantages. Objective measures eliminate reporting errors and give a more accurate picture of energy expended on different activities.

Accelerometers also provide data about the patterning of physical activity through the day and across the week. These are important issues for understanding how activity is constrained in older persons and for identifying opportunities to promote regular exercise. Recent studies of the elderly in the UK and the US have shown these methods are feasible and have documented associations between physical activity and psychological wellbeing, disability, BMI, and self-confidence (e.g. Harris, Owen, Victor, Adams, and Cook, 2009; Troiano et al 2008).

It is impossible to foresee which new measurement devices will become available in the near future. However, because of the flexible set-up of the MESS facility, it can easily accommodate new technologies and new approaches when these emerge.

4.4 Links with administrative data

Population registers offer other data that can be combined with the data from the LISS panel. Examples from Statistics Netherlands registers include tax records with detailed information on income, social security records on entitlements to old age social security benefits and records on projected occupational pension entitlements. Linking data from the LISS panel with data from registers also creates the possibility of methodological studies on representativeness, item-non-response, mode and context effects, and selection effects. The enrichment with administrative data not only improves the means of checking data quality, it also reduces response burden. There is no need to collect information that is already available in the administrative data. In addition, datasets can be enriched with contextual data or information that is hard to obtain from respondents directly.

4.5 Special groups

A special immigrant panel exists alongside the normal LISS panel within the framework of the MESS project. It is a joint project of CentERdata, the Department of Cross-Cultural Psychology of the Faculty of Social Sciences at Tilburg University, and Statistics Netherlands.

Recent decades have seen much research on the position and acculturation of various, notably non-western, immigrant groups. These studies provide valuable insights into adjustment processes and acculturation outcomes of different immigrant groups. For example, we now know that non-western immigrants prefer integration in the public domain (e.g., work, school) but separation in the private domain (e.g., home, in-group). We also know that Turkish and Moroccan immigrants in the Netherlands tend to be less adjusted than Surinamese and Antillean immigrants and that school performance of non-western immigrants is considerably below mainstream levels (although the gap is gradually diminishing).

Yet our knowledge of immigrant acculturation is still fragmented. A main shortcoming of extant research is its disparate nature, usually owing to convenience samples using a variety of instruments. One reason for this is that representative samples of immigrants are hard to draw. In consequence, most Dutch acculturation data do not provide much scope for an integrated body of knowledge. The immigrant panel considerably enlarges the infrastructure for researchers interested in acculturation issues, especially among hard-to-reach immigrants.

The sample for the immigrant panel, drawn by Statistics Netherlands from the population register, has been stratified by ethnic groups. It includes both first and second-generation immigrants. The standard definitions of Statistics Netherlands of first and second-generation immigrants are used as well as the standard definitions of Western and non-Western countries.

The definition provided by Statistics Netherlands for a person with a first generation foreign background is: ‘Someone born abroad with at least one parent who was born abroad’, while the definition for a person with a second-generation foreign background is: ‘Someone born in the Netherlands who has at least one parent born abroad’ (see also <http://www.cbs.nl/statline>).

The sample includes (first and second-generation) immigrants from the four major non-Western immigrant groups in the Netherlands: persons with a Moroccan, Turkish, Surinamese and Antillean background. In addition, it includes the large Western immigrant group of persons with an Indonesian background. Due to their socio-economic and cultural position, people from Indonesia living in the Netherlands are seen as people with a ‘western’ background. They are mainly people born in the former Dutch East Indies. Persons with a South African background constitute a small but special group, which was oversampled with the objective of comparing the acculturation process of a group close to the Dutch culture and language to that of other cultural groups. In addition to these six specific groups, a group consisting of persons with a Western-European background was drawn; a group of persons with a Western non-European background; and a group consisting of persons with a variety of non-Western backgrounds. All groups consist of first as well as second-generation immigrants. Furthermore, the sample included a control group of persons of Dutch origin. The MESS immigrant panel members receive simPCs and broadband Internet access if they do not have a computer and/or Internet, and they are paid the token amounts as incentives for participation described for LISS panel members above.

Recruitment was carried out between March and December 2010. The recruitment procedures were tailored to the groups with a non-Western background, based on experiences with these groups in the earlier recruitments of the LISS panel. In addition, the response rates of the different ethnic groups were continuously monitored during the recruitment and changed when necessary for specific groups. The final panel membership rate is 28% of the total gross sample. In total, 1,885 household registered for participation in the immigrant panel. A supplement to the original grant made it possible to treat the immigrant panel as the LISS panel: it is open to any interested academic researcher, free of charge (more details on the original sample, the recruitment process and the recruitment response are available at:

http://www.lissdata.nl/lissdata/About_the_Panel/Composition_and_Response).

5 Costs, sustainability, and further development of MESS

5.1 Costs

Building a large-scale infrastructure in the exact sciences, like a telescope or a particle accelerator, requires a huge budget in the construction phase. Costs for exploitation in later years are fairly modest. For an infrastructure like the MESS facility there are significant start-up costs, e.g. for recruiting the panel and providing respondents with equipment, but the running costs should not be underestimated either. This applies particularly if the facility is open to the scientific community and can be used free of charge. Still, total costs for building an infrastructure in the social sciences are only a small fraction of costs for large-scale infrastructures in the exact sciences.

Costs for setting up a panel like the LISS panel depend heavily on Internet penetration, the type of hardware, and the level of support during the construction phase. Recruitment of the LISS panel including incentives, a very extensive pilot study and provision of hardware, added up to approximately € 900,000. This amount excludes the personnel investment during the construction phase, which amounted to approximately 4 full-time equivalents in total. Running costs depend on the number of surveys administered to the panel and can be divided into two categories: 1) costs for conducting the questionnaires (e.g. incentives and broadband

subscription), and 2) personnel costs. The number of surveys administered to the LISS panel is increasing over time, and has reached the upper limit agreed upon with the panel members (maximum 30 minutes per month). On a yearly basis, this implies a total €700,000 (approximately) paid in incentives. Personnel is involved in managing the project, programming and testing the questionnaires and experiments, data cleaning and dissemination, data quality control, and software development for panel administration and the dissemination of the (meta)data. On a yearly average, 7 full-time equivalents were involved in these tasks in the past years.

The MESS project involves a fairly substantial budget. Nevertheless, when taking into account the enormous amount of (multi-disciplinary) data that is collected from a large sample in a very efficient way, it is still cheaper than data collected through more traditional methods. Central running costs could be reduced significantly by asking researchers to arrange a budget for their own study. However, the open access character of the facility is considered to be the key element of the whole infrastructure. Innovative new ideas should not be hampered by a lack of infrastructure or budget. A central budget covered the setup of the infrastructure, and continues to cover the use of the facility.

5.2 Sustainability

The core study collecting a multi-disciplinary and extensive set of longitudinal data yields a unique amount of information on a wide variety of topics that has no counterpart in any existing socio-economic panel survey elsewhere. The return on investment steadily increases over time: in general, panel data become useful for longitudinal analysis only after three or more waves.

Researchers have used data from the core questionnaire in combination with data they had collected in a specific, approved study in the LISS panel. Many of the approved studies make effective use of the panel design and collect data at several points in time. The quality of the panel in terms of coverage and sample selection is sufficient to meet the objectives, resulting in a wide use of the panel and the core data. However, even when appropriate sampling is used and Internet access is provided whenever needed, there remains a potential source of selectivity in the response rates. We continuously need to monitor attrition and monthly non-response.

Panel attrition remained relatively low in the first years of the LISS panel (on average, less than 10% per year). De Vos (2009a) examined whether specific groups show especially high or low attrition rates. The probability of attrition is significantly affected by age, the provision of a simPC and broadband Internet connection, and the employment status of the persons in the household (i.e., for age: elderly are more likely to drop out, for simPC: households are less likely to drop out, and for employment status: two-earner households are least likely to drop out). However, attrition is far more closely related to respondents' past response behaviour than to household characteristics. Skipping a questionnaire or completing questionnaires irregularly turn out to be the best predictors of future drop-out.

Besides attrition, the group of respondents who are still part of the panel but have not completed a questionnaire for several months is equally problematic. A considerable part of the monthly non-response is by the same panel members every month. Panel members who participated before but have not completed a questionnaire for three months or longer are defined as 'sleepers'. Sleepers made up 22% of the panel members in July 2009.

De Vos (2009b) studied the characteristics of the sleepers. He describes respondent characteristics that increase the likelihood of 'sleeping'. For example, non-western immigrants have a higher probability of becoming sleepers than non-immigrants. However, similar to attrition, previous non-response is a better

predictor of becoming a sleeper than any of the exogenous explanatory variables included in the analysis. This suggests the need for a general strategy to keep panel members 'awake' by regularly attracting their attention and encouraging their participation. By regular phone calls we now keep in touch with panel members who have been inactive for a while. These calls are also used to keep track of the personal situation and (changes in) contact data of panel members. If a sleeper does not wake up after a prolonged period and several contact attempts, he or she is dropped from the panel.

Even though the LISS panel was based on a proper probability sample and recruited with much attention to coverage and response stimulating procedures, some biases in sample composition exist. In order to correct these biases, we have drawn a stratified refreshment sample in 2009, oversampling the hard-to-reach groups which had a below-average response in the main recruitment. This sample was stratified on household size, age, and ethnicity. The question remains whether we will succeed in 'correcting' the undercoverage of the elderly and non-Internet population in this way. Elderly respondents appear to be more reluctant than we expected to accept a computer and Internet access free of charge.

The composition of the LISS panel and the monthly response rates are receiving considerable attention. The first refreshment sample was drawn so as to increase representation of hard-to-reach groups that had low response rates in initial waves. However, due to continuous attrition other refreshment samples will be needed as well.

5.3 Further development of MESS

The MESS Project constitutes an advanced data collection environment for the social sciences. It offers a means of conducting new, innovative, and multi-disciplinary survey research in the social sciences. Next steps include follow-up experimentation with advanced measurement devices (see also Section 4.3). Communication technology can be used to minimise the role (and thus burden) of the respondent in providing data. In addition to being more accurate, such measurements can be conducted more frequently, including on a weekly or even daily basis.

In terms of developing a facility like MESS more widely, a next step would be to set up similar facilities in other countries. MESS has received considerable attention from the international scientific community so far. New foreign initiatives patterned after the MESS project exist and are growing in number. Recent initiatives are:

1. ELIPSS (Étude Longitudinal par Internet Pour les Sciences Sociales. Formerly named DIME-SHS); Sciences Po (France).
2. GIP (German Internet Panel): University of Mannheim (Germany). See also:

http://reforms.uni-mannheim.de/english/internet_panel/index.html

The grant proposals of the initiatives were modelled closely on the MESS proposal. We are collaborating with these two starting panels to share our experiences, harmonise the core data, and to offer, prospectively, a Europe-wide facility for data collection.

6 Concluding remarks

The MESS facility provides both an optimal infrastructure for empirical research in the social sciences and the financial resources to carry out this research. It revolutionises empirical social sciences in several directions: (1) it takes maximal advantage of newly available technology and procedures; (2) access to the facility is simple and open to every academic researcher; (3) by combining the content of a number of usually separate but overlapping surveys it is highly efficient, cost-effective, and one can exploit relations between domains that are separate in existing surveys; (4) data become available for analysis very quickly, thus greatly improving the efficiency of scientific research and its societal relevance; (5) it integrates different academic disciplines, including economics, behavioural and social sciences, biomedical sciences, and law.

We have shown that it is possible to use Internet interviewing while complying with high quality demands as regards coverage, sample composition, and data quality. It proves possible to correctly apply sampling theory to the construction of an online panel. For the LISS panel, Statistics Netherlands drew a probability sample of households from a population register. These households were then contacted through a face-to-face interview, asking respondents to join the panel. The research institute provides a computer and Internet connection to those households that would otherwise be unable to participate. Hence, this panel uses online interviewing as just another way of asking questions and not as a sampling frame. It has been shown that participants for this online panel can be recruited quite effectively from the probability sample using traditional means of contact, such as telephone interviews, supplemented with face-to-face contacts for households without a known telephone number.

It is our view that the MESS project offers a new way of collecting household panel data over time. In the LISS panel, a core questionnaire was implemented that is comparable to the questionnaires of well-known longitudinal household studies throughout the world in terms of content and domains. As in the traditional longitudinal studies, this core questionnaire is repeated every year. Moreover, the core questionnaire of the LISS panel is longer and more detailed than most comparable questionnaires used in traditional longitudinal studies. The flexibility of online data collection is thus combined with the traditional household samples and panel designs, yielding a uniquely large range of longitudinal data.

The specific aims of the further implementation and development of the MESS project are to:

- Ensure the continued measurement of the longitudinal core study, leading to a data source with rich information on many aspects of the lives of a large representative sample of the Dutch population;
- Experiment with and implement new innovative measurement devices — such as (1) smartphones with GPS and the ability to read bar codes (like QR codes); and (2) biomarkers, such as accelerometers, blood pressure measurement devices, etc. — to link up with the life sciences;
- Set up an innovation panel (of about 1,000 households) to devise and test a number of interventions (such as providing feedback on measurements of health), taking advantage of new technology and new developments in behavioural sciences;
- Use the facility as an alternative to the traditional economics laboratory to perform large-scale population-representative experiments that lead to a better understanding of preferences and decision-making processes at individual and household levels;

- Extend the possibilities of linking to various sources of administrative data on, for example, income, wealth, and health (or the use of health-care facilities), in collaboration with Statistics Netherlands;
- Improve the general population-representative nature of the study by putting special focus on hard-to-reach groups, e.g. immigrants and the elderly, finding optimal ways to include them in data collection efforts;
- Develop innovative tools to optimise user-friendly access to the data for the (national and international) research community;
- Collaborate with major European data collection efforts in their search to improve quality and efficiency with mixed-mode designs combining Internet and traditional methods;
- Support and stimulate initiatives to set up representative Internet panels similar to MESS in other European countries and start building a European network coordinating these initiatives.

It is a long list, but then innovation never ends.

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Biography

Marcel Das holds a Ph.D. in Economics from Tilburg University (1998). In 2000, he became the director of CentERdata, a survey research institute specialized in web-based surveys and applied economic research, housed at the campus of Tilburg University. As a director of CentERdata he has managed a large number of national and international research projects. He is one of the principal investigators of the Dutch MESS project for which CentERdata received major funding from the Dutch Government. Since February 2009, Das is Professor of Econometrics and Data collection at Tilburg University. He has published in international peer reviewed journals in the field of statistical and empirical analysis of survey data and methodological issues in web-based (panel) surveys.