

Large-Scale Survey Interviewing Following the 2008 WenChuan Earthquake

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Introduction

The May 12, 2008 Wenchuan Earthquake was one of the most devastating earthquakes in recent years, currently ranking as the seventh earthquake in terms of number of deaths caused since 1900 (U.S. Geological Survey, 2008)¹. The Chinese government launched a major rescue effort, and a reconstruction plan — “The overall planning for post-Wenchuan earthquake restoration and reconstruction” (Government of China, 2008)— was published on September 23, 2008. One of the inputs to the reconstruction plan was the Post Wenchuan Earthquake Rapid Needs Assessment, a household and community survey carried out in July 2008 in 3652 households. In order to assess the reconstruction, a second survey was carried out one year later in July 2009 in the same communities covering 4014 households.

Both surveys were large-scale computer-assisted personal interviewing (CAPI) surveys. The surveys had their overriding purpose to assist the Chinese government on the provincial and national level in early and mid-term recovery planning. Especially the first survey operated on a very strict timeline as data were required for the development of the General Plan. The use of sub-notebook computer aided interviewing was essential for completing the surveys within strict timelines. Nevertheless, several challenges were also noted during the surveys.

The purpose of the present paper is to discuss some of the advantages and limitations of applying computer aided interviewing in the large-scale Rapid Needs Assessment survey and the subsequent Reconstruction Survey.

Advantages of the computer aided interviewing with Blaise

Description and choice of CAPI with Blaise

To provide the data for the Chinese government in the early reconstruction plan, the Post Wenchuan Earthquake Rapid Needs Assessment Survey had to be finished quickly. The go-ahead for the survey was given as late as June 20th, while the government asked that the initial report from the survey should be delivered by the 15th of July, 2008 in order for it to be used. At the same time, as the basic household data needed for sampling were not available from the provincial government, much time was needed for obtaining the data needed compiling a data frame. Therefore, there were severe limitations on the time that could be spent on the data collection, cleaning and analysis.

Computer-assisted interviewing undoubtedly benefitted the data collection. During the field work, each interviewer was equipped with an Asus Eee-pc sub-notebook (“net-book”) computer running Windows XP and using Blaise 4.8 as a computer aided interviewing data entry tool (Statistics Netherlands, 2002). Computer aided interviewing was on the whole very successful. It saved the time needed for data entry, and perhaps most importantly the computer aided interviewing allowed for continuous tabulation and quality control while the survey was on-going. Moreover, as the data were sent from the field every day,

¹ The six earthquakes with higher death tolls are the 1976 Tangshan (China), the 2010 Haiti, the 2004 Sumatra (the Asian Tsunami), the 1920 Haiyuan, Ningxia (China), the 1923 Kanto (Japan) and the 1948 Ashgabat (Turkmenistan) (U.S. Geological Survey, 2010).

the source code for the production of the tabulation report could be developed as the survey progressed, taking account of real data. This made possible the production of a report before the deadline. Several different options for building the CAPI data entry applications, such as availability of software, the type of the hardware being used and the characteristics of the survey, were considered. The Blaise system had been used by the team for several previous PAPI surveys for data entry purposes; and therefore the interface and programming of the Blaise system was familiar to the team. Even though this was the first time the team used Blaise on a CAPI survey, the previous experiences benefitted the development of the instruments in the limited time available. As computers running standard Windows XP were used, standard Blaise could be used. Given that the data entry, especially for the first survey, had to be completed very quickly, the fact that a Blaise programmer can produce data entry without having to do detail formatting of data entry forms was also an important consideration. Furthermore, other researchers have reported that Blaise could be a useful and powerful environment not only for normal data entry applications but also for CAPI data entry applications (Rosemary Crocker, 1999).

Advantages compared to PDAs:

An alternative to using net-book computers would have been to use PDAs. These have successfully been employed in many small and large surveys, including in emergency situations (Pedersen, 2010). In general, available software for PDAs was at the time either cumbersome or difficult to use, expensive or too simple to handle a complex questionnaire. The cumbersome category includes software that supports more generalized data base systems, such as Handbase². The expensive category included CSPRO-X, the commercial version of CSPRO. A free version of the CSPRO data entry system has since been released with implementation for PDAs. The too simple category includes software such as Pendragon Forms³ that does not handle hierarchical files well.

The surveys in question had a relatively complex set of questionnaires, with sections for households, individual household members and a randomly selected person in the household. The survey covered the issues such as housing, infrastructure, basic demographic information, health situation, and mortality during earthquake, employment before and after the earthquake, household economic activities, economic support received, social network, and migration. One randomly selected member in the household was interviewed on their psychological health after the earthquake, participation in the rescue activities, trust in persons and institutions, attitudes to various forms of assistance, satisfaction with services and assistances. Even though there are apparent physical disadvantages with lap-tops, such as comparatively low battery life, heavier machine and so on, there are advantages of lap-tops over PDAs. The large screen and normal keyboard enables a friendly user interface. In particular, the larger screen of a net-book makes it possible to present more contextual information to the interviewer than what is possible on a PDA. While open-ended questions and qualitative interviews are nearly impossible with PDAs, this is not the case with the lap-tops. Formerly, PDAs had a definite price advantage over fully fledged computers. With the advent of net-books, this is no longer the case.

A final reason for choosing net-books rather than PDAs was that net-books, running vanilla Windows-XP are much better supported in the internet user community than PDAs. The same is true for Blaise, compared to PDA based software, perhaps with the exception of CSPRO.

Dramatically reduced the time needed for a survey:

The ability to collect high-quality data while dramatically reducing the time from collection to analysis could prove extremely critical in early stages of a humanitarian emergency. One apparent advantage of a computer-assisted survey is that neither paper questionnaire transportation nor data entry after the field

² <http://www.ddhsoftware.com/handbase.html>

³ <http://pendragon-software.com>

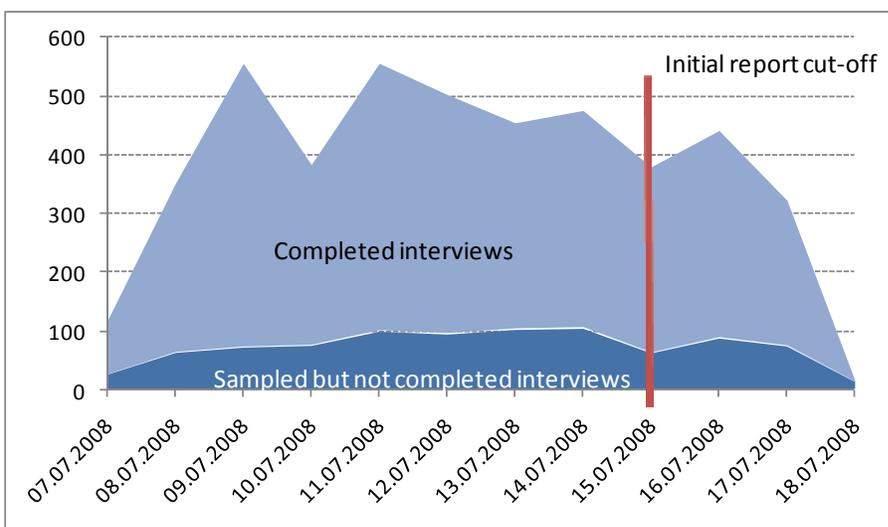
work is needed. Substantial parts of the work for data entry, data consistency checks and data cleaning were incorporated with the interviewing. The use of CAPI reduced the time needed for data cleaning, thus making more time available for data analysis.

The automatic skip and logical branching by the Blaise instrument not only improve the quality of the data, but also reduce the interview time (D. Forster, 1991). Even though we did not formally test how much time was saved by computer during the interview, there was evidence indicating that it did reduce the interview time. During the pilot, experienced researchers used paper questionnaires and reported that it took on average an hour to complete one interview. However, in the first field practice during the training, most trainees managed to complete the interview in less than an hour.

Even though a computer-assisted survey increases the technical requirements of the field work operation, it simplifies survey management. Paper questionnaire management and questionnaire transportation are not needed. The need for field editing is also reduced, as almost all the logical errors have been controlled by the data entry application during the interview. This will be discussed later.

All these features have contributed to a quick and high quality survey. The field work of the survey formally started on 7th July 2007, and the data from 2739 (75%) households were collected by 14th, July. Figure 1 shows the progress of the field work, and the first initial report was submitted to the Chinese government on 15th, July 2008. It would have been impossible if CAPI had not been used for the interviews.

Figure 1 Field work in the Post Wenchuan Earthquake Rapid Needs Assessment Survey



Technical benefits and advantages:

Several features of Blaise were found to be beneficial in facilitating the interviews during the field work. Interviewers navigated the lengthy survey much more easily on the electronic questionnaire. The Blaise questionnaire displays one question at a time, and only advances to the next question once the current question is answered. The Blaise data entry application keeps automatic track of which question should be answered next. Automatic routing also made it impossible to inadvertently skip a question, or ask a question which should have been skipped. CAPI eliminated most skipping errors, and is also reduced the missing errors (Norman M. Bradburn, 1991). The program could also limit response choices on subsequent questions depending on answers to prior questions, thereby avoiding the long listings of answer choices. In addition, the data entry application always interprets the logical branching correctly, without any effort on the part of the interviewer. For example, when some questions are only designed for

a specific age-group, Blaise can be designed to automatically show the questions only when the person in question is eligible.

A well designed Blaise program also performs internal consistency checks. Such checks include range checks and consistency checks. Range checks compare the given response to the range of possible responses. Consistency checks are more complicated checks, which analyze the internal consistency of several responses. In the case of surveys that use paper questionnaires, internal validity checks have to be conducted at the data cleaning stage that usually follows the data collection stage. Then when errors are detected, they can often only be recoded to a missing data code because it is no longer possible to ask the respondents what they really meant. However, a computer-assisted survey provides an opportunity to carry out range checks and consistency checks when the data are entered, and forces the interviewers to stop and check their mistakes. These factors are likely to eliminate many of the most common data entry errors and missing data. With a paper questionnaire, survey administrators have to spend much time training the interviewers on how to reduce data entry error, and a field editor is usually needed to detect these errors in the field. Therefore, using CAPI saves a lot effort in training and field editing, and yields higher quality data. The computer-assisted survey has a significantly lower overall error rate and it also significantly reduces the inter-individual variability in the data accuracy when compared to the paper version survey time (D. Forster, 1991).

Another advantage of CAPI is that it can improve random selection of respondents within the household. Both the Sichuan surveys included a questionnaire targeting a randomly selected adult household member about his/her psychological status, attitudes and opinions. In a normal PAPI (Pencil-and-paper interviewing) survey, after the information for all the household members is collected, the interviewer selects one member based on some predetermined random procedure, such as a Kish table or the household member who had a birthday most recently. If the interviewer strictly follows the instructions, there will be no selection bias. However, interviewers tend to select household members who are at home so as to avoid extra effort to find the selected member, and may also have preferences with regard to age and gender. CAPI makes it possible to design the program so that one household member is selected by the program randomly. It not only saves lots of effort by the interviewer to follow the instructions for selection, but also reduces the potential bias during the random selection.

Quality assurance during field work:

With paper questionnaires, some days or weeks are normally required to enter and clean data before the survey managers can evaluate the quality of the field work. In many cases, it might be already too late if serious problems are found. Without the data entry phase, the computer-assisted survey makes it possible to carry out rapid data analysis and quality control every day right after the field work. The result of initial data analysis and feedback on the performance of each interview team and each interviewer could be sent back to the field in time, so that the quality could be improved to the largest extent possible. It turned out to be extremely useful especially in the early stage of the field work.

A benefit of CAPI systems is that they generally allows information about the interview process itself to be recorded. This can be used both to monitor the behavior of the interviewers and to gain data on how individual questions work – for example if a question normally takes much more time than others to complete. The audit system of Blaise is extremely extensive, - a main problem with it is that it easily drowns one in data,

There are other potential benefits which might improve survey quality when using CAPI. Notes and the interviewer manual can be incorporated into the Blaise data entry program. It was not done in the need assessment survey due to the limitation on the time for the application development; however it would be useful for the interviewers to be able to search for help any time they want. It would also be possible to exploit other capabilities of the computer such as recording sound, thus enabling direct storage of the verbal interview itself. This might be of help in resolving inconsistencies detected during data analysis or cleaning.

Limitations of computer aided interviewing with Blaise

Hardware limitation and challenges in the field:

One of the main constraints with lap-tops when we carried out the first survey in 2008 was the limited time of operation on a single battery charge. In some areas seriously hit by earthquake, the electricity supply had been destroyed. At that time the best battery for the Asus Eee-pc sub-notebook we could obtain only allowed three hours of operation. Although every interviewer was equipped with a spare battery, this was not enough for an eight-hour working day. Therefore some interviewers were forced to use paper questionnaires towards the end of the day. However, even in 2008 the areas not supplied by the electricity were not very common so the limited battery capacity did not become a major problem. In cases where both batteries were out of power and no electricity could be had from the household, the interviewer would use the paper questionnaires, and enter the data at night when they could charge the lap-top. However, this constraint with CAPI should disappear with the improvement of technology. In fact, it is quite possible today to get net-books with a much longer battery life than what we could get in 2008.

Yet another challenge of CAPI is data loss due to hardware failures or human error in using the computers. Therefore extra work with data management and equipment maintenance is needed during the field work. In the Sichuan surveys, the program was set to automatically save every minute. Each team was instructed to copy the data to the supervisors' USB, and the data were sent by email to the headquarters every day. After the data were sent to the headquarters, copies of all the data were still kept on interviewers' lap-tops and supervisors' USB during the whole field work, therefore the loss of data in any one source would not be a catastrophe. Before the start of the survey equipment maintenance was one of the worries of the survey team. One technician was available at all times by phone in case a technical problem arose. All the interviewers always carried a few paper questionnaires in case the lap-top crashed. Only one lap-top of the 80 in use crashed in the first survey, and was replaced by the vendor immediately. In the second survey two lap-tops crashed during interviews, and paper questionnaires were used that day. Possible crashes were planned for, so the crashed net-book was replaced within the day. In neither of the surveys were any data lost due to technical problems with the computers.

Screen readability presented a problem in the field, particularly in bright sunlight. After the first survey, feedback from the interviewers was that the font chosen for display was so small that they had difficulty in reading the screen. This was then improved in the second survey. Standard Blaise is flexible in altering the font size and characteristics for different part of the questionnaire, and increasing the font size helped to some extent. However, the Asus Eee-pc sub-notebook only has an 8' inch screen, and to increase the font size caused some questions to require more than one page to show all answer categories. The interviewers found this not only inconvenient during the field work, but were unsurprisingly also prone to forget the invisible answer categories.

Programming challenges

Due to the time limitations on the surveys, the Blaise data entry application had to be developed and tested in parallel with the development of the questionnaire. This required good organization and cooperation between the programmer and the questionnaire designer. After the first draft of the questionnaire was sent to the programmer, the questionnaire administrator started to log all subsequent changes. When part of the program was ready, it was given to all the team members every day for testing. In both surveys, when the questionnaire was finalized, the data entry system was ready for the training. Nevertheless, some errors were also found by the trainees during the training.

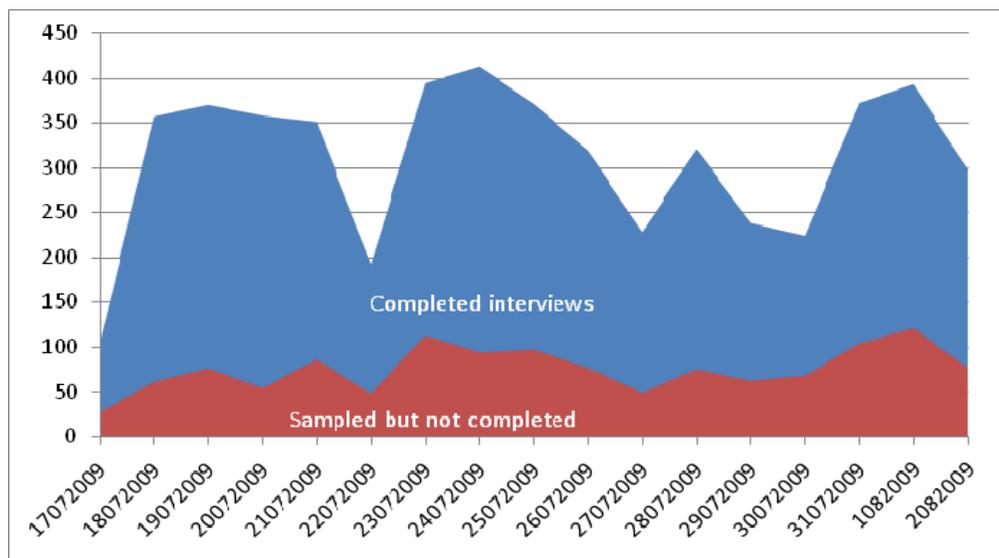
While one would like to have the CAPI program completely correct by the time the field period begins, it is likely that some bugs will show up during the actual field interviewing even with the most rigorous testing beforehand. This is of course also a sad fact of life as regards pencil-and-paper interviewing questionnaires. The possibility of correcting errors after the field period begins is relatively small with CAPI, but, not impossible. Fortunately, the errors are normally detected in the early stage of the field

work. When the field work started, the teams were sent to the same area in the first two days and they spent the first two nights in the same place, so that it was possible for the program to be updated when errors were found. In the first survey, a problem was only found on the first day of the field work and the program was modified and updated on all the 80 computers in the field. The strict rules that Blaise enforces for changing the data entry application when data have been entered are actually quite beneficial here, because it forces the data entry programmers to ensure that compatibility of data files are taken seriously and that changes are implemented in a controlled manner.

Mis-keying errors

Even with all the benefits CAPI has provided to improve the data quality, we found that the mis-keying errors during interviewing do exist and are not easily detected. As mentioned before, the Blaise data entry application made internal validity checks through the whole interviews. Some mis-keying problems can be partly solved when the out-of-range data or inconsistencies are detected. However, many mis-keying errors cannot be detected with internal validity checks, as they constitute logical answers. In PAPI surveys, such errors are also inevitable during field work and the data entry phase. Unfortunately, there is little data that can be used to compare the occurrence of mis-keying errors between CAPI and PAPI. However, with carefully designed data entry, such as double entry, it is possible to minimize the mis-keying errors during the data entry stage in PAPI surveys. Thus, while the CAPI method has the advantages of integrating several survey steps into one single activity, it also has its disadvantage of introducing more undetectable keying-errors during the field work. The second Sichuan survey used the same sample as the first survey, down to the household level, thus creating a panel. This made it possible to find out the mis-keying errors which were not easily detectable when just considering a single survey. The second survey in most respects followed the design of the previous survey. The questionnaire was changed somewhat, in that the questions that most directly related to the immediate consequences of the disaster was removed, and questions relating to the reconstruction were added. The exception for this was households living in camps, where a new sample was drawn. Camp inhabitants could not be followed from one survey to the next because some camps had not been established at the time of the first survey, and many of those that had been constructed had already been dismantled by the time of the second.

Figure 2 Field work in the Reconstruction Survey



The data from the rapid needs assessment survey and the following reconstruction survey indicated that the interviewers committed more mis-keying errors when they were under pressure. The first survey was carried out two months after the earthquake. To provide data following the government planning schedule, the first survey followed an extremely strict timeline. There were only six and a half days' for field work

before the initial report, with 75 percent of the data collected; and the team spent another three extra days after the initial report to finish the remaining interviews. In the first stage before the initial report, the team completed on average 365 interviews per day; and in the second stage, on average 304 interviews per day. In 2009, the second reconstruction survey took place July 17 to August 2, 2009. Figure 2 shows the field work progress for the second survey. With the same number of 80 interviewers, the team completed on average 243 interviews per day.

Partly due to the exceptional migration after the earthquake, and partly because the panel was not planned when the first survey was carried out, it was a challenge to revisit the households interviewed in the first survey. When the data from the two surveys were matched, household members' basic information was also manually checked to confirm the match. In all, 2030 households and 6433 people were matched. However, the inconsistencies of the household members' gender, age, residency status and etc. between the two surveys indicated that there were mis-keying errors during the field work. The mis-keys of age could not easily be corrected, while gender and residency status often could be corrected with the assistance of other information in the survey. People's name, relationship with household head and other information were combined to manually correct people's gender and residency status. When no information could support people's gender and residency status, random imputation was applied, but this was only used in a few cases. Around 90 cases (1.4%) were found to have mis-typed gender, and 86 cases (1.3%) have mis-typed residency status in the first survey; while (0.5%) mis-typed gender and 24 (0.4%) mis-typed residency status in the second survey. Apparently, there were more mis-keying errors in the first survey.

When interviewers have to concentrate on both interviewing and data entry, especially when they are under pressure (for example because of reluctant respondents), mis-keys are probably more frequent than with the traditional Pencil-and-Paper Interviews. Extra work in the program design had to be done in order to avoid errors.

Strategies for avoiding errors depend to some extent on how the interviewers use the computer. If the keyboard is used, then the mis-keys can probably be minimized by assigning values a bit farther away from each other for the questions such as gender or "yes/no" questions, i.e. assigning 0 and 1, instead of 1 and 2. If the mouse is used, increasing the font size and adding extra space between the answers may reduce the errors. Finally, auto-skip in Blaise is often used for the data entry with PAPI, so as to avoid extra typing. However, auto-skip with CAPI probably introduces more mis-keying errors, since interviewers have less chance to double check what was typed.

Mis-keying of large numbers

Apart from the general mis-keying errors, mis-keying of large numbers was found to be especially common and may seriously affect data quality. Normally, there is no easy way to identify such mis-keying errors, as long as the data are in the reasonable range. However, during training we found that the CAPI facilitated the test on the performance of the trainees, and helped pin-point the weak parts where most errors were found. We had a mock interview between the trainees and the trainer during training, and at the same time all the trainees were supposed to enter the interview into their computers. After the mock interview, all the data were gathered and analyzed. It took very little time to find out the performance of each interviewer and the common problems. One of them was the problem in entering large values correctly. A very high percent of the trainees have mistyped the values of income, fees and cost (table 1). It turned out that the errors were not only due to the mis-keys but also due to the misunderstanding of the reported unit. As table 1 indicates, the mis-keys are far from random – rather they introduce a definite downward bias for large numbers and an upward bias for small numbers. Furthermore, the mis-keys of the large values occur more frequently than other questions; and the outcome of the mis-keying affects the data much more seriously than other questions.

Table 1 Mis-keying errors found during the training¹

	Percentage of trainees who answered correctly	Correct answer (Yuan)	Mean of all the answers (Yuan)
Family business income	62.3 %	120,000	86,589
Living assistance from government	81.8 %	2,700	8,400
Personal income in the past one year	79.5 %	14,400	20,209
Annual salary in the past one year	77.6 %	120,000	99,342
Current monthly salary	96.1 %	10,000	9,776
School fee in the past one year	61.0 %	5,000	5,319

¹ The table was calculated based on 76 trainees

Although erroneous entry of large numbers is also a problem for many PAPI surveys, with CAPI surveys, extra safe guards may be added to reduce the impact. When the problem was identified during the interviewer training, the data entry system was revised, so that a warning box showed up after each such large value entered, and the large value was translated into values in Chinese character to be confirmed (for example, 10,000 was translated into ten thousand in Chinese). Although it adds extra work for the interviewers to double check the value they enter, it is worthwhile because it helps reduce the risk of mistyping.

Conclusion

Blaise turned out to be an effective tool for developing data entry applications rapidly for CAPI use in emergency settings. The CAPI approach eliminated the lag between field work and reporting. This was essential for the policy use of especially the first Sichuan survey. Net books served as an excellent platform as they are lighter than ordinary laptops and easier to use and more versatile than PDAs. The ease by which they can be programmed using standard data entry software such as Blaise was a major point in their favor.

The flexibility of the Blaise data entry programming language and the automatic handling of screen layout in the Blaise data entry module made concurrent questionnaire development and data entry programming possible. For ordinary surveys concurrent development is best avoided, but for time pressed settings, such as those of the first earthquake survey, it is unavoidable. Rather than be a hindrance, the strict version and type control on the data structure inherent in Blaise facilitated the rapid development.

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