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COMPUTER ASSISTED TELEPHONE INTERVIEWING

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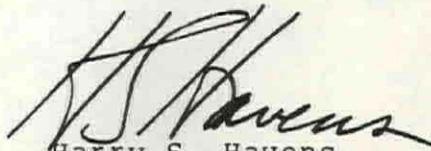
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One line of effort of the Evaluation Guidelines and Methodology issue area is identifying and developing methods to improve the conduct of Federal evaluation studies. This involves among other tasks, conducting studies which focus on an identified need and potential methods to satisfy it. Much of the value of these studies lies in their survey nature, i.e., spend enough time examining an evaluation methodology, or approach, so that a decision about its utility can be based on something more than an educated guess.

This document, a product of just such a survey of methodology, identifies a potentially useful "off-the-shelf" method available for use by GAO. It presents an overview of computer assisted telephone interviewing (CATI), a technique we identified during our more general examination of survey methods. Application of the CATI methodology may afford GAO some benefits in timeliness and data reliability. We feel the potential is sufficiently high to warrant distribution of this overview document as an internal report to the professional staff.

Due to time constraints we could not interview officials of all current organizations using CATI. The organizations mentioned by name in this report are only intended to be examples of CATI capabilities available at universities and commercial research firms. Their mention is not intended as an endorsement.

We invite your comments and encourage you to bring to our attention any promising methods and approaches you have applied and/or see as potentially useful for GAO.



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CHAPTER 1

INTRODUCTION

Computer assisted telephone interviewing (CATI), an interesting and innovative telephone interviewing technique, places under computer control some survey elements usually controlled by the interviewer. Basically, the survey questionnaire is stored in a sophisticated computer system, questions are displayed on a cathode ray tube (CRT) screen connected to the computer, and responses are directly entered into the computer.

Before providing (1) a general description of the CATI technique, (2) a detailed description of present and proposed CATI use by survey organizations, and (3) an analysis of the feasibility of adapting CATI to GAO, the reader should have a brief background of survey methods and CATI's role in survey methodology.

CATI is one form of telephone interviewing. Telephone interviewing, in turn, is just one of several survey data collection methods. For example, GAO auditors can use personal interviews, mail interviews, and telephone interviews. As Table 1 indicates, each method has its own advantages and disadvantages.

Personal interviews are useful if observation, additional questioning (probes), or visual aids are an integral part of the survey design. A long or complicated interview may also justify personal interviews. Unique characteristics of the respondent population may require personal interviews. For example, one GAO survey at the White Mountain Apache Indian Reservation had to be presented by an Apache who could interpret and explain the question to the respondent.

On the other hand, if the response is needed quickly, cost is an important factor, the number of respondents is very large, or the respondent sample is geographically widespread, alternatives to the personal interviewing method may be appropriate.

Correspondingly, mail interviews can give wide distribution for a large number of respondents at a minimum cost since no field staff is needed, no interviewer training is required, and additional data collection (follow-up) costs are relatively low. Mail interviewing also eliminates interviewer bias.

Table 1

Some Relative Merits
of Survey Methods

	Personal Interviews	Mail Interviews	Telephone Interviews
Advantages	<ol style="list-style-type: none"> 1. Probes and visual aids easily used 2. Complex, more difficult and time consuming surveys can be conducted 3. Identity of respondent known 4. Highest potential response rate 	<ol style="list-style-type: none"> 1. Least expensive 2. No interviewer bias 3. Wider distribution of sample possible 4. Easy to implement/easy to follow-up 	<ol style="list-style-type: none"> 1. Control of interviewer bias easier 2. Fastest Method 3. Simple follow-ups 4. Easy to design
Disadvantages	<ol style="list-style-type: none"> 1. Most expensive 2. Time consuming 3. Interviewer supervision difficult 4. Difficult to implement 	<ol style="list-style-type: none"> 1. Lack assurance of respondent identity 2. Most time consuming 3. Nonresponse bias problems (for non-GAO surveys) 4. Difficult to design 	<ol style="list-style-type: none"> 1. Probes difficult 2. Non-telephone owners 3. Unlisted/unpublished and multiple numbers 4. Limitations on scope and complexity

However, mail interviewing may have a long turnaround time (the time between mailing the questionnaire and receiving the completed document). Nonresponse bias (the bias introduced by failure to get all questionnaires adequately completed and returned) and the fact that we are not always certain someone other than the intended respondent did not complete the questionnaire are two additional shortcomings of mail interviewing that should be considered in deciding on a survey method. GAO mail surveys, however, generally have high response rates, minimizing nonresponse bias.

Telephone interviewing, long held in disregard, is now becoming a more widely accepted data collection technique for several reasons. Rising survey costs, more precise telephone survey methodology, and a larger percentage of the population owning telephones makes this method more attractive. But, telephone interviewing is still not problem free.

Telephone interview costs generally fall somewhere between the lower mail survey and the higher personal interviewing costs. Also, depending on the size of the sample, the number of interviewers available, the number of questions, and question complexity, telephone surveys can be completed quickly.

Theoretically, this method not only allows the highest supervisory control level, but also the interviewer can be reasonably sure of the respondent identity, and probes can be used.

However, some experts feel that this method has several serious shortcomings. They argue that the universe or population from which samples are drawn is incomplete since not everyone owns a telephone. Further, if the telephone directory is used to draw a sample, there exists the problem of outdated directories and unlisted/unpublished numbers. Certain geographic areas or demographic classes of individuals are more likely to either not own a telephone or have an unlisted/unpublished number. Failure to account for these measures increases the study error. They also argue that telephone interviews must generally be short (about a 20 minute maximum).

Other experts contend that new survey methodology and techniques help minimize, if not eliminate, some of these problems. They also cite examples of telephone studies involving successful interviews of an hour or more.

CHAPTER 2

COMPUTER ASSISTED TELEPHONE INTERVIEWING (CATI) CAN SAVE TIME AND INCREASE DATA RELIABILITY

The CATI survey method, now in its formative stages, is thought by some to be the "way of the future" in data collection for certain purposes. CATI can assist in designing survey instruments, administering sampling, supervising interviews, improving interviewing capabilities and control, coding, and processing data. These features facilitate speedy data collection, enable more complex telephone interviews, impose a more stringent quality control level, and increase data reliability. Appendix I lists several features generally available in a CATI system. Although each CATI feature mentioned is currently available, a given survey organization's CATI system may not encompass them all.

CATI FACILITATES SPEEDY DATA COLLECTION

CATI can facilitate rapid data collection by either shortening or eliminating some conventional telephone interviewing steps. CATI computerizes sample selection, increases the number of interviews an interviewer can conduct during any given time period, immediately enters response codes, computerizes follow-up procedures, and requires less data verification.

Telephone interviews commonly employ random digit dialing samples. This involves randomly selecting sample telephone numbers from all theoretically available telephone numbers in a geographic area to minimize the effect of unlisted/unpublished telephone numbers and obsolete telephone directories. CATI not only handles random digit dialing processes very efficiently, but also can be used with samples selected by other methods.

The CATI system can select a series of randomly selected telephone numbers and show them one at a time on the computer display. The interviewer can then dial these numbers and conduct the interviews. Further, once non-assigned telephone number banks or banks assigned to categories outside the study's scope are identified, the computer can eliminate them from further selection consideration. Also, if several characteristics (e.g., area codes) are in the sample, CATI can use these criteria to

schedule calls. This is helpful in studies that include more than one time zone. For instance, if the study was being performed in Washington, D.C., the computer could select a sample from each geographic area but schedule West Coast interviews for later in the day.

Similarly, complex systems of follow-up calls can be scheduled by the computer system. A follow-up is an additional attempt to contact a potential respondent who was unavailable during previous calls. CATI systems can record times and dates of unanswered or unsuccessful calls and can assign a complex follow-up schedule. For example, if the first call is unsuccessful, the system may schedule follow-up calls at a different time of the day and/or a different day of the week. A major beneficial aspect of CATI is that it can reschedule and keep track of a large number of follow-ups quickly, efficiently, and inexpensively.

Another beneficial CATI aspect is that it eliminates some related paperwork and clerical duties and thus frees the interviewer to concentrate solely on the interview. This makes it possible for an interviewer to complete more interviews during any given time period than is possible using conventional telephone interviewing techniques.

A separate step to keypunch questionnaire responses is eliminated by CATI. The CATI system requires the interviewer to key each answer into the computer as soon as the respondent answers the question. Once an acceptable answer is keyed into the machine, the next question is displayed and the interview continues. Since CATI can immediately notify the interviewer of answers outside the feasible range and since the answers are keyed into the computer progressively in a stepwise fashion, higher accuracy is assured and less data verification is needed.

CATI QUESTIONNAIRES CAN BE MORE COMPLEX

Survey researchers define a "branch" or "skip" pattern as a combination of a controlling question and one or more subsequent dependent questions. More simply, this involves asking the controlling question and then, depending upon the answer, asking one or more different questions. The control question could ask the respondent's age. Then, depending on the answer, the interview "skips" or "branches" to another set of questions. For example, if the respondent is less than 20 years old, the interviewer would ask a series of questions relevant to teenage issues. If the

respondent is over 65 years old, questions on medical care of the elderly would be asked. If the respondent's age falls somewhere between these categories, another set of questions would be asked.

Critics argue that conventional telephone interviews must be restrictively simple. They believe that dependent questions must closely follow control questions. They feel that this limits the complexity level. They argue that very complex questionnaires are too difficult for interviewers to follow accurately and quickly. CATI can reduce this complexity somewhat by automatically performing the "skip" operations for the interviewer. The CATI system automatically branches to the dependent question as soon as the control question response is coded into the computer. The interviewer, then, sees only the appropriate dependent question, rather than having to search the entire questionnaire for the appropriate question to ask. Also, the dependent questions need not be physically located near the control questions in the computer program. Therefore, much more complicated questionnaire design and use is possible.

Another CATI feature is cross-indexing responses. CATI allows early answers to be used when asking subsequent questions. For example, the first question could be "What State do you live in?" The answer may be "Montana" and a later question could automatically be displayed to read "Do you consider Montana's tax structure equitable?"

CATI IMPROVES QUALITY CONTROL

CATI improves telephone survey quality control by giving increased structure to the interviewing process. It does this by making physical supervision easier, assuring consistent questioning, and providing data coding checks.

CATI interviews (similar to most conventional telephone interviews) are usually conducted from a central interviewing room. The supervisor can easily monitor all interviewers' work. In a CATI system the supervisor can quickly discern the question the interviewer is asking and check the interviewer coding simply by watching the computer display screen while listening to the interviewer.

Since the computer displays identical questions to all interviewers, this helps assure that all questions are asked similarly by all interviewers. As mentioned earlier, this capability also assures that the proper questions are asked (proper branching is followed) and

eliminates the possibility of an interviewer forgetting to ask one or more questions.

Data coding checks are an important CATI quality control feature. Data coding checks are computer verification that all coded responses are within the feasible response range. CATI notifies the interviewer of coding errors. For instance, if a question's range of feasible codes is all whole numbers between and including 1 and 6, and if an interviewer codes the answer as 7, the computer will automatically notify the interviewer that 7 is an invalid code.

This procedure is also helpful when a question is subdivided into different categories where the total of all categories should equal a certain figure, such as 100 percent. For example, if a question has three parts whose sum should total 100 percent and the three responses are 43 percent, 21 percent, and 37 percent, CATI will instantly notify the interviewer that the total does not equal 100 percent. Additionally, it will instruct that the question should be asked again.

CATI HELPS PRODUCE RELIABLE DATA

Data reliability is defined as the ability to reproduce the results of a data collection effort. Data reliability, rather than being a separate category, is directly linked to many of the points made when speed, complexity, and quality control were discussed.

CATI improves data reliability by facilitating more consistent sampling and follow-up procedures, by eliminating separate keypunch requirements, by providing data coding checks, by assuring that questionnaires are more complete, by assuring that all interviewers use and convey the same questions, and by facilitating easier supervision.

Additionally, the time of response is available as a measure when CATI is used. Each interview and follow-up is coded with the time and date. Therefore, response patterns can be traced over time. This may be useful in determining if late or hard to contact respondents' answers differ significantly from interviews completed earlier. In effect, a time series relationship can be developed.

CATI can provide daily or periodic tabulations of some basic frequencies or statistics on all or some questions. This feature can identify, early in the study, any questions that cause serious study design problems.

For example, there may be some questions that no or very few respondents are answering or that respondents are answering inadequately. If these problems are identified early in the study, the situation may be rectified.

CATI IS AN IMPROVEMENT
BUT IS NOT A PANACEA

Since CATI is still in its formative stages, any given CATI system may not incorporate all the features mentioned. Each individual CATI system must be examined and trade-offs analyzed. For example, a CATI system that incorporates rapid programming of the questionnaire may do so by eliminating some data coding checks or cross-indexing features.

Since CATI is relatively new, novel problems may arise. Of course, once CATI is operational for a longer period of time, most of these problems will have been encountered and solved. The survey researcher must use professional judgment to decide if CATI use is justified for an individual study. The advantages and disadvantages must be carefully weighed.

CHAPTER 3

ORGANIZATIONS THAT ARE DEVELOPING OR HAVE CATI CAPABILITIES

Several organizations have capabilities for rapid collection of information using a CATI system. We examined

- the capabilities (and one-time effort using a CATI system to assist in estimating the prevalence of disability among California working age adults) of the Survey Research Center, University of California, Berkeley;
- the CATI capabilities (and some recent contracts with the Federal Government) of the Chilton Research Service;
- the proposed system of the Bureau of the Census, Department of Commerce; and
- the plans for CATI implementation of the Survey Research Center, University of Michigan.

SURVEY RESEARCH CENTER UNIVERSITY OF CALIFORNIA, BERKELEY

The Survey Research Center is the principal campus facility for survey research at the University of California, Berkeley. The Center maintains professional staff and resources necessary to conduct surveys and assist in all phases of the research process--from study design to analysis.

The Center has conducted studies for governmental and nonprofit agencies in such areas as health care, education, criminal justice, energy, and the environment. The National Science Foundation, U.S. Forest Service, and the Department of Housing and Urban Development were some of the Center's clients.

During the past year, the Center has devoted considerable effort toward developing a CATI system. Since most of the CATI development work was focused on its first assignment--to conduct the California Survey of the Disabled--the discussion of the Center's capabilities and experiences with CATI will be directly related to this study.

CATI Features Used
By The Survey Research Center

While some of the capabilities of the Center's CATI system may be general or common features, others make this CATI system unique to Berkeley.

In order to conduct the "Disability Study," the Center joined with UCLA's Institute for Social Science Research in developing the CATI system. Once the initial CATI system was operational, joint survey efforts were conducted from both sites, one at Berkeley and the other at UCLA. The CATI programs were programmed on dedicated minicomputers with Berkeley having 8 of a total 22 interviewing CRT terminals. Each site had a separate supervisors' room which contained a bank of monitors that reproduced the screen of each interviewing CRT terminal. Accompanying each monitor was a telephone that provided the supervisor the capability of listening to the interview while observing the monitor.

The objectives of the "Disability Study" were to estimate the prevalence of disability among working age adults in California's household population and in each of its 26 Rehabilitation Districts, as well as to describe the characteristics of the disabled population. This necessitated contacting a large number of households. CATI proved very useful for this purpose. For this survey, a cross-sectional household design was developed with a proportionately stratified sample of telephone households. A list of primary and secondary telephone numbers was developed, using a random digit dialing technique. From this list more than 70,000 numbers were dialed during the survey, counting nonworking and nonresidential telephone numbers. This resulted in contacts with 30,000 households that included over 54,000 individuals. Peak production during the survey efforts amounted to about 1,750 completed interviews per week. This was a large effort made more manageable by CATI.

CATI was instrumental in maintaining complex schedules for the telephone calls. The time for calling telephone numbers was rotated through eight different time periods such as early morning, late morning, and early evening. CATI also maintained reserve telephone number listings in order to keep the interviewers busy (in order to avoid lulls in the work level). Another scheduling feature specific to Berkeley's CATI system is that it allows interviewers to schedule callbacks within 60 minutes for unanswered calls and within 30 minutes for busy numbers rather than immediately assigning the numbers to a predetermined callback schedule. If the second calls are unsuccessful, then the numbers go back to the initial scheduling scheme.

The survey used four types of interviewers: trainee, regular, refusal converter, and Spanish speaking. The last category of interviewers is most interesting, since the CATI system had the capability of switching immediately from English to Spanish versions of the questionnaire whenever necessary. This unique CATI feature proved especially desirable since California contains a relatively large Spanish speaking population.

The actual survey questionnaire used was long (58 pages containing between 200 and 300 individual questions) and complex (involving numerous "branches" or "skip" patterns). CATI helped shorten the response time by automatically performing the "branch" operations. This feature, by simplifying the interviewers' job, allowed interviews with a disabled person to be completed in about 25 minutes.

Berkeley's CATI system prepared reports on each telephone number by date, time, interviewer, results, and any interviewer notes. These reports were sent to the supervisors. The system also identified for the supervisors numbers that reached preset limits for refusals; language problems, other than the ones programmed; no answer numbers; and busy numbers. Then, the supervisor decided whether or not to restart the calling sequence by increasing the preset limits.

Advantages and Disadvantages

Berkeley gained valuable experience in both the development and implementation of CATI during this project. Some advantages of CATI have already been mentioned; CATI can specify telephone number lists, schedule initial calls, schedule call backs, facilitate bilingual questioning, efficiently handle "branching" sequences, and produce detailed records by phone number.

Possibly one of the most encouraging signs was that most interviewers preferred the CATI system over pencil and paper telephone interviews. The main feature that the telephone interviewers preferred was CATI's method of handling questions branching, since it freed the interviewers from cumbersome paperwork and editing. A few interviewers felt that CATI allowed them to concentrate more on the respondent, thus enabling them to establish better rapport.

Berkeley's experience with CATI, however, demonstrates that this method can encounter problems. First, it took about eight months of intensive work by three senior staff and several assistants to design, program, and debug the CATI system. Berkeley considered this a disadvantage since it covered a period longer than expected.

Some interviewer problems also occurred. It took 80 to 90 hours of training spread over 3 weeks before an interviewer was ready for fieldwork. This was longer than Berkeley had anticipated. Moreover, some interviewers, both experienced and trainees, were either unable to learn or unwilling to accept CATI. Those interviewers did not continue with the study. Of those interviewers staying with the study, experienced interviewers were more frustrated by the CATI experience. However, this may be due to their being assigned more difficult tasks, such as refusal converter (an interviewer who attempts to convince a potential respondent to cooperate who has already declined to participate in the study).

Due to the new nature of the CATI technology, diagnosing malfunctions was very difficult. It was often difficult to distinguish between programming and interviewer errors.

Possibly the most serious limitation was that the CATI system did not have the capabilities of providing tabulations, various summary totals, or other structural presentations describing the survey results.

During their study, the University of California, Berkeley gained some valuable, albeit expensive, experience. They are further developing their CATI system and are continuing with CATI survey efforts. They are convinced that CATI surveys have a definite place in their future research efforts.

CHILTON RESEARCH SERVICES

Chilton Research Services is a Pennsylvania based commercial firm that conducts survey research. We chose to speak about Chilton because it is generally agreed that they were the initial developer of the first operational CATI system. Some historical background may help the reader better understand CATI.

By 1972, as a culmination of several years of basic research by Chilton for AT&T, an early CATI system had been developed and was operational. Three basic steps led to this result.

Initially, hard copy questionnaires were used where the interviewer recorded the survey results on printed questionnaires. These questionnaires were then edited, keypunched, and corrected. The average completion rate reported by Chilton for this method was about four interviews per hour.

The next step employed optically read cards where the interviewer entered the responses on a card that could be machine read. The questionnaire was printed on a "wheel-like" device that was rotated over the computer card. These cards were read into a minicomputer and the data converted to tape. The average completion rate using this method was about five interviews per hour.

The third step actually involved programming the questionnaire into the computer, displaying it on the CRT screen, and recording the responses directly into the computer while the interviewer was on the phone with the respondent. This was a CATI system. Its average completion rate was about eight interviews per hour, equal to twice the number of hard copy questionnaires that could be produced in the same time period.

Chilton has continued to refine and develop the CATI process, as have many other public and private CATI organizations. Present CATI systems are much more sophisticated than the basic system introduced by Chilton in 1972.

To better give an example of the usefulness and flexibility of CATI, we have selected three studies done by Chilton for different Federal agencies. One study contracted with Chilton for data collection only, another for data collection and analysis, and the third for all three phases of the survey: design, data collection, and data analysis.

In December 1977, an emergency task force, composed of representatives from the Food and Drug Administration (FDA), the National Institutes of Health, the Center for Disease Control (CDC), and the National Center for Health Statistics was formed to investigate a number of sudden deaths. These deaths were reported among young and middle-aged women who had been using protein products in strict dieting programs. As of July 1978, 58 deaths were associated with very low-calorie protein diets.

Due to the seriousness of the problem, FDA and CDC undertook a survey. Realizing that they needed quick, accurate information from a large sample, FDA contracted with Chilton Research Service to collect the data using the CATI approach.

A sample size of 13,900 telephone households was drawn. However, inspection of tabulations for certain survey items indicated that the size of the sample had to be increased to improve data precision by racial group. An additional 5,360 households were added to the sample, bringing the total

number of households to 19,260. Screened telephone interviews were conducted between March 9 and April 15, 1978, which resulted in 6,616 qualified females.

FDA and CDC provided the survey instrument for the study. Chilton conducted the telephone interviews, performed a follow-up study of nonresponse bias, calculated response weights for data projection purposes, and prepared edited computer tapes for FDA. Data tabulations and statistical analysis were conducted by FDA. The cost to FDA for Chilton's participation in this study was about \$44,500. An FDA official told us that FDA's news releases based on these survey results, produced drastic reductions in the use of liquid protein.

The National Institute of Education (NIE) currently has a contract with Chilton to conduct a study on cigarette smoking among teenagers. Chilton is involved in both the data collection and analysis phases of this study. CATI is particularly useful here because, among other factors, each telephone call must initially screen the respondents to select those 12 to 19 years of age, new variables must be immediately calculated by combining tar and nicotine data stored in the computer with answers given by the respondent during the interview, and the questionnaire is fairly complex (with over 20 separate "branch" or "skip" operations).

NIE's contract calls for a total of 5600 hours of telephone interviewing with an approximate sample size of 2600 (with an optional 370 additional interviews with 19 year-olds). The analysis will consist of basic cross tabulations of the 1978-1979 data, as well as correlation techniques and discriminant function analysis on a retrospective 1974 sample with similar attitudes and demographic characteristics in order to predict 1978-1979 levels. The total cost to NIE will be about \$211,000.

The third example is a study under contract to the Consumer Product Safety Commission (CPSC) in which Chilton is involved in all phases of the survey--design, data collection, and analysis. This study has a sample size of about 3000 consisting of three categories:

- (1) households with 1 child under 5 years old,
- (2) households with the household head over 65 or handicapped, and
- (3) other selected demographic breakdowns.

This study examines the safety and effectiveness of crib design and child resistant containers. Due to the many screening questions, need to access either of two versions of the questionnaire, and the overall questionnaire complexity, CATI was a logical choice. For its participation in all phases of this study, Chilton's contract award is about \$108,000.

This section has attempted to use Chilton's experiences to give the reader a better understanding of CATI's development, capabilities, uses, and costs. Again, this is only an example. Any GAO surveys proposing contracts with CATI organizations must ensure that fully competitive bidding procedures are followed. Further, the cost figures stated in the above section are only applicable to those individual studies. Cost estimates for other studies will vary, depending on such factors as sample size, question complexity, overall questionnaire complexity, respondent characteristics, the time available for the study, etc.

BUREAU OF THE CENSUS
DEPARTMENT OF COMMERCE

During our identification efforts for methods that may be used for rapid collection purposes, we were informed by a Bureau official that the Bureau was planning to develop a computer assisted telephone interviewing system. This includes moving forward with the purchase of a minicomputer.

The official expects that when the CATI system becomes operational in the Bureau's 12 regional offices, it will be used in the full range of surveys. This would mean that 40 to 60 CRT interviewers would be needed with one or more dedicated minicomputers in each regional office. The official further stated that once they have the initial minicomputer on site, there will be 6 to 12 months of research before the Bureau advances to the regional office stage of their CATI efforts.

In its continuing efforts to assess the capabilities of CATI, the Bureau of the Census conducted a test of CATI in August 1977. The Bureau used the facilities located at the University of California, Los Angeles. The test was conducted in four counties in the State of California and 690 respondents were selected for interviews. Bureau personnel conducted the survey using the Current Population Survey questionnaire. Some of the preliminary findings were:

--The interviewers stated that the CATI system took care of many of the details and that they could pay

more attention to what the respondent was saying and thus conduct smoother interviews.

- The interviewers stated that they enjoyed face-to-face contacts more than telephone interviews.
- The computer system proved to be extremely reliable.
- The response rates for the Current Population Survey and the CATI test appeared similar.

Although the data collected by the test would not be published, procedures were developed to process it. Edits were integrated into the computerized survey instrument so that inconsistent or incomplete answers could be detected and corrected during the interview. At the end of each day, data was processed through a series of computer programs in the following manner:

- Each telephone number was classified according to whether the interview was complete, partially complete, or if no contact had been made. Counts were produced for each of the categories.
- Incomplete cases were prepared for follow-up calls.
- Data was reformatted to prepare it for tabulation.
- Tabulations were produced for most of the data.

The Bureau, with assistance from UCLA is taking extra care and effort examining the most effective ways to produce data tabulations, summary totals, and report presentations.

SURVEY RESEARCH CENTER
UNIVERSITY OF MICHIGAN

The Survey Research Center (SRC), University of Michigan, a relative newcomer to CATI research, has two main goals for its developing CATI system. The first goal, which they have already accomplished, is to have their basic CATI system operational by January 1, 1979. Second, they hope to develop a more universal CATI system in which no special features have to be tailored to any individual study.

SRC, aware of problems other organizations have been having programming the questionnaire and producing desired data tabulations, is placing special emphasis on designing a system whereby (1) the questionnaire can be entered in the computer as quickly as a hardcopy questionnaire could

be produced and (2) periodic data tabulations can be produced quickly and inexpensively.

SRC currently has two major CATI studies planned. In the Spring of 1979, they will perform a CATI study for the National Science Foundation. This study will be followed in the late Spring or early Summer by a study performed for the National Center for Health Statistics (NCHS). The NCHS study is designed to compare CATI, conventional hard-copy telephone interviews, and personal interviews.

Although SRC's CATI system is still in the development and testing phase, upon completion it may be more efficient than current CATI systems. An official of another CATI research organization told us that it was his opinion that when fully developed the SRC CATI system will be the most advanced system by far.

CHAPTER 4

SHOULD GAO USE CATI?

Cooperative CATI projects are defined as studies produced by GAO working in cooperation with a survey research organization. This would involve using the survey research organization's CATI system, rather than GAO establishing its own in-house CATI capabilities. Contracts or purchase orders for the services of the CATI organization would be necessary.

Cooperative CATI projects may be advisable if, for example, time constraints dictate the need for rapid data collection. CATI amplifies the advantages of telephone interviews. GAO may also want to participate in CATI projects in order to gain experience working with a CATI system or to perform parallel (or comparative) studies.

CATI MAY BE THE MOST COST-EFFECTIVE METHOD

Once it is determined that CATI may be an appropriate method, CATI costs must be carefully examined. Each assignment must be examined on a case-by-case basis since costs can vary depending on sample size, questionnaire complexity, programming requirements, required response rate, expected analyses to be performed, and many other factors. CATI cost should be carefully and completely discussed with the CATI survey organization.

GAO may design its own data collection instrument and perform its own analysis for most cooperative projects. GAO would rely on the CATI organization for data collection only. The FDA/Chilton cooperative study described in Chapter 3 most resembles a probable GAO cooperative arrangement. The FDA/Chilton study conducted 6600 interviews at a cost of approximately \$44,500. GAO mail survey data collection would generally be considerably less expensive than CATI methods. However, mail interview cost savings must be balanced against the CATI time savings and CATI's somewhat greater quality control and data reliability. Therefore, even if mail interviews have lower direct or measurable costs, CATI may still be the optimal survey method depending upon the implicit value assigned to the time saved and the increased study reliability.

The time required for a study is dependent on many factors. The length of the interviewer's work day, the length and complexity of the interview document, the place where the potential respondents will be called (work or home), and the anticipated number of screening calls necessary to reach qualified respondents, are just some of these factors. However, a very rough estimate of the range of time necessary can be derived.

The additional cost of interviewers would have to be balanced against the time savings due to the use of CATI. The following graph deals with the time elapsed during data collection only. It does not address the time required for questionnaire design and programming or analysis.

The amount of time required to complete mail interviews is generally invariant to the sample size. Mail interview data collection usually takes between six to eight weeks, as indicated by the shaded section of the graph, no matter how many mail questionnaires are distributed.

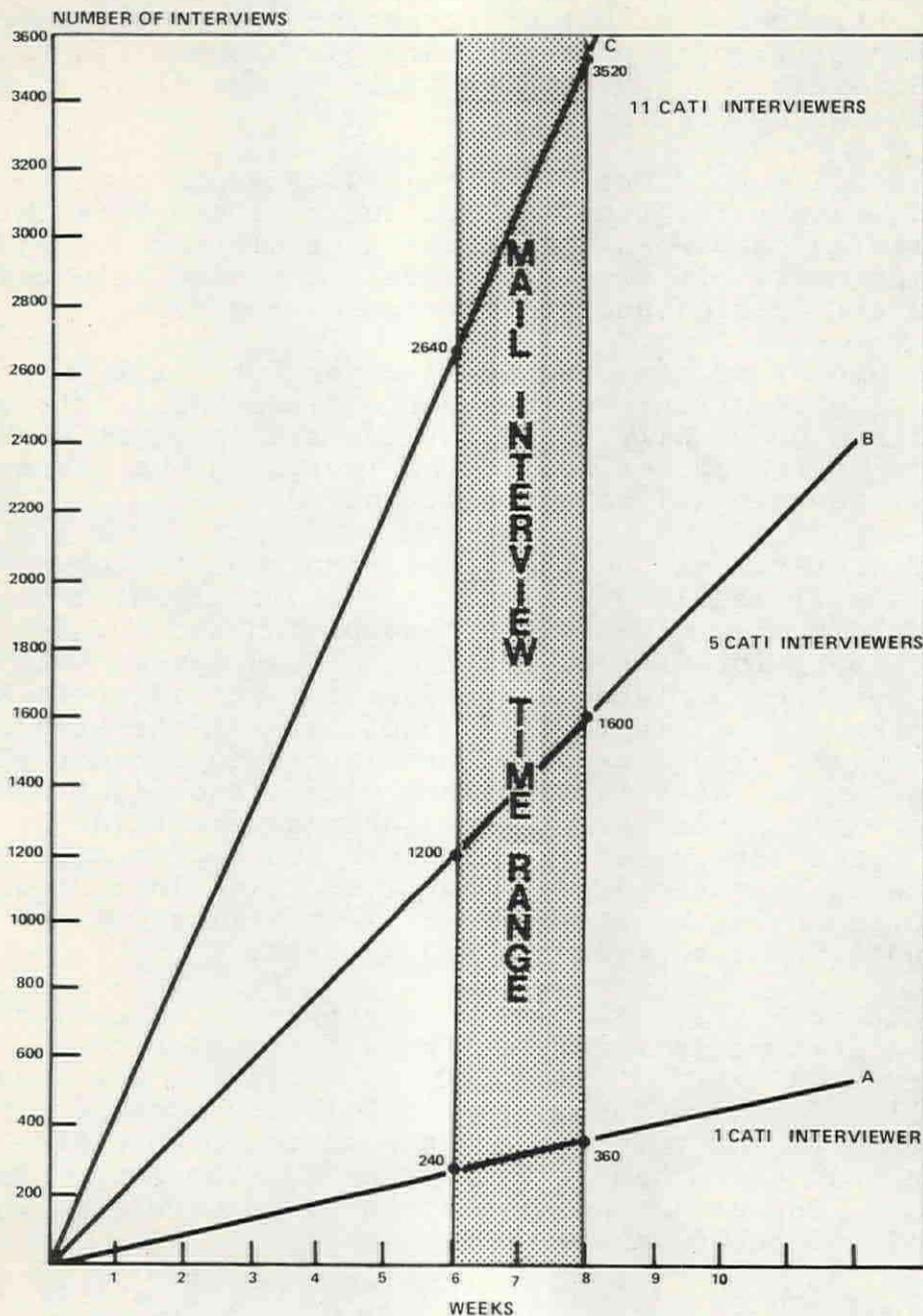
CATI interviews, on the other hand, due to the need for direct interviewer involvement, show a direct relationship between the number of interviews completed and the length of time necessary for data collection. If we assume that one interviewer can complete an average of eight interviews each day of the week, a single CATI interviewer (indicated by line A in the graph) would require three weeks to conduct 120 interviews, six weeks for 240 interviews, and eight weeks for 360 interviews. Similarly, five interviewers (line B) could conduct 1,200 interviews in six weeks and approximately 1,600 interviews in eight weeks. A total of 2,640 interviews could be conducted by eleven CATI interviewers (line C) in six weeks and 3,520 interviews in eight weeks.

In other words, one CATI interviewer could conduct up to 240 interviews in less time than that required for mail interviews. A staff of five CATI interviewers would save data collection time for up to 1,200 interviews and a staff of eleven CATI interviewers could conduct up to 2,640 interviews in less time than it would take for the mail interview technique. The amount of time saved would depend on the number of available interviewers.

GAO MAY WANT TO USE CATI
TO GAIN EXPERIENCE OR TO
PERFORM COMPARISON STUDIES

GAO may undertake a cooperative CATI effort to get "hands-on" experience with a CATI system. This experience

Graph 1: A comparison of the length of time necessary for data collection for mail interviews and CATI interviews*



*Since the length of time for mail interviews is generally invariant to the sample size and number of interviewers while CATI is not, we have shown a wide range of interviewing staff sizes.

can help GAO personnel gain an understanding of not only the principles of CATI, but also the system's actual operation. Thus, initial cooperative efforts can provide ideal training for GAO personnel and prove helpful in facilitating future cooperative studies.

Cooperative projects can also provide a methodology for comparing CATI costs, timeliness, and reliability with other survey methods. Comparative or parallel CATI studies can provide benchmarks by which these methods can be compared.

A comparative CATI study is a survey done using CATI, which possesses characteristics similar to previous studies that used other survey methods. If question number and complexity, sample size, and general population characteristics of the CATI study are similar (they need not be identical) to studies done with other methods, a rough estimate of the comparative costs, timeliness, and reliability of the methods can be developed.

More precise estimates can be derived from parallel studies. A parallel CATI study selects two or more valid subsamples from the same population during an individual study and uses different survey methods, CATI being one method, to collect data from these subsamples. In a parallel study the questionnaire and the sample characteristics are identical, or as close to identical as possible.

Each method's timeliness, cost, validity and reliability can be more exactly measured, examined, and compared against the other methods used in the study. Therefore, the most timely and least expensive method can be determined and each survey method's biases can be more clearly identified.

Comparative or parallel CATI study results can become an integral part in determining when cooperative GAO CATI projects are economical and feasible.

COOPERATIVE PROJECTS WOULD REQUIRE COORDINATION

Operationally, cooperative CATI projects should involve three principal individuals or organizations. They should involve (1) the assignment team leader/director and staff, (2) FGMSD questionnaire design experts and programmers, and (3) the CATI survey organization program director and staff. These three groups must coordinate closely to insure that the study objectives are met.

A typical sample survey can be divided into three phases: survey design, data collection, and analysis. Cooperative projects require coordination in all three phases.

During the design phase, the team leader/director must coordinate with FGMSD survey design and programming experts to assure that, among other features,

- the CATI technique is desirable and necessary;
- an appropriate study proposal is made by GAO to the CATI survey organizations;
- the survey organization contract bid is valid and feasible; and
- proper procedures are followed in the contractor selection process and that the most qualified survey organization is chosen.

Once a contractor has been selected, the team leader/director and the FGMSD experts must coordinate with the survey organization program director to develop,

- an adequate and comprehensive survey design and analysis plan; and
- a technically accurate and contextually complete questionnaire.

During the data collection phase, maximum cooperation is vitally important. Since GAO has no CATI facilities of its own, the actual data collection would be conducted at the CATI survey organization's headquarters by their interviewers. GAO supervision of the computerization of the questionnaire, the actual data collection process, and the interviewer operations is important to ensure GAO that quality standards are met.

The GAO team leader/director can continue cooperation with FGMSD/TAG during the analysis phase. As well as receiving input from the questionnaire design expert, the team leader/director can also call upon FGMSD's statisticians and data analysts if any additional assistance is required to construct or interpret statistical tests.

CHAPTER 5

SUMMARY AND CONCLUSIONS

Rising survey costs, more precise telephone survey methodology, and a larger percentage of the population owning telephones has made telephone interviewing more attractive to survey researchers. Computer Assisted Telephone Interviewing, a relatively new telephone interviewing technique, has been the focus of much of the current interest since it amplifies many of the advantages of telephone interviewing.

CATI systems facilitate speedy data collection, enable more complex telephone interviews to be used, impose more stringent quality control levels, and increase data reliability. (See Chapter 2.)

However, these advantages are not without some penalties. More interviewers may be necessary to save time on large samples. CATI costs considerably more than mail surveys but less than personal interviews. CATI also requires considerable computer programming support and software development. (See Chapter 3.)

This paper compares CATI's theoretical advantages and disadvantages and suggests that, on balance, cooperative CATI projects may be feasible for a number of GAO projects. At a minimum, this paper shows that comparative or parallel CATI studies would prove useful in gaining additional "hands-on" experience with a CATI system. These studies would produce empirical data to judge the feasibility of continued CATI use by GAO and to more accurately determine when CATI would be the optimal survey method.

GENERAL CATI FEATURES

The features described below are general in nature. That is, they are not specific to any one individual CATI system. An individual CATI system may or may not incorporate all of these features depending on the system's overall level of sophistication.

SURVEY INSTRUMENT DESIGN ASSISTANCE

- Survey instrument and procedural instructions can be entered in the computer.
- Appropriate interview files can be created.
- Survey instrument design changes can be quickly added.
- Survey instruments with highly complex skip patterns can be accommodated.

SAMPLING ADMINISTRATION

- A list of telephone numbers can be generated using techniques such as random digit dialing.
- The desired sample design can be assured.
- Telephone number status reports by sampling stratum can be prepared.

INTERVIEW SUPERVISION

- The supervisor can monitor all interviews, both by telephone and on CRT screen; a "Help" command for the interviewer to summon the supervisor can be provided.
- Call back schedules can be computerized.
- The supervisor can decide the final disposition for certain numbers.

INTERVIEWING CAPABILITIES AND CONTROLS

- Questions can be sequentially displayed on the CRT screen.
- Branching can be controlled by the computer program.
- Personalizing features can be applied to the questionnaires.

- The interviewer can retrieve and modify key information about all household members (information such as first name, sex, age, employment status, income, etc.)
- Answers to key questions are inserted as fills to subsequent questions. For example, if a respondent reports the primary disabling condition as heart trouble, a following question is "When did you first notice your (heart trouble)?"
- The interviewer can examine any previous questions and answers in major sections of the interview.
- The interviewer can back up in major sections of the interview to revise answers to previous questions and the computer program provides revised branching based on the new answers.

CODING ASSISTANCE

- For each completed interview a printout can be prepared for coder review.
- Range errors, logical inconsistencies, or other identifiable errors can be noted.
- Revised data values can be entered through an on-line console.
- Updated printouts noting any residual errors or required editing and coding can be prepared.
- Daily interview status logs can be prepared.
- The computer can assist in coding open-ended responses.

DATA PROCESSING

- Response variables can be formatted and labeled in a common data base so that they can be accessed for structural presentation.
- Intermediate tabulations can be prepared.
- Final tabulations, reports, and presentations can be prepared.

SELECTED ORGANIZATIONS THAT HAVE OR
ARE IMPLEMENTING CATI CAPABILITIES

The following list is not to be viewed as a complete compilation of all CATI organizations. It is, rather, a listing of those CATI organizations we were able to identify within the timeframe of our study.

This list is intended to be used as a reference. Team leaders should not contact any of these organizations without first discussing the objectives of their study and intended uses of CATI with FGMSD/TAG/SA.

Amrigon, Inc.
6560 Cass Avenue
Detroit, MI 48202

Audits and Surveys
One Park Avenue
New York, NY 10016

Chilton Research Services
Radnor, PA 19089

Computers for Marketing Corp.
215 Market Street
San Francisco, CA 94105

Custom Research, Inc.
3850 Metro Drive
Minneapolis, MN 55420

Market Facts
Suite 1240
1750 K Street, NW.
Washington, D.C. 20006

Research Triangle
P.O. Box 12194
Research Triangle Park, NC 27709

Survey Research Center
University of California,
Berkeley
2538 Channing Way
Berkeley, CA 94720

Survey Research Center
University of Michigan
Box 1248
Ann Arbor, MI 48106



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