

## THE PILOT TESTING OF ALTERNATIVE ADMINISTRATIVE PROCEDURES AND SURVEY INSTRUMENTS

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Survey research is in many ways as much an art as it is a science. While it is possible to transfer general procedures from one spatial and temporal setting to another, each survey effort is to a large extent unique. Thus, every survey should be preceded by a pilot study (1). Often, pilot studies have consisted only of a pretest of the questionnaire, perhaps even administered to a sample not representative of the population to be sampled in the main survey. In a university setting, this usually translates to the testing of the questionnaire on a captive classroom audience; in other settings often only an "in-house" test is performed. Three reasons may be seen for the employment of cursory pilot studies in most cases. First, it is possible that some researchers have not recognized the importance of a full-scale pilot study. Second, budgetary constraints often have obviated any large-scale pilot-study effort, frequently because the importance of budgeting for it was not recognized. Third, time considerations may make it infeasible to carry out a pilot study.

The purpose of this paper is to discuss the need to pretest alternative survey forms and the probable benefits which accrue. The major contention of this paper is that if two or more proposed procedures or proposed methods for asking a question are foreseen to have both advantages and disadvantages, both procedures should be tested in a pilot study. The need to test alternative procedures is highlighted by Dillman (11).

### The Dade County On-Board Transit Survey and the Southeast Michigan Regional Travel Survey

The discussion in this paper employs examples from pilot studies designed by the authors for two transportation surveys: The Dade County On-Board Transit Survey and the Southeast Michigan Regional Travel Survey. A brief description of the purposes of each survey and the survey mechanisms follows.

The Dade County On-Board Transit Survey was designed to collect data from a random sample of bus passengers (2). The principal purposes of the survey were to provide:

- 1) A major test of a proposed monitoring and surveillance activity for the Metro Transit Agency (MTA) as called for by the Transportation Development Program (TDP) (3);
- 2) A partial supplement to the travel data collected by the 1980 Census on trips to work and part of a data base for using the census data to update trip-rate estimates for nonwork trips;
- 3) Needed data on CBD bus ridership, the current data base being seriously deficient in this part of the matrix;
- 4) Improved data to MTA for use in adjusting its revenue-based, patronage-estimating formula, particularly as needed after recent changes in transfer policies;
- 5) Data on the use of media by bus passengers, particularly as it relates to providing riders and potential riders with information on the bus system and the services available;
- 6) Part of the data needs for a recalibration of the Dade County modal-split model;
- 7) Data on the perceptions of riders about the

MTA system and specific elements of it and a basis for comparing bus-rider judgments (attitudes) with those of the general population of Dade County, the latter being collected in a separate survey in 1980 by MTA (4B).

In common with most U.S. urban areas, bus riders constitute less than ten percent of the population of Dade County. Hence, any survey aimed specifically at bus riders would be highly inefficient if the sample were drawn from households, employees, or any other non-travel-specific grouping of the population. Thus, the survey mechanism was designed as an intercept survey of bus passengers. A dual survey mechanism was employed including a brief form to be completed on the bus and a longer, take-home, mail-back survey (5).

The Southeast Michigan Regional Travel Survey was designed to collect data from a stratified random sample of the population in seven southeast Michigan counties. The principal purposes of the survey were to provide:

- 1) The means to update trip-generation rates and modal-split models;
- 2) Attitudes of the population toward transportation and energy (10);
- 3) Attitudes toward possible changes in the transit system;
- 4) Preferred methods of obtaining information on car-pooling.

The trip-generation and modal-split models to be updated use certain demographic characteristics and income as input variables, so that these characteristics must be measured to permit updating to be accomplished. Also, the survey coincided with a period of high unemployment in the southeast Michigan region (mainly connected to a low cycle in the automotive industry). Because of the potential effects of this on trip making, detailed information was required on employment status.

The selected survey mechanism was the home-interview survey. Two instruments were used. The first was an attitudinal, demographic survey asked of a randomly-selected adult household member. The second was a travel log, distributed to each household member over five years old, designed to obtain trip information for a 24-hour weekday period.

### The Testing of Alternative Survey Forms

Frequently, in the design of a survey instrument, two or more ways appear to be potentially useful to ask a given question or set of questions; or there may be several possible ways to request answers, e.g., using 5-point, 6-point, or 7-point scales on judgmental questions. Similarly, many survey instruments may contain questions that are particularly crucial to the purposes of the survey, but that are difficult to ask. For such situations, two or more alternative formats often will be developed for such questions, but choice among them may not be obvious. In either case, the most definitive test of the alternative formats is to test each one as part of the pilot study. To do this, a carefully-structured scientific test of each alternative must be developed. An example is

described in this section based on a set of problem questions in the Dade County On-Board Transit Survey.

In that survey, questions concerning respondents' perceptions of the times and costs of bus transportation versus alternative modes needed to be asked for purposes of recalibrating the Dade County modal-split model, but all suggested formats for asking these questions were viewed as difficult. Compounding this problem is the fact that bus riders are not a random sample of the population, but rather are more likely to be members of specific sociodemographic groups in which problems of comprehension or concentration are likely to be more pronounced. This section describes in more detail the forms (including the alternative formats) used on the pilot study of the Dade County survey and the results obtained.

The survey instrument was designed as a two-part entity. An on-board form (form a) was printed on card stock (to make it easier to fill out while riding a bus) and was designed to be short enough to fill out on a bus. Although a reply-paid panel was printed on this card, so that mail return was possible, the form was designed to be placed in a receptacle at the exit door of the bus, or handed back to the survey person. The second part was a longer, take-home form (form b) designed to be completed at home and mailed-in in a reply-paid envelope provided. The whole package was stapled and included an instruction page and a letter from the County Transportation Coordinator. The instruction page explained briefly the purpose of the survey, instructed respondents that form a was to be completed on the bus, but form b was to be done at home and returned by mail. In addition, a free bus-pass incentive was offered to gain cooperation. The back of this page contained helpful county telephone numbers. The letter from the Transportation Coordinator stated the reasons for the survey, and the importance of each person's contribution, reviewed the instructions for filling out the forms, and provided a telephone number for help, comments, or verification that this was a bona fide survey. The entire survey instrument was combined such that, when looking at the instruction page, a one inch tab from each of form a and form b showed below the top page. This simplified the problem of the respondent finding each form. The major reason for the two-part form was to permit the evaluation of nonresponse bias (5).

In the pilot study, 2158 forms were distributed: 632 (29 percent) of the on-board forms and 380 (18 percent) of the take-home forms were returned, although due to time constraints only 301 of the take-home forms were computerized.

Two versions of the on-board form and three versions of the take-home form were devised. Because a possible "shadow effect" of one questionnaire upon another existed, each on-board form (called the on-board Short and the on-board Long for reasons explained below) was combined in equal numbers with each take-home form (called the take-home Short, take-home Long, and take-home Table). This produced the following six versions of the questionnaire:

- 1) On-board Short / Take-home Short
- 2) On-board Short / Take-home Table
- 3) On-board Short / Take-home Long
- 4) On-board Long / Take-home Short

5) On-board Long / Take-home Table

6) On-board Long / Take-home Long

These versions were distributed in a systematic mix to consecutive bus riders as they boarded, to assure that, as far as possible, the full range of six survey instruments was distributed at each bus stop.

#### Alternative On-Board Forms

The major purpose of the on-board form was to elicit some response from persons who would not be bothered taking a form home, spending 45 minutes completing it, and remembering to mail it. Also, reading and writing on a moving bus is very difficult and many persons in Dade County, particularly the elderly, ride the bus for only a few blocks at a time. All these considerations seemed to dictate the use of an on-board form that was as brief as possible.

A competing force, however, was the importance of collecting origin-destination information by trip purpose from as many passengers as possible. Because the response rate would be higher on the on-board form than the take-home form, the possibility of asking for origin-destination information on the on-board form presented itself. Obtaining such information is not simple because it means asking people for the addresses of their origin and destination as open-ended questions. This can have a number of negative impacts on the survey. First, the length of the document increases significantly. Second, these questions require writing words on a moving bus, rather than simply checking a box or writing one or two numbers on a line. Third, such questions very well may frustrate respondents who do not know the address of their origin or destination and they simply may stop filling out the form. Fourth, any self-administered survey is biased against the illiterate, but a semi-literate person may be able to handle a form on which he/she can read slowly and check boxes. Such a person would experience difficulty with the origin-destination questions.

Thus, it was decided to create two versions of the on-board form: the on-board Short and the on-board Long. The only difference between the two forms is that the on-board Long contains the origin-destination questions.

It is important to note that the alternative of asking the origin-destination questions on the take-home form was used in all cases. Irrespective of the presence of these questions on the on-board form, the origin and destination of the trip were needed on the take-home form as an aid to recall of the subject trip and a context-setting device for judgmental questions and questions on alternative modes.

The number of on-board forms distributed was 2158: 1079 of each version. A 31.3 percent response rate (338 returns) was achieved for the on-board Long; a 27.2 percent response rate (294 returns) was achieved for the on-board Short. These two response rates are significantly different at the 5 percent level, but not at the 1 percent level ( $Z = 2.09$ ), so that the null hypothesis, that the addition of these two questions, while lengthening the form, would not discourage response, cannot be rejected at the 5 percent level.

In addition to the possible implications of the presence of the origin and destination questions

on response rate, it is also possible, for reasons stated above, that there may be some effects on the quality of information received on the form. Many aspects of quality are difficult to assess. Thus, the surrogate variable used for judging quality is the percentage of missing answers to each question. It is recognized that this variable does not measure the quality nor the accuracy of the information provided.

Although more on-board Long forms were returned, the percentage of missing information was clearly greater on the Long form. A t-test for examining for a significant difference between the average percentage of missing information for the ten questions in common between the two forms shows ( $t = 1.79$ ,  $\alpha = .05$ ) that the average percentage of missing information on the on-board Long is significantly greater than on the on-board Short. The percentage of missing information is greater both for the questions which appear prior to the difficult origin-destination questions and for the questions which appear subsequently. In addition, the lengthening effect of these questions appears to have reduced significantly the percentage of respondents writing in comments in the Comments section ( $Z = 7.22$ ,  $\alpha = .05$ ). One of three explanations is possible. First, because the origin-destination questions lengthened the form by 33 percent, respondents ran out of time and had to get off the bus. Second, respondents tired of filling out the form because it was longer. Third, after struggling with writing words on a moving bus for the address questions, respondents were reluctant to try to write words again in the Comments section.

Another problem with the on-board Long form was that the origin-destination questions were not completed well. On the on-board form, 69 percent of the responses included a usable address for the origin of the bus trip. On the take-home form, 88 percent provided a usable origin address. This percentage might have been even higher, but no doubt some respondents completing the take-home form probably figured they had answered already the question on the on-board form and decided to skip it on the take-home form. Evidently, respondents who took the time to complete and mail back the rather complicated take-home form were not deterred by the address questions. Thus, even given the lower response rate on the take-home form, a satisfactory number of origin-destination addresses would be received on the final survey if these questions were omitted from the on-board form.

In sum, the decision was made to produce a revised version of the on-board Short form for the main survey. Although a significantly higher response rate (at the 5 percent, but not at the 1 percent level) was achieved for the on-board Long, the form yielded a significantly higher rate of missing information and significantly lower rate of comments. Also, tests of the take-home form seemed to yield sufficient origin-destination information for analysis purposes. That the lengthening of the form by 33 percent did not affect the response rate adversely is similar to the results shown below for the testing of alternative take-home forms. While this result, to some extent, is at odds with conventional wisdom that states that longer forms should achieve lower response rates, it could be that both the Long and the Short versions of the

on-board form were sufficiently short to lie within the tolerance range of the same population groups (11).

#### Alternative Take-Home Forms

One of the major purposes of the take-home form was to collect data to recalibrate the Dade County modal-split model. Optimally, disaggregate, behavioral modal-split models require individual perceptions of time and cost parameters for a selected mode and one or more alternative modes (6). Because at least thirteen modes can be identified in Dade County, it would obviously be beyond the patience of the vast majority of respondents to provide data on all alternative modes. Thus, an initial decision was made to query perceived time and cost parameters for the bus ride on which the respondents received the form and three alternative modes. If a respondent provided data on at least one alternative, the response was usable for the modeling. The importance of this information as well as the obvious difficulties of asking questions about alternative modes prompted considerable attention to the modal-split questions.

Thus, three versions of the take-home form were designed: the take-home "Long" form, the take-home "Short" form, and the take-home "Table" form. Each of the three versions may be separated into four Sections:

Section I was devised as a warm-up section beginning with a set of perceptual questions designed to create interest. Also included are a series of questions for devising marketing strategies.

Section IV asks for information on education, income, automobile ownership, family structure (relationship, age, sex, driver's license), residential status, employment, and race. Such information is needed both for the Dade County modeling sequence and federal reporting requirements.

Section II asks for detailed information on the bus trip the respondent was making when the form was distributed. This includes information on the land use and the address at the origin and destination, access and egress modes to the bus, and time and cost of the trip. In addition, on the Long form, eighteen perceptual questions are asked about the bus ride on which the respondent received the form.

Section III asks the respondent to select three alternative modes and answer a series of questions, imagining that they had used the alternative modes instead of the bus for the trip on which they received the form. The manner in which these questions are asked varies by the version of the form. For the Long form, the respondent is asked to look at a list of thirteen modes and cross out the means of travel used on the day he or she received the form. Three alternative modes then are selected by the respondent to become "Travel Means A," "Travel Means B," and "Travel Means C." The respondent must then be capable of translating his choices for A, B and C to a separate page for each, where detailed questions about times, costs, frequencies, and eighteen perceptual questions are asked.

The Short form is designed in the exact same manner as the Long form except that the three sets of eighteen perceptual questions about the

alternative modes are omitted.

The Table form requests the same information as the Short form, except that respondents are asked to fill in times, costs, and frequencies for the bus ride and three alternative modes in the cells of a matrix where the thirteen modes form the rows and the modal characteristics form the columns.

All three of these formats display potential problems because following either the rather difficult procedure of translating the abstract notion of Travel Means A from one page to another or filling in the cells of a matrix are both difficult tasks for the bus-riding public who may not be accustomed to filling out forms. Another difficulty is introduced because it is necessary to request people not accustomed to doing so to think hypothetically about a situation (modal choice) that they may not have thought about a great deal. This applies particularly to transit captives who, because they lack an automobile, probably never have thought about the time and cost parameters of other modes.

Before the execution of the pilot study the belief was that each form displayed some significant benefits. If respondents would persevere with the Long form, the most information would be obtained. On the other hand, The Long form was ten pages long in comparison with eight pages for the Short form and six pages for the Table form. If respondents could be shown to complete the matrix satisfactorily, a much shorter, and overall simpler-looking form could be used. If the Table proved unsatisfactory and the Long form proved long enough to discourage response, the Short form might represent the best alternative.

One other advantage of the Table form was the ability to shade some of the cells in the matrix to indicate that no response should be placed there. On the Long and Short forms, all of the time and cost questions had to be asked for Travel Means A, B, and C. Then, if the respondent selected, say, walk, for Travel Means A, he would be asked how long he spent traveling in vehicles and finding parking! This would certainly serve to confuse some respondents. On the Table form, the cells for these questions could be shaded out.

The overall response rate for the take-home form was 16.7 percent; 380 forms were returned of the 2158 distributed. Only 301 forms are included in the analysis because the others arrived too late for processing. Of the 719 Long forms, 97 (13.5 percent) were returned; 84 (11.7 percent) of the Short forms; and 120 (16.7 percent) of the Table forms. The proportion of Table forms returned is significantly greater ( $\alpha = .05$ ) than both the proportion of Long forms ( $Z = 1.69$ ) and Short forms ( $Z = 2.72$ ). This is the expected result given that the Table form was two pages shorter than the Short form and four pages shorter than the Long form. On the other hand, there exists no significant differences between the response rates of the Long and Short forms ( $Z = 1.03$ ), although it is noteworthy that a greater response rate was achieved for the Long form. In sum, considering only the response rates, the Table form appears best.

The quality of the information on each form, however, as measured by the percentage of missing answers for each question, leads to a different conclusion. On the Table form, an average of 39 percent of the data is missing, compared with 31.9

percent for the Short form and 30 percent for the Long form. While no significant differences exist ( $\alpha = .05$ ) between the average percentage missing on the Short and Long forms ( $t = .481$ ) or Table and Short forms ( $t = 1.452$ ), there is a significantly higher average percent missing on the Table form than on the Long form ( $t = 1.92$ ). Thus, it would appear that, while the brevity of the Table form induced a significantly greater percentage of persons to fill out the form, respondents obviously experienced difficulties with some of the questions.

Examining the percentage of missing information on various portions of the questionnaire reveals some insights into various aspects of questionnaire design and suggests some needed changes in the take-home form.

The attitude and marketing questions were filled out relatively well on all three forms, with 7.8 percent of respondents omitting answers to the attitude questions and 10.3 percent, to the marketing questions. In both cases, the Long form has the least missing information, the Short form the most, and the Table an intermediate rate, although the differences in the rates are not great.

For the questions in Sections II and III about the time and cost of the bus ride and the alternative modes, the superiority of the Long form and the overwhelming problems of the Table form become clear. The average percentage of missing information on the Table form is between 43 percent and 55 percent higher than on the Long form. Also the percentage of missing information on the Short form is strikingly higher than on the Long form. Two explanations for the lack of response to the questions in the matrix on the Table form are possible. First, it is probable that many respondents were simply incapable of following instructions for the matrix and filling it in. Second, the instructions for the matrix occupy almost an entire column of the form and the matrix itself takes up one column. The Table form contained twelve columns of questions. Respondents might have felt that it was not worth trying to figure out the matrix when it was only one question on the form, and, anyway, they had done their "duty" by answering the other questions.

There is an obvious explanation for the somewhat better results from the Long form than the Short form in spite of its greater length: The presence of the perceptual questions sparked respondents' interest in the form.

All these factors then pointed toward a decision to use the Long form for the main survey. Two factors, however, indicated the need to make a significant modification by eliminating Travel Means C from the survey form. First, it may be noted that for all three forms, as one looks from the questions about times and costs for the bus trip, through these same questions for Travel Means A, B, and C, that the percentage of missing information increases. On the Long form, for instance, the percentages increase from 29.6 to 35.4 to 45.7 to 48.4.

The second reason for removing Travel Means C from the final version of the questionnaire was the shadow effect of the length of the modal-split questions upon the completeness of the questions following the modal-split section. Evidently, when respondents tired of the modal-split

questions, they did not look to see what came next, but were probably sufficiently deterred by the length of the questionnaire, that they simply placed it in the envelope for mailing. In fact, this effect was so severe that the missing information on the Long form is on the order of twice the percentage on the Short and Table forms. Some slight effect is seen also in the lower percentage of respondents writing comments on the Long form.

A third reason for eliminating Travel Means C was the feeling that doing so might encourage higher response rates to Travel Means A and B. That is, the respondent who, for example, worked his or her way through the questions about the bus trip and Travel Means A, might have had a negative reaction to filling out the questions twice more. By reducing the repetition from four times to three, it was hoped to persuade more respondents to persevere and complete the form.

In sum, then, while the Table form resulted in a significantly higher response rate, the Long form was completed best by the respondents. The length of the Long form, however, did result in some negative effects: a drop-off rate in answering the modal-split questions and a lower likelihood of completion of the questions following the modal-split questions. For these reasons, the final decision was to use the Long form, modified by the elimination of Travel Means C.

Thus, some very positive, and in the long run, cost-saving measures were learned from the rather extensive pilot study of the on-board and take-home forms. More importantly, a small in-house pretest on secretarial staff of the Table form had failed to uncover the full extent of the problem revealed in the pilot study. Had a decision been made to pretest just the Table form on the pilot study, the problem would have been discovered and another pilot study would have been necessary to test the Long and Short forms. Even worse, had a decision been made on the basis of an in-house pretest to use the Table form, the expensive main survey might have failed to generate data of sufficient quality to support the modeling effort.

#### The Testing of Alternative Survey Forms and Mechanisms for the Southeast Michigan Regional Travel Survey

Additional advantages of performing an extensive pilot study of the survey instruments are shown by experiences on the Southeast Michigan survey. Two alternative forms and two alternative survey mechanisms were tested. The two issues to be decided involved the procedure for querying occupation and which of the two surveys (the home-interview attitude survey and the travel logs) should precede the other.

Conventional wisdom in survey research (7,8,9) indicates that asking respondents for occupational information should be done as an open-ended question with a sufficient degree of probing until the interviewer is satisfied that he or she has obtained enough information to permit a coder to categorize the respondent correctly. Three problems exist with this procedure. First, it relies upon the quality of the interviewers to be able to probe successfully. Second, the person coding the answers does not have access to the respondent (except with the trouble of a phone call). Third, asking a respondent for both job

type (by which is meant agriculture, business, government, etc.) and work type (professional, manager, clerical, sales, etc.) as open-ended questions can lead to confusion as to the meaning of the questions.

Thus, a second procedure also was pretested in the pilot study. Response cards were handed to the respondent with answers to each of the occupation questions. The respondent was then asked to classify himself or herself with some degree of assistance from the interviewer. Interviewers were instructed to make liberal use of the "Other" categories when necessary. The categories employed are those used by the U.S. Census Bureau, with some minor wording modifications. One advantage of this procedure is that the respondent is providing his or her perception of his or her occupation. Another advantage is that, because census categories are used, the main survey can be checked against the census for response bias.

At a debriefing session of the interviewers for the pilot study, the interviewers were unanimous in the opinion that the response cards should be used. Both the interviewers and interviewees were reported to have an easier time getting to what the interviewers described as more realistic answers when they employed the cards. Thus, the second procedure was adopted for the main survey.

As mentioned above, the Southeast Michigan survey consisted of an attitude survey of one randomly-selected respondent and travel logs for each household member over the age of four years. Two possibilities existed for the survey:

Procedure 1: Distribute the travel logs, make an appointment to pick up the travel logs, and then do the attitude survey when picking up the travel logs.

(Travel log first, Interview after)

Procedure 2: Do the attitude survey and then distribute the travel logs, make an appointment to pick up the travel logs.

(Interview first, Travel Logs After)

Procedure 1 had the following advantages. Because the attitude survey was of very limited utility unless the travel logs were completed, and a high percentage of refusals to complete the travel logs was expected, time would not be spent on the attitude survey unless the travel logs were complete. It also would permit the interviewer to probe more easily for completion and correct interpretation of the travel logs. Procedure 2, on the other hand, would permit some rapport between the interviewer and the interviewee to develop during the course of the interview. It might then be expected to be easier to convince the household to take and complete the travel logs.

Both procedures were pretested in the pilot study in which 138 households were contacted. There were 41 nonresponses including 17 outright refusals, 1 termination, and 23 "no answers." Of the remaining 97 households, half were given travel logs first (Procedure 1); half, interviews first (Procedure 2). Procedure 2 was clearly superior. When presented with the travel logs first, 53 percent of respondents refused to take the travel logs, compared with a 4 percent refusal rate when the interview was done first. Evidently, it is necessary to build up rapport prior to asking respondents to participate in something which, on the surface, appears to be a

difficult task. Also, in both procedures, once respondents had complied with whatever form was presented first, very low refusal rates (4 and 5 percent) were experienced for the other form.

#### Conclusion

The benefits of testing alternative survey forms when logical arguments concerning the advantages and disadvantages of each form can be offered has been discussed. Two pilot studies designed by the authors, an on-board survey in Dade County and a regional travel survey in Southeast Michigan, have been used as examples.

The major contention of this paper is that if two or more questioning procedures can be imagined to have both advantages and disadvantages, all alternatives should be tested. Examples with respect to the appropriate place to ask for origin and destination address information on the Dade County on-board form, ways to ask modal-split questions on the Dade take-home form, ways to ask occupation questions on the Southeast Michigan survey, and the order in which survey instruments should be presented for the Southeast Michigan survey have illustrated the benefits of such a testing procedure. The implications of the results of the pilot studies of alternatives for these two surveys is that, had a wrong decision been made without the benefit of a pilot study, the final cost of the entire survey effort might have been greater than it was.

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