TRAINED INTERVIEWERS

The skill of the interviewer is directly related to the quantity and quality of data resulting from a survey, whether the interview is in person or over the telephone. Good interviewers can ask questions in such a way as to encourage honest responses and can tell the difference between those who really don't know the answer and those who are simply reluctant to answer. Newly recruited interviewers should practice on typical respondents like those they might meet in the field. These practice sessions should be under the watchful eye of experienced interviewers, who can then evaluate the interview and suggest improvements in interview technique.

DATA CHECKS

Completed questionnaires should be scrutinized carefully by someone other than the interviewer to see that the form is filled out correctly. At this stage, and again later if data is entered into a computer, a predesigned system of data checks should be made to spot obvious errors in information.

The ranges of measurements can be checked to sort out the cases in which, say, the age of a person is listed as 1040, or a married adult is listed as 9 years old, or a family is reported to have 53 children under the age of 12. Data can be cross-checked in a well-designed questionnaire to see, for example, whether the respondent's reported age agrees with the reported year of birth. Simple arithmetic facts—for instance, proportions must be between 0 and 1 and the hours per day assigned to different work tasks cannot sum to more than 24—can be included in these data checks. Checking data quickly, so that questionnable responses can be corrected while the respondent is still available, is very important to the success of a sample survey.

After all the responses are collected and the data is being analyzed, additional data checks can be employed. The survey results should be representative of the population, and, sometimes, sample data can be checked against known facts for the population to see whether potential problem areas exist. For example, if the population is 50% female but the sample is only 10% female, there may be serious errors in summary measurements that average over males and females. If average income for survey respondents is well below the reported average from other sources for the target population, then large errors may show up in summary measurements on variables related to income. Some of these potential problems may be solved by augmenting the sample or by changing the form of analysis, but even if they cannot be solved, any inconsistencies should be pointed out in the final analysis.

QUESTIONNAIRE CONSTRUCTION

After sample selection, the most important component of a well-run, informative, and accurate sample survey is a properly designed questionnaire. This subject is the topic of Section 3.6.

3.5

METHODS OF DATA COLLECTION

The most commonly used methods of data collection in sample surveys are personal interviews and telephone interviews. These methods, with appropriately trained interviewers and carefully planned callbacks, commonly achieve response rates of 60% to 75%, and, sometimes, these rates can be even higher. A mailed questionnaire sent to a specific group of interested persons can achieve good results, but, generally, response rates for this type of data collection are so low that all reported results are suspect. Frequently, objective information can be found from direct observation rather than from an interview or mailed questionnaire. These four types of data collection are discussed in the following subsections.

PERSONAL INTERVIEWS

Data are frequently obtained by *personal interviews*. For example, we can use personal interviews with eligible voters to obtain a sample of the public sentiments toward a community bond issue. The procedure usually requires the interviewer to ask prepared questions and to record the respondent's answers. The primary advantage of these interviews is that people will usually respond when confronted in person. In addition, the interviewer can note specific reactions and eliminate misunderstandings about the questions asked. The major limitations of the personal interview (aside from the cost involved) concern the interviewers. If they are not thoroughly trained, they may deviate from the required protocol, thus introducing a bias into the sample data. Any movement, facial expression, or statement by the interviewer can affect the response obtained. For example, a leading question such as "Are you also in favor of the bond issue?" may tend to elicit a positive response. Finally, errors in recording the responses can also lead to erroneous results.

TELEPHONE INTERVIEWS

Information can also be obtained from persons in the sample through *telephone interviews*. With the advent of wide-area telephone service lines (WATS lines), an interviewer can place any number of calls to specified areas of the country for a fixed monthly rate. Surveys conducted through telephone interviews are frequently less expensive than personal interviews, owing to the elimination of travel expenses. The investigator can also monitor the interviews to be certain the specified interview procedure is being followed.

A major problem with telephone surveys is the establishment of a frame that closely corresponds to the population. Telephone directories have many numbers that do not belong to households, and many households have unlisted

numbers. A few households have no phone service, although lack of phone service is now only a minor problem for most surveys in the United States. A technique that avoids the problem of unlisted numbers is random-digit dialing. In this method a telephone exchange number (the first three digits of the seven-digit number) is selected, and then the last four digits are dialed randomly until a fixed number of households of a specified type are reached. This technique seems to produce unbiased samples of households in selected target populations and avoids many of the problems of trying to sample a telephone directory.

With random digit dialing in a residential survey, only about 20 % of the numbers will lie within the frame of interest. Most of the remaining 80 % will be unused numbers or numbers belonging to businesses and institutions. The rate of usable numbers can be improved by using random digit dialing to locate clusters (blocks of numbers). Once a residential number is identified, more residences can be selected from the same cluster by leaving the first eight digits the same and randomizing only the last two. This improves the proportion of usable responses, because telephone companies assign numbers in blocks.

A study of post-election attitudes and voting behavior reported by Bergstein in "Some Methodological Results from four Statewide Telephone Surveys Using Random Digit Dialing," *Proceedings of the Section on Survey Research Methods*, American Statistical Association, 1979, used this clustered technique. It found that only about 23 % of first-stage calls resulted in usable residential numbers; however, with the clustering technique, the percentage of usable residential numbers rose to approximately 57 %. This technique, therefore, can pay big dividends in savings of time and money. Incidentally, in this same study, trained interviewers (those with over six months of interviewing experience) produced a 77 % response rate, while those with less training produced only a 67 % response rate.

Telephone interviews generally must be kept shorter than personal interviews because respondents tend to get impatient more easily when talking over the telephone. With appropriately designed questionnaires and trained interviewers, telephone interviews can be as successful as personal interviews. [See Schuman and Presser (1981) for more details.]

SELF-ADMINISTERED QUESTIONNAIRES

Another useful method of data collection is the *self-administered questionnaire*, to be completed by the respondent. These questionnaires usually are mailed to the individuals included in the sample, although other distribution methods can be used. The questionnaire must be carefully constructed if it is to encourage participation by the respondents.

The self-administered questionnaire does not require interviewers, and thus its use results in a savings in the survey cost. This savings in cost is usually brought at the expense of a lower response rate. Nonresponse can be a problem in any form of data collection, but since we have the least contact with respondents in a mailed questionnaire, we frequently have the lowest rate of response. The low response rate can introduce a bias into the sample because the people who answer questionnaires may not be representative of the population of interest. To eliminate some of this bias, investigators frequently contact the nonrespondents through follow-up letters, telephone interviews, or personal interviews.

DIRECT OBSERVATION

The fourth method for collecting data is *direct observation*. For example, if we were interested in estimating the number of trucks that use a particular road during the 4–6 P.M. rush hours, we could assign a person to count the number of trucks passing a specified point during this period. Possibly, electronic-counting equipment could also be used. The disadvantage in using an observer is the possibility of errors in observation.

Direct observation is used in many surveys that do not involve measurements on people. The U.S. Department of Agriculture, for instance, measures certain variables on crops in sections of fields in order to produce estimates of crop yields. Wildlife biologists may count animals, animal tracks, eggs, or nests in order to estimate the size of animal populations.

A closely related notion is that of getting data from objective sources that are not affected by the respondents themselves. Health information can sometimes be obtained from hospital records, income information from employer's records (especially for state and federal government workers). This approach may take more time but may yield large rewards in important surveys.

3.6

DESIGNING A QUESTIONNAIRE

As stated earlier, one objective of any survey design is to minimize the nonsampling errors that may occur. If a survey is to obtain information from people, then many potential nonsampling errors should be considered and, it is hoped, controlled by the careful design of the questionnaire. We briefly discuss questionnaire construction in this section, but it is a very important topic and should be investigated further by those attempting to design complex questionnaires for surveys. An excellent reference, and the one on which we rely extensively for the discussion that follows, is Schuman and Presser (1981). Some major concerns in questionnaire construction are outlined in the following subsections.

QUESTION ORDERING

Respondents to questionnaires generally try to be consistent in their responses to questions. Respondent consistency may cause the ordering of the questions to affect the responses, sometimes in ways that seem unpredictable to the inexperienced investigator. An example discussed in Schuman and Presser (1981) illustrates the point.

An experiment was conducted with the following two questions:

A. Do you think the United States should let Communist newspaper reporters from other countries come in here and send back to their papers the news as they see it?

B. Do you think a Communist country like Russia should let American newspaper reporters come in and send back to America the news as they see it?

For surveys in 1980 in which the questions appeared in the order (A, B), 54.7 % of the respondents answered yes to A and 63.7 % answered yes to B. For surveys in which the questions appeared in the order (B, A), 74.6 % answered yes to A and 81.9% answered yes to B. So the evidence suggests that asking question B first puts the respondents in a more lenient frame of mind toward allowing Communist reporters into the United States. In other words, those who answered yes to B, when it was asked first, tried to be consistent and also answer yes to a similar question, A. Thus the context in which a question is asked is very important and should be understood and explained in the analysis of questionnaire data.

Order is also important in the relative positioning of specific versus general questions. Respondents may be asked the following questions:

A. Will you support an increase in state taxes for education?

B. Will you support an increase in state taxes?

It would not be unusual to find more people supporting B if asked in the order (B, A) than if asked in the order (A, B). If question A is asked first, persons who support taxes for education and answer A affirmatively may think that B implies an increase in taxes *not* necessarily going to education, and they may then say no to this question. If B is presented first, the same people who support more taxes for education may answer affirmatively since they have not yet seen a specific question on taxes for education.

Attitude toward a question in a survey is very often set, or changed, by preceding questions that bear on the same topic. Schuman and Presser report that more crime victimization was reported by respondents when the question on victimization occurred *after* a series of questions on crime than when it occurred by itself. Evidently, the questions on crime helped the person responding to remember small incidents when he or she was a victim of crime, incidents that might otherwise have been forgotten. Attitudes toward government can be quite negative after a series of questions emphasizing government

waste and inefficiency, and they can be much more positive after a series of questions emphasizing the necessary and timely functions government performs.

In a series of questions involving ratings, the first question is often considered in a different light from those that follow, and it tends to receive more extreme ratings. For example, suppose a person is to rate a number of possible vacation sites, with each one receiving a numerical rating from 1 to 10, 10 being very good. If the first site looks good to the respondent, it will tend to be rated close to 10 and the others will tend to be rated lower. If the first site looks unattractive, it will tend to be rated close to 1 and the others will tend to be rated higher. Thus, among the group of good sites, each will tend to receive its highest ratings when it appears first on the list. Similarly, each bad site will tend to receive its lowest rating when it appears first on the list. Evidently, the first item on the list is used as a reference point, and other items are rated up or down relative to the first item.

For many survey questions the order of the possible responses (or choices) to a particular question is as important as the position of the question on the questionnaire. If a person being interviewed is presented with a long list of possible choices, or if each possible choice is wordy or difficult to interpret, then the person is likely to respond with the most recent choice (the last one on the list). If a respondent must choose items from a long written list, then the items appearing toward the top of the list have a selection advantage. For example, consider the election of candidates for office from a long slate: Those toward the top of the list tend to get elected. In a list of simple choices, such as strongly agree, agree, disagree, and strongly disagree in an attitude survey, alternatives tend to receive their highest frequency of response when listed first. That is, the proportion who strongly agree will tend to be higher when that option is a first choice rather than a fourth choice.

Researchers attempting to design a questionnaire should be aware of the common ordering problems for question and response. They should attempt to counter potential difficulties by considering the following techniques:

1. Printing questionnaires with different orderings for different subsets of the sample.
2. Using show cards or repeating the question as often as necessary in an interview so that the question and possible answers are clearly understood.
3. Carefully explaining the context in which a question was asked in the analysis of the survey data.

OPEN VERSUS CLOSED QUESTIONS

Since questionnaires today are often designed to be electronically scored after completion, with the data in a form for computer handling, most questions will

be *closed questions*. That is, each question will have either a single numerical answer (like age of the respondent) or fixed number of predetermined choices, one of which is to be selected by the respondent.

Even though closed questions allow for easy data coding and analysis, some thought should be given to *open questions*, in which the respondent is allowed to freely state an unstructured answer. The open question allows the respondent to express some depth and shades of meaning in the answer. But it can cause great difficulties in analysis because answers may not be easily quantified and may be nearly impossible to compare across questionnaires. In contrast, the closed question may not always provide the appropriate alternatives, and the alternatives listed may, themselves, influence the opinion of the person responding. Once a questionnaire is completed, however, the data handling is fairly routine, and valid statistical summaries of reported answers are easily constructed.

A typical open question, similar to ones actually used in Gallup polls, is as follows:

> What is the most important problem facing the United States today?

This question can provide meaningful results as it is, since many people will choose similar problems as being most important. However, their choices could be forced into predetermined categories by the following closed question:

> The most important problem facing the United States today is (check one):
>
> A. national security.
> B. crime.
> C. inflation.
> D. unemployment.
> E. budget deficits.

One can see that any closed form of this question will limit the alternatives and may force a respondent into an answer that would not necessarily be a first choice.

A good plan for designing a closed question with appropriate alternatives is to use a similar open question on a pretest; then choose as the fixed alternatives those that most nearly represent the choices expressed in the open answers. To come up with a short list of alternatives from the open-ended answers will not always be easy, but this approach will provide more realistic alternatives than could be obtained from mere speculation.

RESPONSE OPTIONS

On almost any question that can be posted, someone being interviewed will want to say that he doesn't know or has no opinion. Since such responses give

no useful information about the question and essentially reduce the sample size, typical survey practice is to avoid using these options. The respondent is forced to make a choice from among the listed informative answers, unless the interviewer decides that such a choice simply cannot be made.

However, to force people to make decisions on questions they know nothing about seems inappropriate. Thus a good questionnaire will provide screening questions to determine whether the respondent has enough information to form an opinion on certain issue. If so, the main question is asked without a "no opinion" option. If not, the question may be skipped.

In other words, questions about which nearly everyone has enough information to form some opinion, such as questions on stricter enforcement of speed limit laws for drivers, should be stated without a "no opinion" option. Questions of a specific, narrow, or detailed nature, such as questions on a recently passed city ordinance, should be prefaced by screening questions to see whether the respondent has any information on the subject.

Even after the "no opinion" option is eliminated from a question, there remains the problem of deciding how many options to allow. Frequently, questionnaires attempt to polarize opinion on one side or the other, as in the following question:

> Do you think the enforcement of traffic laws in our city is too strict or too lenient?

Here no middle ground is offered. One reason for not allowing a middle choice, such as "just right the way things are," is that respondents may take this choice far too often as an easy way out. The two-choice option forces the person responding to think about the direction of the response, but the interviewer should explain that various degrees of strictness or leniency can be taken into account. "Which pole am I closest to?" is the point that the respondent is urged to consider. Of course, if one wants to categorize the degrees of strictness or leniency in this question, then more than two options can be presented. However, questionnaire designers usually wish to keep the number of options as small as possible.

WORDING OF QUESTIONS

Even for questions in which the number of response options is clearly determined, the designer should be concerned about the phrasing of the main body of the question. Yes–no questions like

> Do you favor the use of capital punishment?

should be asked in a more balanced form, such as

> Do you favor or oppose the use of capital punishment?

Some questions have strong arguments and counterarguments woven into

them. Schuman and Presser (1981, p. 186) show results for a comparison of the following questions.

A. If there is a union at a particular company or business, do you think that all the workers there should be required to be union members, or are you opposed to this?

B. If there is a union at a particular company or business, do you think that all the workers there should be required to be union members, or should it be left to the individual to decide whether or not he wants to be in the union?

Among persons presented with question A, 32.1 % responded that workers should be required to be union members; but among those presented with question B, only 23.0 % responded in this way. Question B has a stronger counterargument in the second phase of the question. People with no strong feelings either way are particularly susceptible to strong arguments or counterarguments within the body of the question. Again, questions should be asked in a balanced form, with little argument or counterargument within the text of the question.

Do you agree that courts are too lenient with criminals?

will receive many more yes responses than it should simply because that response seems to agree with the interviewer's notion of the correct response. Leading questions should be rephrased in a balanced form, as discussed earlier in this subsection.

Responses to many questions can be drastically altered just by an appropriate, or inappropriate, choice of words. Schuman and Presser (1981, p. 277) report on studies of the following questions:

A. Do you think the United States should forbid public speeches against democracy?

B. Do you think the United Stated should allow public speeches against democracy?

In one study those presented with question A gave 21.4 % yes responses, while those presented with question B gave 47.8 % no responses. People are somewhat reluctant to *forbid* public speeches against democracy, but they are much more willing to *not allow* such speeches. *Forbid* is a strong word and elicits a negative feeling that many cannot favor. *Allow* is a much milder word and doesn't elicit strong feelings. The important point to remember is that the tone of the question, set by the words employed, can have a significant impact on the responses.

Questions also must be stated in clearly defined terms in order to minimize response errors. A question like

How much water do you drink?

is unnecessarily vague. It may be reworded as follows:

Here is an eight-ounce glass. (Hold one up.) How many eight-ounce glasses of water do you drink each day?

If total water intake is important, the interviewer must remind the person that coffee, tea, and other drinks are mostly water.

Similarly, a question like

How many children are in your family?

is too ambiguous. It may be restated as follows:

How many persons under the age of 21 live in your household and receive more than one-half of their financial support from you?

Again, the question must be specific, with all components well defined.

In designing a questionnaire, we must always remember that people do not remember factual information very well. An interesting study in this area is reported by Bradburn, et al., "Answering Autobiographical Questions: The Impact of Memory and Inference on Surveys," *Science*, April 10, 1987, pp. 157–161. Three main points in the article are as follows:

1. Do not count on people to remember even the simplest facts. One study reports that only 31 % of respondents correctly recalled their savings account balance, and only 47 % got it correct *when allowed to consult their records*.
2. People do not generally determine frequencies of events by simple counting. If asked "How many times have you visited a doctor in the past year?," they will tend to establish a rate for a shorter period of time and then multiply. For example, a certain respondent may think she visits a doctor about once a month, and then multiply by 12 to get an annual figure. If asked "How many times have you eaten at a restaurant in the past month?," an interviewee may decompose the event into breakfast, lunch, and dinner, and approximate an answer for each meal before adding them back together.
3. People tend to telescope events that they remember well into a shorter time frame. Thus, an automobile accident or a reward on the job may seem to be more recent than it actually was. Similarly, events that are not recalled easily may seem to be longer ago then they actually were.

Knowledge of these facets of human behavior can be helpful in designing a good questionnaire. We can, for example

1. Ask questions about facts in more than one way, seek out more than one source, or use direct observation as much as possible.
2. Help with the decomposition process by decomposing the questions we ask (such as asking about water, soft drink, beer, and coffee consumption rather than simply asking about drink consumption).

3. Relate questions about events in relationship to important milestones in life (such as "Was the hospital visit before or after you moved to this address?"; "Was it before or after your daughter left for college?") to compensate for the telescoping.

Responses will always contain some errors, but careful questioning can reduce these errors to a point at which the results are still useful.

Many more items could be discussed on the topic of questionnaire construction. But the items presented here are the most important ones, and each should be considered very carefully before sampling is begun.

3.7 PLANNING A SURVEY

We will now review and extend some of the ideas presented in previous sections in the form of a checklist. Each item on the checklist should be carefully considered in the planning of any survey.

1. *Statement of Objectives*: State the objectives of the survey clearly and concisely, and refer to these objectives regularly as the design and the implementation of the survey progress. Keep the objectives simple enough to be understood by those working on the survey and to be met successfully when the survey is completed.
2. *Target Population*: Carefully define the population to be sampled. If adults are to be sampled, then define what is meant by *adult* (all those over the age of 18, for example), and state what group of adults are included (all permanent residents of a city, for example). Keep in mind that a sample must be selected from this population, and define the population so that sample selection is possible.
3. *The Frame*: Select the frame (or frames) so that the list of sampling units and the target population show close agreement. Keep in mind that multiple frames may make the sampling more efficient. For example, residents of a city can be sampled from a list of city blocks coupled with a list of residents within blocks.
4. *Sample Design*: Choose the design of the sample, including the number of sample elements, so that the sample provides sufficient information for the objectives of the survey. Many surveys have produced little or no useful information because they were not properly designed.
5. *Method of Measurement*: Decide on the method of measurement, usually one or more of the following methods: personal interviews, telephone interviews, mailed questionnaires, or direct observations.
6. *Measurement Instrument*: In conjunction with step 5, carefully specify how and what measurements are to be obtained. If a questionnaire is to be used, plan the questions so that they minimize nonresponse and incorrect response bias.
7. *Selection and Training of Field-Workers*: Carefully select and train the field-workers. After the sampling plan is clearly and completely set up, someone must collect the data. Those collecting data, the field-workers, must be carefully taught what measurements to make and how to make them. Training is especially important if interviews, either personal or telephone, are used, because the rate of response and the accuracy of responses are affected by the interviewer's personal style and tone of voice.
8. *The Pretest*: Select a small sample for a pretest. The pretest is crucial, since it allows you to field-test the questionnaire or other measurement device, to screen interviewers, and to check on the management of field operations. The results of the pretest usually suggest that some modifications must be made before a full-scale sampling is undertaken.
9. *Organization of Fieldwork*: Plan the fieldwork in detail. Any large-scale survey involves numerous people working as interviewers, coordinators, or data managers. The various jobs should be carefully organized and lines of authority clearly established before the survey is begun.
10. *Organization of Data Management*: Outline how each piece of data is to be handled for all stages of the survey. Large surveys generate huge amounts of data. Hence a well-prepared data management plan is of the utmost importance. This plan should include the steps for processing data from the time a measurement is taken in the field until the final analysis is completed. A quality control scheme should also be included in the plan in order to check for agreement between processed data and data gathered in the field.
11. *Data Analysis*: Outline the analyses that are to be completed. Closely related to step 10, this step involves the detailed specification of what analyses are to be performed. It may also list the topics to be included in the final report. If you think about the final report before a survey is run, you may be more careful in selecting items to be measured in the survey.

If these steps are followed diligently, the survey is off to a good start and should provide useful information for the investigator.

3.8 SUMMARY

The objective of a sample survey is to make inferences about the population of interest from information contained in a sample. The population consists of the