# PROBLEMS, TRADE-OFFS, AND SOLUTIONS FOR CAPI SURVEYS

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## Introduction

Starting in the 1980's, many in the statistical community subscribed to a visionary Brave New World of automated data collection. Computers would create survey instruments and process accurate data better, faster, easier, and cheaper than pencil and paper methods. The growing body of experience with Computer Assisted Personal Interviewing (CAPI) is reassuring. For example, not only do respondents accept the computer, but some are more willing to answer sensitive questions, feeling their confidentiality is better protected. (Iverson, 1991)

On the other hand, computerization forces us to face problems with pencil and paper interviewing (PAPI) that have been glossed over in the past. Above all, we are learning that computerization impacts the skill needed by survey designers and that the transition costs of moving from PAPI to CAPI are both considerable and often inconvenient.

## CAPI Issues in Survey Design

Traditional practice in design of paper instruments has focused on the clarity and cognitive validity of the questions and the answer options. The options for handling item refusals, data editing, dealing with missing values, and specifying the data base layout could be deferred until the survey was in the field. On the other hand, there was an unavoidable lag time from finalizing content to fielding to allow for forms design, printing, and distribution of the printed instrument (and, perhaps, an accompanying field interview manual) to the interviewers. With CAPI, more design has to be completed in advance, but a finished and tested CAPI instrument is field-ready without futher machinations.

The greatest advantage of CAPI is its capacity for effective quality control. Skip patterns become automatic and error-free (after debugging). Range and consistency checks (where implemented) are always enforced. A valid entry can be required for (almost) every question, greatly reducing the missing data problem. This means that the quality of the collected CAPI data will be more consistently high than is possible by relying on the variable human performance of interviewers, however good they are.

Besides data quality control at the source, another indisputable benefit of CAPI is electronic transfer of data. It is faster to transfer all collected data directly from each interviewer to a central collection site each interview day.

The benefits of electronic transfer are irrefutable: no mailing, fewer people handling/delaying the data, no keying, improved confidentiality, automated inventorying and aggregation of case data at the central site, reduced storage requirements, and direct transition into automated data processing and cross-case data editing.

These quality and speed advantages come with several significant costs attached. One cost is the greater burden on front end survey design for CAPI. Skip patterns must be explicit for every possibility (including don't know, refused, or not applicable) and for every question or data entry blank. (Kinsey, 1994) Survey designers have been less than exhaustive in their logic, leaving some decisions to the interviewers or to data keying personnel.

Data edit design can no longer be deferred with impunity. The layout of the data base and the post-interview data processing requirements must be defined in greater detail and earlier for CAPI versus PAPI surveys.

"At present, software problems are the most common..." (Iverson, 1991) Some systems have limited capacity for backing up and changing answers. Some have limited ability to handle "rosters" (successive rounds of questions addressing each instance of a person or event for which similar information must be gathered.) Some are limited in total data capacity or in mode of question presentation or in flexibility to adjust to varying interview situations. Some look more like programming languages, and others look more English-like, but all require some understanding of computer logic.

There are also hidden impacts on the survey designers job. Traditionally, skip patterns have been defined as "go to" 's. ("If yes, continue; if no or don't know, skip

to question 13.") If computer programmers are involved in the CAPI implementation (and they usually are), the logic has to be translated. (Kinsey, 1994) Modern programming practice minimizes the use of GOTO commands. Their overuse results in "spaghetti" code, which is hard to comprehend, document, or debug. Instead, programmers want to state for each question the prerequisite requirements for asking that question. ("Ask question 10b, smoking-in-pregnancy, only for female respondents who have responded "yes" to the prior question on smoking history.")

This distinction is not trivial. If statisticians aim to design their instruments for ease of computer implementation, they have to learn a quite different pattern of questionnaire logic than they are used to. If they do not accept that challenge, and leave the logic translation to the programmers, then they face longer delays and longer test and debug periods.

Programmers can translate the draft "skip to" type logic to "ask only if" logic, but in doing so, they must interpret the survey designers intent. For complex surveys, it is virtually impossible that the programmers will make the intended interpretation in all cases.

In order for survey statisticians to verify that the CAPI instrument performs as desired in all cases, they must endure long periods of tedious, repetitive testing. They must exercise all logical paths for all questions sets. They must repeat the exercise of all logical paths for each respondent characteristic used in a check item, fill, edit, or skip pattern. Worst of all, for very large and complex instruments aimed at a broad range of respondents (like the general public), it appears impossible to define and carry out any systematic test scheme exhaustively. The mathematical possibilities are overwhelming.

As if that were not sufficiently daunting, there are also the problems of successive versions. During any round of testing by the statisticians, it is likely that the programmers are continuing to find and correct errors themselves and also improve the computer implementation for speed, user friendliness, and other features. They will also fix the problems identified by the statisticians in previous testing. Version control becomes very important here. Statisticians may find themselves performing extensive testing on the wrong computer versions. (Kinsey, 1994)

In successive rounds of testing, three phenomena tend to reduce the testing actually performed. First, the statisticians "burn out" eventually on retesting and re-retesting the same instrument. Second, they see a declining incidence rate of discernable errors. Thus, the instrument is eventually deemed to be at least "good enough", if not "apparently perfect." Finally, a date arrives when the interviewers must be trained on the instrument and the logistics of fielding have to commence. It is "fish or cut bait" time.

There is a trade-off between the amount of effort statisticians are willing to put into changing their work habits to prepare more readily computerizable instruments and the amount of testing and debugging they have to do. To the extent that statisticians indulge in the wishful thinking that survey computerization is "somebody else's" problem, thet have not made an effective transition from PAPI to CAPI.

If survey statisticians do make an appropriate transition to the CAPI environment, that can introduce yet another problem. With instrument modification being "merely" a matter of editing a computer program or some text files, the fixed lag between changing a questionnaire and getting it form-designed and printed "disappears." The smoother the working relationship between the statistician(s) and programmer(s), the more tempting it is to continue to modify the instrument closer and closer to the fielding date (or, at the limit, closer to the fielding time on the fielding date.) (Connent, 1994)

The problem can be further compounded in cases where a survey is in the field continuously. The front end work on the new CAPI instrument may conflict with the back end time on the previous PAPI round. The same statisticians may need to be screening, cleaning, editing, and analyzing the prior PAPI data at the same time they are supposed to be performing the intensified front end work on the forthcoming CAPI instrument.

## CAPI Issues in Field Implementation

The good news on electronic transfer is that we get the instrument into the field and the data out of the field faster than with manual methods. In bypassing the manual handling of the collected data, however; we also forego a traditional means of assessing the performance of interviewers. To some extent, this is appropriate and efficient. We no longer need to verify that they are following the correct skip patterns; that is now out of their control. Still, other problems may have stayed the same ("curbstoning") or even gotten worse (mistyping or miskeying).

Some new means must be found for the field supervisors to learn how their interviewers are

performing. Timeliness matters so as to detect and correct poor practices before too much data is corrupted or lost.

There must be plans for completing interviews where the computer cannot be plugged in. The computers must have sufficient battery life; there must be a paper backup; or the loss of those interviews must be acceptable. There must be plans for replacing equipment in cases of malfunction. There must be plans for backing up data from the hard disks to floppies and for control and recycling of the floppy disks.

Severe problems may arise regarding "response rates." Where the PAPI interviews are very long, there is a danger that interviews may be refused if the respondent suspects how much time would be demanded.

This leads interviewers to avoid defining that time demand in advance. Instead, they try simply to get started and then look for signs of impending breakoff. If they sense a potential breakoff, they try to get as much data as they can - perhaps in a personal shorthand notation or using ditto marks for successive roster levels. They then "edit" (and complete) the paper form at their home or hotel room.

Done judiciously, this can result in maximum collection of valid and accurate data. Overdone, it can be a form of "curbstoning", making up data rather than getting it from the intended respondent(s).

Such situations create special problems in a transition to CAPI. If the CAPI instrument uses full quality control, it precludes expediting the interview. That can result in collecting less data than on PAPI for some interviews. Thus, although CAPI avoids missing single questions, it could result in more missing data due to more breakoffs before the survey is completed.

CAPI interviews are not necessarily longer than PAPI interviews. After all, interviewers do not have to flip back through pages to determine answers to check items so as to resolve complex skip patterns. Some CAPI systems allow the interviewer a degree of manual control such that in case of impending breakoff the interviewer can concentrate on completing the most important sections or roster levels. There is some experience indicating that interviewers can cover CAPI instruments as fast or faster than the same instruments in PAPI - after they have developed the requisite familiarity and skill. (Baker, 1991)

The problem here is that survey statisticians have two conflicting goals. They want all interviews to be conducted with absolute consistency, precisely following a predefined protocol and collecting all required data in turn. But they also want all the interviews they can get. As long as instruments are on PAPI, it is possible to avoid seeing the conflict and leave resolution of the sticky situations to the ingenuity of the interviewers. Where CAPI increases the rigidity of the interviewing protocol, the risks of missing chunks of data and lowering response rates increase as well. Now the survey statistician has to assess those risks and make the decisions before going into the field.

Part of the problem, of course, lies in the definition of "response rates." When we count minimally completed interviews as responses, our rates overstate the value of the data collected. Conversely, if we were only to count totally completed interviews as responses, we would understate the value. A "true" measure of the data value would have to take into account the topical content of the data foregone relative to that collected in a partial interview, and also the relative values of those types of data to the users of the data set.

The problem is tending to get worse, not better. With computers taking over the processing of skip patterns (and difficult fills), statisticians can design increasingly complex surveys. Technical enhancements such as ACASI (audio computer assisted self interviewing), which can be conveniently combined with CAPI for sensitive topic interviewing (Iverson, 1991; Kinsey, 1994), expand the range of feasible data gathering. Increasing attempts to improve social equity, such as the Americans with Disabilities Act and health care reform, increase the needs for complex sets of data. Thus, health surveys are tending to get progressively larger and more complicated. This, combined with more rigid enforcement of interviewing protocols (via CAPI or otherwise), increases the potential for outright refusals or partial interviews.

Costs of PAPI-CAPI Transition

Claims that CAPI would be cheaper than PAPI, especially for ongoing PAPI surveys, are true only under special conditions. This is most likely to be true when the computers to be used are available at little or no cost, and the interviewers already know how to use them. In most cases one faces the added cost of the computers, along with their added training and logistics costs. Granted, one avoids the costs of postage, of keying, and of some editing of large amounts of data, and of storing what may be large numbers of awkwardly sized paper forms. Still, the introductory

costs have proven burdensome or prohibitive for some large surveys where the quality and speed advantages of CAPI are readily accepted. (ICCM, 1994.)

CAPI operating costs may well be less than PAPI costs after the transition is complete. For some complex surveys, even the transition costs may be amortized over a few years of CAPI data collection, resulting in a lower net cost of CAPI than PAPI.

For continuing surveys such as the National Health Interview Survey, the high back end costs of the PAPI survey must be confronted concurrently with the high front end costs of the CAPI introduction. That creates a peak cost of transition. This peak cost is especially difficult to meet while attempting to downsize government and reduce budget deficits. Given that government accounting is largely on a cash, rather than accrual basis, there is no credit for amortizing transition costs.

Also, if CAPI surveys are evaluated as having greater risk of refusals or partial interviews, and if that risk is compensated by increasing the sample sizes, then the differential costs of the larger sample are properly attributed to CAPI.

Conclusion

In view of the arguments presented in this paper, the author concludes that CAPI can be justified only on the basis of higher data quality and faster processing from collection to final release. Following transition, it is reasonable to expect operating costs (but not necessarily total net costs) to be less than PAPI. These benefits must be weighed against generally greater costs and also the risks of lowered response rates and more partial interviews for large, complex surveys.

Thus, transition from PAPI to CAPI requires a leap of faith. A survey manager has to identify suitable technology, realize the impacts on survey designers and field staff, cover the costs of transition, and accept the risks involved. That manager then has to decide that the better data quality and the faster processing to release are worth the downside. Generally, experience is showing that they are.

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