

THE ROLE OF THE QUESTIONNAIRE IN SURVEY DESIGN

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The modern statistical survey is an effective method of meeting the ever-increasing demand for timely and accurate data. One important component of the statistical survey is the questionnaire. This article discusses the role of the questionnaire in meeting the needs of users, the relationship of the questionnaire to the other components of survey design, and the effect of the questionnaire on the quality of survey data. The importance of viewing the questionnaire as an integral part of the total survey design is stressed.

1. INTRODUCTION

The escalating demand for appropriate and timely information of various kinds and from various sources calls for an organized approach to the entire process of data collection. The past forty years have seen the emergence of the statistical survey as an important tool to meet this need.

One important component of the statistical survey is the questionnaire. In the sections which follow, we describe the role of the questionnaire in meeting information needs, the relationship of the questionnaire to the other components of survey design, and the effect of the questionnaire on the quality of survey data. Although the discussion is presented mainly in the context of the household survey conducted by personal interview, many of the comments are relevant to questionnaires and surveys of all types.

2. INFORMATION NEEDS AND THE ROLE OF THE QUESTIONNAIRE

The simplest definition of a questionnaire is that of a group or sequence of questions designed to elicit information upon a subject from a respondent. Within the range of techniques in questioning, the questionnaire may range from a list of undefined topics to a highly structured set of questions with no options for response other than those listed.

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The questionnaire plays a central role in a complex process (the interview) in which information is transferred from those who have it (the respondents) to those who need it (the users). The questionnaire is the means through which the information needs of the users are expressed in operational terms which can be presented to a respondent in such a way that he will supply the required information. For this transfer of information to be effective, the questionnaire must meet the requirements of both users and respondents.

The expression of information needs, which a user may initially only vaguely understand, in terms suitable to the respondent is not something that can be accomplished in one step. Instead, the questionnaire design evolves and is refined as part of the overall survey development process.

For example, the user may begin with a need for information on "the housing conditions of the poor". He develops this into survey objectives by asking questions such as:

- (a) What is the problem we are trying to solve?
- (b) What specific items of information are needed?
- (c) How will the information be used?
- (d) How accurate and timely does the information have to be?

In answering these questions, his thinking becomes more quantitative, and he expresses his information needs in terms of specific survey concepts. The survey concepts describe both what is to be measured and the units for which measurements are required. He may describe "housing conditions" in terms of the number of rooms, the presence of plumbing and electricity, or the state of repair of the dwelling. He may define "the poor" in terms of income level or in terms of assets and debts.

It is important to emphasize that specific question wording is not at issue in the development of survey concepts. The first step for the user in expressing

his information needs is to decide what should be measured, not how it will be measured. The user should choose the concepts based on their relevance to his information needs. He should consider, for example, what concepts are most appropriate for the uses to be made of the data and whether the concepts are compatible with other sources of information.

Once information needs have been expressed in terms of specific survey concepts, the questionnaire becomes the instrument by which these concepts are measured. Through specific questions and accompanying instructions, the user specifies precisely how the survey concepts are to be measured in operational terms. Several questions may be required to measure complex concepts. In the Canadian Labour Force Survey, for example, as many as ten questions are needed to measure the concept "unemployed".

The questionnaire often serves as the document for recording of measurements as well. This is mainly of benefit to the interviewer or respondent, since it is convenient to record the answers immediately following the question. In theory, however, there is no reason why the questions and answers cannot be on two separate forms.

In the more structured types of surveys, the questionnaire is an important method of standardizing and controlling the data collection process. In statistical surveys, in contrast to other methods of investigation, the researcher usually cannot do his own data collection but must rely on interviewers hired for the job. Without specific question wordings and instructions to follow, interviewers would inevitably change the meaning or emphasis of questions and quite possibly the responses. The questionnaire helps ensure that the researcher measures what he wishes to measure with every respondent. It is, in effect, a "program" for the interviewer and respondent to follow in order to produce the desired result.

The questionnaire cannot be too rigid, however. It must be flexible enough to adapt to respondents of different age/sex groups, languages and social backgrounds. Different words or groups of words may be needed in order to convey the desired meaning to all respondents. The questionnaire must also

anticipate all of the possible answers that could be given. This is especially true in the initial, exploratory stages of research where an unstructured collection of data may be the most appropriate approach.

It must be recognized that the questionnaire is a complex and often imprecise measuring instrument. The subjects of measurement are human beings, and the process of measurement is based on language. As well as being a measuring instrument, the questionnaire is also a form of communication involving the researcher, the interviewer and the respondent. It transmits a request for information to the respondent, and it transmits the respondent's answer back to the researcher in a form useable to him. Warren Weaver, in The Mathematical Theory of Communication (1949), identifies three problems that must be faced in the design of any communication system:

- A. How accurately can the symbols of communications be transmitted? (The technical problem).
- B. How precisely do the transmitted symbols convey the desired meaning? (The semantic problem).
- C. How effectively does the received meaning affect conduct in the desired way? (The effectiveness problem.)

All three problems are directly relevant to the construction of questionnaires, and all three problems are closely linked. Within the context of statistical surveys, the way in which the questionnaire solves these problems plays a major role in determining how well the information needs of the user are met.

3. THE QUESTIONNAIRE AND THE COMPONENTS OF SURVEY DESIGN

The process of making the survey concepts operational in a specific document forces the researcher to consider not only question wording, sequencing and layout, but nearly every other aspect of the survey as well. The questionnaire design must take into account elements such as the type of population

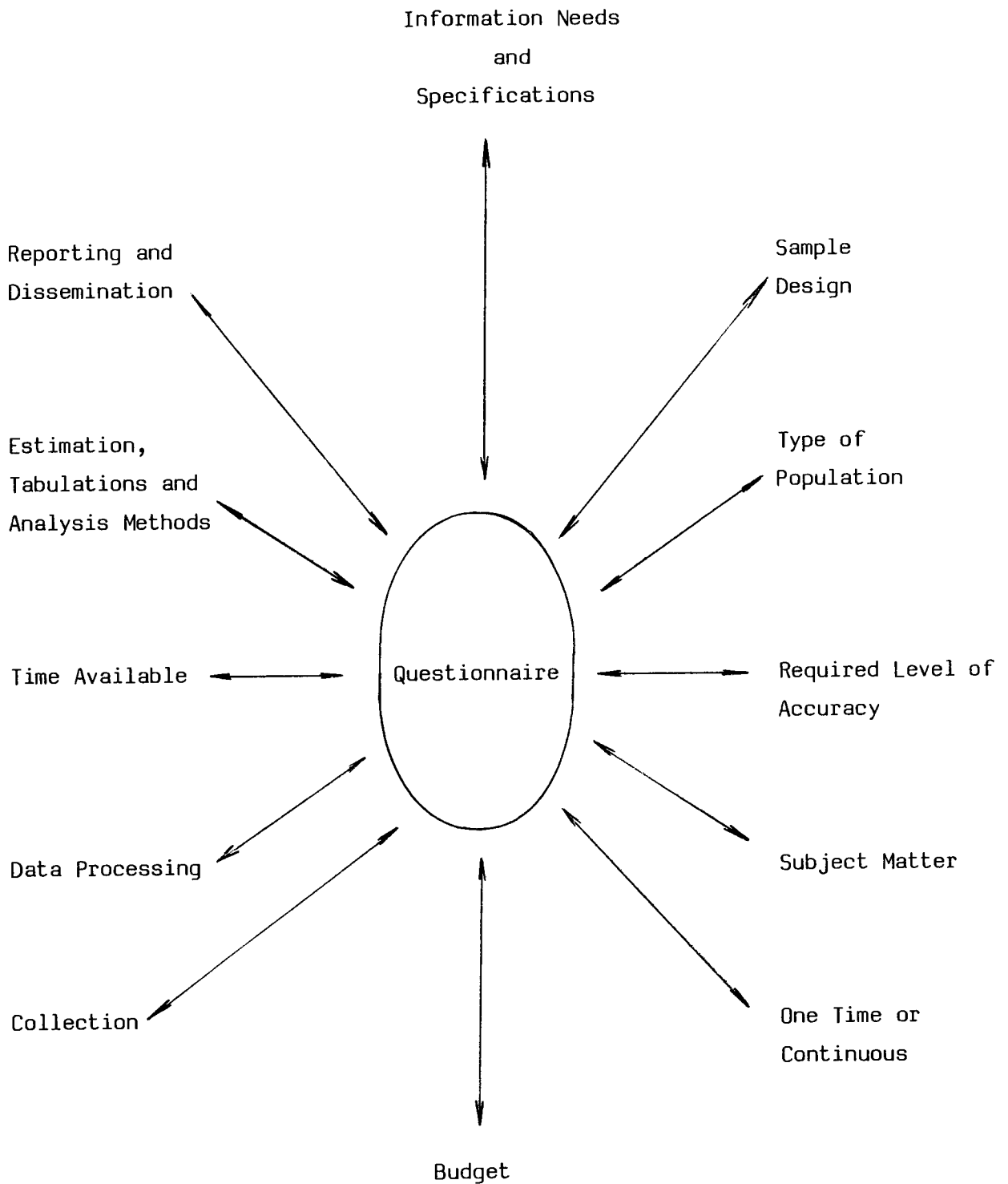
being surveyed, the sample design and sample size, the subject matter of the survey, the interviewing method, the data processing techniques to be used, and the budget and time available.

Figure 1 illustrates the questionnaire's relationships to some of the other elements which make up the total survey design. These interrelationships form a complex network; changes to one component of the design often require changes in several other components as well. Virtually any component of survey design could be placed at the centre of this network, but for the purpose of discussion we have chosen to focus attention on the questionnaire.

Elements such as the type of population, the sample design and the required level of accuracy are closely interrelated with questionnaire design. For example, the heterogeneous nature of many survey populations results in a need for cross-classified data. These needs affect the sample size, the type and degree of stratification, and the reliability of the information. This in turn will affect the questionnaire through the types of questions asked and the level of detail requested. This will further have an effect on the cost and timeliness of the information, the amount of respondent burden, and so on.

The questionnaire design is closely linked to the method of data collection and the survey's subject matter. Each method of data collection, such as personal interviewing, telephone interviewing and mail surveys, creates its own survey conditions which may be more or less appropriate to a given subject matter. These conditions will in turn affect the questionnaire's style of questioning, content, format, length and so on. In personal interviews, for example, it is often possible for the interviewer to collect certain data, such as type of dwelling and sex of respondent, by direct observation rather than questions. In addition, the questionnaire can be designed for the use of flash cards or other visual aids by the interviewer. The element of face-to-face communication is also a powerful motivating factor for the respondent. A personal interview is often the only choice when a complex, long and demanding questionnaire is involved. In telephone interviews, much of the social interaction between interviewer and respondent is lost and the respondent's

Figure 1: Elements Affecting the Questionnaire



co-operation may be affected. The questionnaire must rely entirely on verbal communication for its success, and the subject matter may have to be less demanding. However, with certain sensitive surveys, (e.g. criminal victimization surveys), the extra distance between interviewer and respondent may actually make it easier to answer questions. In mail surveys, the questionnaire itself assumes the role of interviewer. It must introduce the survey, motivate the respondent to co-operate and guide the respondent in completing the interview. It is a particularly demanding role which must be taken into account in designing the questionnaire.

Whether the survey is one-time or continuing also has an effect on questionnaire design. With a continuing survey, there is often more scope for learning from experience and refining the questionnaire over time. Experiments in question wording, programs to monitor response errors, and other methods of evaluating and improving the questionnaire design may only be feasible with a continuing survey. However, the ability to improve a questionnaire must be balanced against the disadvantages of change: for example the inability to make comparisons over time, the necessity to retrain interviewers, and the necessity to change expensive computer software.

In many continuing surveys, such as the Canadian Labour Force Survey, the same respondents are interviewed several times. The questionnaire must take into account the total response burden during the respondent's stay in the survey. The questionnaire may also have to adapt to different collection methods: for example in the LFS the first interview is conducted in person while in urban areas most subsequent interviews are conducted by telephone. Questionnaires designed for continuing surveys must be developed with the longer term view in mind.

The questionnaire is also interrelated with data processing and budgetary concerns. The format of questions, for example open or closed, has direct implications for operations such as coding, data capture, editing and tabulations. The presence of many open-ended questions increases the time and effort during coding operations, and the programs to edit and tabulate the data become more difficult and costly to write and test.

The questionnaire as an operational expression of user needs thus involves the total survey design itself. Survey design is a combination of intricate components, among which the questionnaire plays a central role. The questionnaire neither determines the form of the other components, nor is its form determined by the others. The process of questionnaire design must flow from and be a part of the total survey design process.

4. THE QUESTIONNAIRE AND ERRORS

All survey-taking is subject to errors from various sources, and in recent years non-sampling error has received increasing attention as a major component of the total survey error (see, for example, Anderson et al (1979), Bailar (1976), Hansen, Hurwitz and Bershad (1961), Koch (1973), and Platek and Singh (1980)). The control of non-sampling errors is an integral and vital part of survey design, requiring specific programs for the diagnosis, measurement and prevention of errors. Further, each program will have its own costs and benefits which must be taken into account in the design of controls (Platek and Singh (1980)).

The questionnaire is both an important source of non-sampling errors, and an important part of programs for their prevention and measurement. The scientific development of data collection has lagged behind that of sample design and estimation; improvements in sampling techniques often deal in fractions of a percent while experiments in question wording may reveal variations of 20 percent or more (Payne (1951)). This section discusses the relationship of the questionnaire to a few of the more important sources of non-sampling errors and illustrates the role of the questionnaire in minimizing these errors.

4.1 Non-response errors

Non-response is one important source of non-sampling error. If the characteristics of interest differ from respondents to non-respondents, bias will almost certainly be introduced into the results. Non-response is basically of two types: the "no contact" type, (e.g. no one home, temporarily absent, bad

weather, etc.) and the "refusal" type. The latter may be either a complete non-response or only non-response to some questions. The questionnaire can do little to eliminate the "no contact" type of non-response but it does play an important role in preventing the refusal.

To understand how the questionnaire does this, it is important to first understand why respondents do or do not respond. Many different psychological forces motivate people to respond to surveys, including an interest in the topic, a desire to be helpful, a belief in the importance of the survey, a feeling of duty, or even a belief in their own importance. Other forces influence people to refuse: for example difficulty in understanding questions, fear of strangers, the feeling of one's time being wasted, difficulty in recalling information, and embarrassing or personal questions. All of these forces will have an effect on the questionnaire design through the way in which survey topics are introduced, the question wording, the questionnaire's appearance and length, assurances of confidentiality, and so on. At the same time, these forces interact with the survey's subject matter, the type of population and the data collection method, which in turn influence the design of the questionnaire.

One must also consider the ability of respondents to respond. Unrealistic demands on the respondent's knowledge or memory, the use of overly difficult and technical language, or excessive demands on the respondent's patience are all sources of non-response which have their roots in the questionnaire. It must be said, however, that the patience of respondents often amazes even hardened survey designers. Chinnappa and Wills (1978) describe an interesting study of non-response to the physical measures component of the Canada Health Survey, where respondents were asked to submit to blood pressure tests, skin-fold measurements, exercise tests, and were even asked to donate blood samples.

A more thorough discussion of the causes and treatments of non-response is given in Platek (1980).

4.2 Response errors

Response errors are a second category of non-sampling errors to which the questionnaire is closely related. Response errors can occur anywhere during the question-answer-recording process, and may be either systematic (response bias) or random (response variance).

Questions on sensitive topics, such as amounts and sources of income, use of alcohol and tobacco, illegal activities or mental illness are subject to large response errors. It is often felt, for example, that the respondent may distort the answer to avoid embarrassment or to appear to conform to societal norms (Warwick and Lininger (1975)). Many questionnaire design techniques have been devised to counter this "social desirability bias", including the anonymous questionnaire, the use of projective questioning techniques,¹ or randomized response techniques in which the respondent chooses which of two (or more) questions he answers by the random choice. However, in a recent study which compared questionnaire responses to external criterion information (e.g. official records or test results), Marquis et al (1981) found, rather surprisingly, that for most items which they studied the response bias was almost negligible, but that the response variance was quite large. This conclusion, if supported by other studies, indicates that measuring and reducing response variance may also be important in sensitive topic surveys. This might involve techniques such as reinterviews, internal consistency checks during the interview, and the collection of other information correlated with the variables of interest. This kind of emphasis has direct implications for questionnaire design.

Questions which depend on the respondent to remember events, such as the taking of a trip or the occurrence of a crime, are another source of response errors. Events may be forgotten, or events which occurred before the reference period may be incorrectly included. Bushery (1981), in an experiment

¹ An example of projective questioning might be the sequence:

1. What do you think most people feel about smoking marijuana?
2. How do you yourself feel about it?

The first question asks for the respondent's view of the societal norm and the second asks for his own view.

with the U.S. National Crime Survey, found that victimization rates with a 3-month reference period were much higher than those reported under a 6-month reference period, which were in turn higher than the victimization rates reported with a 12-month reference period. The bias due to recall loss with the longer reference periods was a much more serious source of error than sampling variability. The choice of an appropriate reference period for questions involving recall has been examined in a number of different subject matter areas (Sudman (1980), National Center for Health Statistics (1972)). Bounded recall, where respondents are interviewed at the end of the reference period, or the use of prominent dates (e.g. Christmas) and calendar aids to jog respondents' memories have shown to be of some value in reducing under-reporting (Neter and Waksberg (1965), Ashraf (1975)). With some topics, however, the only possible way to collect the information is to make the questionnaire into a form of diary, where the respondent records the event during, or shortly after, it happens. Questionnaires of this type are used for the Food Expenditure Survey and the Fuel Consumption Survey of Statistics Canada.

Although questions demanding recall and sensitive topics are important sources of response errors, there are many other causes. For example, an important component of response error is that due to the interviewer, the so-called correlated response error. Each interviewer exerts, to some degree, a common influence on all of the respondents in his/her assignment through the way in which the questions are asked, the way in which the respondent's replies are interpreted and recorded, and so on. The contribution of this component of error to the total survey error is directly related to the size of the interviewer's assignment. In telephone surveys, which may have quite large assignments, the correlated component can be a much more serious error than in personal interviews (Groves and Kahn (1979)). In turn, the correlated response error is more serious in personal interviews than in mail surveys or other surveys of the "self enumeration" type. This consideration was a major reason why the Census of Population and Housing has adopted the drop-off-mailback as the standard technique since 1971. The choice of data collection method in turn has a direct influence on the questionnaire design.

Numerous other examples of response errors could be given. They depend on what question is asked, how the interviewer asks it, the way in which the respondent interprets and answers the question, and the way in which the interviewer interprets and records the answer. The interview is a dynamic, interactive process of communication between interviewer and respondent. How it is handled determines whether or not the interview produces the desired information in an accurate and efficient fashion. In the heat of the interview, it is the questionnaire, through its content, question wording, instructions and layout, which must play the major role in controlling the situation.

4.3 Data processing errors

Once the interview is completed, the questionnaire becomes primarily a data processing document. Errors can occur at all phases of processing including coding, data capture, editing, imputation, estimation and tabulation. The way in which the questionnaire was designed will have a significant impact on the number and type of errors at this stage of the survey.

By including data capture codes right on the questionnaire, for example, data capture errors are usually reduced significantly. The data are captured directly from the questionnaire without first being transcribed onto another form. A step beyond this is the Computer Assisted Telephone Interview. The questionnaire is stored in a computer program, which controls the entire interview process. The questions appear one at a time on a video display terminal in front of the interviewer, who then asks the question and types the respondent's reply directly into the computer. The data can be edited immediately and errors corrected while the respondent is still on the telephone. The process also reduces the incidence of questions missed or of incorrect application of skip instructions.

Editing and imputation errors are also closely related to the questionnaire design. Problems of missing or inconsistent data can often be traced back to faulty questionnaire design. The ability to reconstruct or impute for missing values often depends on what concomitant variables were included on the questionnaire and what kind of fail-safe mechanisms were built in. For example,

in a survey which requests information on several detailed components of income, cases where the information is not given or is incorrect can often be salvaged by including a question asking for total income.

Non-response errors, response errors, and data processing errors are a few of the non-sampling errors which are closely linked to the questionnaire and to the other components of the overall survey design. The questionnaire is inevitably a cause of non-sampling error, but it must also go as far as possible in preventing errors. The degree to which the questionnaire succeeds at this task depends largely on the survey designer's knowledge of the various sources of errors and on his skill in integrating the design of the questionnaire with that of the entire survey. Each new survey may present new problems and pitfalls and as such they must be anticipated and taken into account in developing questionnaires.

5. CONCLUSION

The preceding sections have illustrated the questionnaire's role as both an expression of the user's information needs and as an important determinant of the quality of survey data. In both roles, the questionnaire is closely linked to all of the components of survey design. The total survey design, and in particular the questionnaire, must try to maximize both the relevance of the data to the user and the accuracy of the data. Successful questionnaire design incorporates both; we must ask the right question, and we must ask it in the right way.

It is important to underline that users' needs and the requirements of accuracy often conflict. The process of questionnaire design involves tradeoffs. A user may have to ask a simpler question than he would like simply for the respondent to be capable of answering. On the other hand, the questionnaire designer should not avoid asking complex questions simply because the answers may contain errors.

Questionnaire development is not simply a laboratory process. Although guidelines exist and research is possible, the skill of questionnaire design is learned to a large extent by practical experience and by trial and error. It is learned through discussions with users, interviewers and respondents. Questionnaire design is undoubtedly an interactive process which cannot be carried out in isolation and independent of other factors in survey development. It interrelates with them and, in fact, it forms an integral part of the total survey design.

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