

PART II: STUDY DESIGN AND IMPLEMENTATION

CHAPTER 2: DEVELOPMENT OF THE CONTINGENT VALUATION SURVEY INSTRUMENTS

2.1 Introduction

The main research objective of the contingent valuation survey was to determine the economic value that people in the Greater Houston-Galveston Area place on a specified change in the environmental quality of Galveston Bay. To accomplish this objective, the contingent valuation survey instruments were carefully developed over a nine-month period, from September 1992 to May 1993. The first section of this chapter describes two aspects of the survey development process--design issues and pretesting. In the next section of the chapter, we discuss the principal design issues that we faced in the development of the survey instruments. In the third and final section, we describe the pretests we conducted in order to help us decide how to resolve these design issues. A concluding section summarizes what we learned from all three pretests.

2.2. Design Issues

In the process of designing the contingent valuation (CV) survey, we faced five main questions relevant to contingent valuation research in general:

- (1) What change in the environmental quality of Galveston Bay should respondents be asked to value, and how should this change be described (i.e., communicated) to them?
- (2) What type of interview format should be used in the survey (i.e., in-person, telephone, or mail)?
- (3) What type of question(s) (i.e., elicitation procedure) should be used to elicit respondents' valuation of the change in environmental quality?
- (4) Exactly how should respondents be told that they would have to pay for the change in environmental quality?
- (5) How could we increase our confidence that respondents in the contingent valuation survey were actually valuing the specific change in environmental quality described for Galveston Bay and not some other environmental quality change (or water quality improvements in general)?

We discuss each of these questions in turn.

2.2.1 The Change in Environmental Quality that Respondents Were Asked to Value

A contingent valuation exercise requires that a description of the commodity to be valued be communicated to the respondent. We faced two problems in this regard. Ideally, we would have wished to describe the environmental conditions in Galveston Bay that would result if a specified set of management actions were carried out. Respondents could then answer questions concerning how much such a change from the existing state to this improved situation would be worth to them. The first problem we encountered was that, at the time we began the study, no management plan had yet been proposed for the Galveston Bay system, nor was there a detailed description of environmental conditions that GBNEP hoped a future management plan would achieve. Thus, it was unclear precisely what was to be valued in the contingent valuation study.

One option for dealing with this problem was to design a management plan that we believed would be similar to the one that would eventually be proposed. This led to a second problem. The current understanding of the systems dynamics of Galveston Bay in terms of its hydrological, biological, chemical, and ecological interactions is not sufficient to predict with much confidence what changes in the bay's environmental quality would result from the implementation of any management plan. Thus, we could not confidently tell respondents how the environmental quality would change as a result of implementing a set of management actions and policies.

During survey development, we experimented with different ways of dealing with these two problems by varying our descriptions of the change in the environmental quality of Galveston Bay that was to be valued by respondents. Background information was provided to respondents that described the various functions of Galveston Bay and its importance to the economy and people of the region. This information had to be sufficiently detailed to provide a common context for evaluating the environmental quality change offered in the questionnaire but nontechnical enough that it could be understood by the general public.

The description of the commodity itself also underwent numerous changes throughout the survey development phase. We initially focused our attention on describing environmental outcomes, or improved conditions in the bay. Indicators such as acres of wetlands, numbers of oil and chemical spills per month, and safe quantities of seafood for consumption were used to describe the outcome of a management plan (i.e., a set of regulations and policies) designed to improve the quality of the bay. Uncertainty in the results of the management plan being offered in the hypothetical market was unavoidable. As a result, we included survey questions to determine the believability of the plan being offered and to distinguish those individuals who accepted the plausibility of the management plan to achieve significant environmental quality improvements from those who rejected it.

2.2.2 Interview Format

The interviews for a CV study can be conducted by mail, telephone, or in-person--or some combination of these. Each type of interview can be appropriate under certain conditions. In-person interviews are generally considered to provide the highest quality data if resources are available to properly train and supervise the enumerators (National Oceanic and Atmospheric Administration [NOAA], 1993). The major disadvantages of in-person interviews are their expense and the possible biases introduced by different enumerators asking the same question in different ways.

Telephone interviews offer several advantages. First, they are relatively inexpensive and can be carried out in a short time. Second, random-digit dialing methods can be used to access a relatively representative sample frame. Third, response rates in well-conducted telephone surveys are quite high--approximately 75 percent in the United States. Fourth, as with an in-person interview, the interview is interactive: the respondent can ask the enumerator questions if something is unclear or requires clarification.

There are, however, two main disadvantages of a telephone survey for the purposes of this research. First, it is difficult to convey much information about the hypothetical scenario over the telephone. For example, it is not possible to show the respondent pictures, diagrams, or lists of items to consider. Second, the amount of time respondents are generally willing to spend on a telephone interview is quite limited (typically about 10-15 minutes in the United States).

Mail surveys have often been used to carry out CV interviews. Mail surveys are less expensive than in-person interviews and avoid the problems introduced by differences among enumerators that arise with in-person interviews. Response rates in properly designed, well-executed mail surveys are generally high. However, the sequence in which the respondent reads the questions in a mail survey cannot be controlled, and this precludes the use of many of the types of questions that CV researchers would like to ask. Also, mail surveys obviously cannot be completed by illiterate respondents.

These three types of interviews can be combined in different ways in an attempt to minimize the disadvantages of each approach. For example, a respondent may be asked to complete and return a mail questionnaire; this may be followed up by a telephone interview. Other possibilities include a telephone/mail/telephone sequence and a mail/in-person sequence.

An important design issue for us was which type of interview format to use in this study.

2.2.3 Elicitation Procedure

There are different ways of asking a respondent about how much his or her household values a specified improvement in environmental quality. One possibility is to ask the respondent a direct question about the most he or she would be willing to pay for the environmental quality

improvement; this is termed a *direct*, or *open-ended*, question. However, respondents may find this type of question difficult to answer for a public good such as improved environmental quality because an individual would not consider it fair that he should have to pay more than other similar households.

Respondents may be shown a list of possible answers in the form of a *payment card*, and asked to indicate their selection from the list. This approach cannot easily be used in telephone interviews or in places with high illiteracy rates. It also requires careful selection of the range of possible answers to be presented on the payment card.

An alternative approach is simply to ask the respondent a question regarding how he or she would vote in a public referendum to implement a management plan for Galveston Bay if it cost households a specified amount. By varying the amount specified to different randomly selected subsamples, it is possible to derive an estimate of the economic value of the management plan (or its anticipated environmental quality improvement) to different types of households and to the entire sample. This is generally considered to be the most reliable method of elicitation currently available for contingent valuation studies (NOAA, 1993).

2.2.4 Payment Vehicle

The goal of a contingent valuation survey is to get respondents to seriously consider the hypothetical good or service described and the choice(s) they are being asked to make in the interview, and to provide answers that would be the same as their actual behavior if they were offered a real choice. This requires that the valuation questions be posed in as realistic a manner as possible. Specifically, this requires that respondents consider the actual manner in which they would pay for the proposed change in environment quality. The method of payment, the institution responsible for collecting the payment, and the duration of payments are all collectively referred to as the *payment vehicle*.

A good payment vehicle for a contingent valuation study should be considered by respondents to be both fair and believable. The duration of payments (i.e., the length of time over which respondents commit to pay) should contribute to the believability of the hypothetical scenario. Any management plan for Galveston Bay would require a commitment of funds over a considerable length of time. However, recent literature on the contingent valuation method (Carson et al., 1992) indicates that long payment periods suffer from a recontracting problem, i.e., people believe that they can renegotiate the payment after a number of years. These authors discourage using payment periods exceeding two or three years. While a long payment period may suffer from recontracting biases, a payment period that is too short may be implausible.

Because Galveston Bay has a number of functions and is used in many ways, we had several plausible payment vehicles from which to choose. These included recreational use fees (e.g., park entrance fees, boat launch fees, etc.), higher water and sewer rates, higher prices on goods

and services produced and transported on the bay, and various types of taxes.

2.2.5 Tests of Reliability of the Respondents' Answers to Valuation Questions

Probably the most worrisome potential error in a CV survey is that a respondent may not reveal his or her true value of the good or service. Many people have questioned whether respondents answer contingent valuation questions accurately and reliably when they are not making real monetary commitments. There is little empirical evidence comparing individuals' hypothetical willingness to pay to their actual willingness to pay.

There are two ways of minimizing the risk of some of these errors and biases. First, contingent valuation researchers have devised ways of minimizing the occurrence of some types of errors and biases. Second, even if the probability of the occurrence of certain types of errors and biases cannot be reduced, the cost of being misled by poor quality estimates can be reduced by finding out whether or not a particular bias exists. In some cases, the magnitude of the bias can be estimated and the estimates of respondents' willingness to pay can be corrected to offset this bias.

There are several procedures for implementing this second approach. Experimental design procedures can be used to detect whether subgroups of the overall sample respond to changes in the survey instrument in the way one would expect. The use of *split samples* to test the accuracy and reliability of WTP responses can be quite tricky and requires considerable care in survey design. Only a limited number of such experiments can be conducted in a single study because of their expense. An important design issue in this research was thus to determine which of such experiments would be most informative and useful to decision makers in terms of developing a better understanding of the robustness and reliability of the results.

In the next section of this chapter we describe the process we used to resolve these five design issues.

2.3 Survey Development Process

2.3.1 Interviews with Focus Groups

Preliminary development of the survey instrument took place during the fall of 1992. We conducted in-person focus interviews in October during an initial visit of the research team to Houston, and open-ended telephone interviews with residents of the Greater Houston-Galveston Area during November 1992. The purpose of these initial contacts with people in the Greater Houston-Galveston Area was to gain insight into the scope of their knowledge about Galveston Bay, their use the bay for recreational purposes, their awareness of policy issues, their ability to comprehend different possible management actions to clean up Galveston Bay, and their acceptance of different means of paying for a management plan.

Of the 21 persons interviewed, most were averse to any type of taxation as a payment vehicle. User fees of all types were clearly preferred to taxation. Fishing and boating were the recreational activities most often mentioned by respondents; swimming in the bay was generally considered undesirable. Most people ate seafood, but many did not know whether or not it came from the bay. Many people commented that they believed the bay was "dirty."

2.3.2 Pretests

We conducted three pretests before carrying out the final contingent valuation surveys. These pretests took place in December 1992, February 1993, and March 1993. The sections below describe what we expected to learn from each pretest, how we went about testing or gathering the information, and what was actually learned.

Pretest 1: December 1992

The focus interviews provided some basic information about how much people knew about the bay and about their use of the bay. But for the final survey we needed to learn more about what was and what was not a plausible valuation scenario. The objective of this first pretest was to see if respondents would value increasingly stringent management plans more than less stringent ones, and to test the wording of questions about environmental attitudes and perceptions, socioeconomic and demographic characteristics of respondents' households, and respondents' uses of the bay. We also wanted to gauge reactions to the payment mechanism and elicitation method.

This first pretest was a mail-only survey. We sent questionnaires to a sample of 100 households drawn at random from phone book listings in the five-county area. The number of recipients in each county was in proportion to the ratio of that county's population to the population of the Greater Houston-Galveston study area.

The questionnaire began with a description of current and projected states of the bay (given current trends if no management plan were to be implemented) and a brief discussion of the need to establish a balance among all the users of the bay. A set of questions about recreational uses and attitudes and perceptions of social and environmental problems preceded a discussion of three management plans (commodities), how these management plans might be paid for, and the valuation questions themselves. The final section contained questions about personal and household socioeconomic and demographic characteristics.

In this initial pretest, each respondent was asked to value three different management plans, which were presented in terms of the environmental conditions that would result 20 years after implementation. These management plans were presented in order of increasing stringency. The first plan only proposed to arrest current trends, maintaining water quality indicators and wetland areas at current levels. The second plan went further in improving water quality and

protecting wetlands, offering indicators on increased safe seafood consumption, reduced numbers of oil and chemical spills in the bay, and reclamation a 20-square-mile area of wetlands over the 20-year policy period. The third plan was the most ambitious. It offered unlimited safe seafood consumption, drastically reduced numbers of oil and chemical spills, and 40 square miles of wetlands to be reclaimed over the 20-year period.

The respondents were asked to think about paying for these management plans through a composite payment mechanism. This was described as "some combination of the following methods" of recovering costs: (1) entrance fees charged at parks, beaches, and boat launches on the bay and increased license fees for fishing and boating; (2) increases in monthly sewage treatment fees on utility bills; and (3) increases in prices for goods transported through the bay or produced in the region that impact the bay. Though a variety of means would probably be used to pay for an actual management plan, it was not clear from the results of this pretest that respondents could conceptualize a monthly lump sum that would include changes in prices, fees, and higher water and sewer prices.

For the elicitation procedure, we used a payment card format for two versions of the questionnaire and an open-ended question for a third. The payment cards (two different lists of possible monthly payments ranging from \$0 to \$50 in differing increments, one for each questionnaire version) were reproduced in the questionnaire below a question asking whether or not the respondent would be willing to pay to support a management plan like the one described. The respondent was asked to circle the payment that represented the maximum that he or she was willing to pay to support the plan. The open-ended versions left blank spaces where the respondent could fill in their desired monthly payment amount. We chose to use this format to gather information on the range of values that respondents might put on any of the plans. This would give us insight into the range of values to offer as prices for the management plan in subsequent pretests.

In addition to specifying a total monthly payment that respondents would be willing to pay for the management plan, we also asked them to divide their monthly payment between the two components of each plan: water quality improvements and habitat protection. The purpose of this exercise was to ascertain if the respondents valued one component of the plan more than the other, to see if they could perform such a disaggregation, and to provide a test of the stability of their original offer.

We received 22 responses to this mail pretest questionnaire. The payment cards appeared to solicit lower bids than the open-ended valuation questions. The range of non-zero bids that respondents offered was from \$.80 to \$25.00 per month. The results of the pretest showed that respondents had a difficult time following our instructions to value each of the three plans and break down their values into components. If the three plans were indeed perceived by respondents as points on a continuum of possible management options that represented increasingly "better" products as environmental protection and clean-up increased, economic theory suggests that respondents should value the third plan at least as much as (and probably more than) the second, and the second at least as much as the first. The results of the pretest

showed that this was not the case. All respondents were offered the three plans, but most chose to value only one or two of the plans. Our design suffered from what might be called a Goldilocks syndrome: the first plan was considered too lenient, the third plan was considered too stringent (or assumed to be too expensive), and the second plan was "just right." These results may have been affected by the order the management plans were presented in the questionnaire, but it was not clear that a reordering would have elicited more accurate responses to the valuation questions.

In only seven of the twenty-two responses did respondents offer valuations for more than one plan. In only two of these seven did respondents increase their monthly payment from one level to a higher one for a more stringent plan. The remaining five respondents did not change their bids from one plan to the next. It was not clear from the pretest why respondents' valuation answers were not sensitive to the stringency of the management plans offered.

Pretest 2: February 1993

The second pretest turned out to be much more of a prototype of the final survey than the first had been. Based on the first pretest, we concluded that respondents needed more information about Galveston Bay and its environmental problems before they could make a reasoned decision on how much it was worth to them to improve its environmental quality. For the second pretest we decided to test the following interview procedure. We sent an introductory letter to a sample of 100 respondents selected randomly from the phone books of four municipalities around a single site--Mall of the Mainland, in La Marque, Texas--inviting them to participate in our study. With this letter we attached a written questionnaire that included a description of the existing state of Galveston Bay and one of three management plans for environmental quality improvement. This written questionnaire contained questions about the respondent's uses of the bay and environmental attitudes and perceptions, but it did not include the valuation questions. Rather, respondents were asked to complete the written questionnaire and to think about how much they would be willing to pay for the management plan described in the questionnaire.

In addition, we sent a 13-minute video to one half of the sample and asked them to watch it before completing the questionnaire. The video was prepared by the Galveston Bay National Estuary Program (GBNEP) to portray the various uses of the bay and their long-term impacts on the bay's environmental quality. All questionnaires contained the same written description of the existing conditions in the bay; however, respondents who watched the video saw a graphic depiction of the current condition of the bay and its competing uses.

We instructed the respondents to return the written questionnaire to us at the Mall of the Mainland during specified hours on the weekend of Feb. 5-7, 1993. We told the respondents that, when they returned the questionnaire to us, we would conduct an in-person interview. We offered to pay respondents \$25 for their participation in the study (upon completion of the in-person interview at the mall). We chose to have the respondents meet us at a mall for the interview rather than having our enumerators visit their homes because resources for the survey

were not sufficient to undertake the latter approach.

In this second pretest we also explored the use of a referendum format (instead of the payment card) for the elicitation method, a change in the payment vehicle, the introduction of a treatment to test for the effect of information on willingness to pay (i.e., the video), and the effect of different descriptions of the change in environmental quality. Judging from the responses to the first pretest, the simultaneous valuation of three management plans was too confusing for most respondents. In the second pretest we thus chose to offer different management plans to randomly selected subsets of the sample. Three new management plans were constructed. The first, Plan A, included a list of measures that would be implemented for Galveston Bay along with a description of expected outcomes of the plan after 20 years. We included a summary table that illustrated the current state of the bay, the expected situation after 20 years without the management plan, and the expected situation with the management plan in place after 20 years. Plan B differed from Plan A only by the magnitude of expected outcomes. For every indicator, Plan B offered significantly better results over the 20-year policy period. Plan C was similar to Plan B, except it covered not only Galveston Bay, but all the bays and bayous along the Texas Coast. We expected respondents to be willing to pay more for Plan C than for Plan B (or A), and more for Plan B than Plan A.

We used a referendum format to ask respondents if they would vote for or against the management plan described in the questionnaire if it cost their household a specified dollar amount per month. The specific referendum points that we used were \$5, \$10, \$20, and \$50, randomly assigned to respondents as they came in to be interviewed at the mall. The payment vehicle for this pretest was changed to a surcharge on the respondent's monthly water bill (or some other utility bill for households without a water bill). If they voted for the management plan at the first amount offered by the enumerator, they were then asked if they would still vote for the plan if it cost them the next higher amount. If they responded negatively to the first question, respondents were asked if they would vote for the management plan at the next lower specified amount. This elicitation design is known as a *double-bounded dichotomous choice* format (Hanemann, Loomis, and Kanninen, 1991). Regardless of their response to the second valuation question, the respondents were then asked an open-ended question to elicit their maximum willingness to pay for the management plan described in the questionnaire.

We also asked respondents to choose from a list of common monthly expenditure items (food, transport, etc.) that they might reduce in order to pay for the management plan. We asked them if they felt such a reduction was realistic, and if the answer was no, gave them an opportunity to revise their bids.

Respondents who had originally received management Plan A were asked their willingness to pay for Plan B, respondents initially given Plan B were subsequently given Plan C, and respondents initially given Plan C were subsequently given Plan B. We asked a single open-ended question about monthly willingness to pay to support the subsequent management plan.

We did not know what response rate to anticipate with this mail/in-person interview procedure, but it was clear that the pretest data set would be much too small to rigorously test the effect of all these variations in the experimental design on respondents' valuation responses. This was not our purpose. Rather we were primarily interested in testing how the logistical arrangements for this interview procedure would work in practice, and what final response rate we could anticipate. We also hoped to form subjective impressions about how people responded to questions in both the written and in-person portions of the interview.

The response rate in this second pretest was disappointing: only 24 percent of the total mailings. We learned, however, that follow-up telephone calls to individuals in the sample were essential to remind people about the in-person interviews at Mall of the Mainland and to convince them that the survey was not a clever marketing promotion. The results of this second pretest seemed to support our impression from the first pretest that there was not a clear relationship between the stringency of the management plans and people's willingness to pay for them. In addition, we found that respondents' willingness to pay for the Texas Coast management plan, Plan C, was often influenced by their calculations of how many other people in the state of Texas would be paying for the plan.

People who received the video enjoyed watching it and felt that it was a balanced, unbiased presentation of information. Of the total number of respondents in this pretest (24), 14 had received the video and 12 of them had watched it. Ten respondents felt that the video helped them think about their willingness to pay for a management plan, though only two felt that their willingness to pay would have been different if they had not seen the video. The actual effect of the video treatment on respondents' willingness to pay could not be reliably assessed given the small number of respondents.

Pretest 3: March 1993

We conducted a final mail/in-person follow-up pretest in March 1993 in order to collect additional information on response rates in a different part of Houston (farther away from the bay) and to test respondents' reactions to further revisions in the commodity offered. This final pretest incorporated comments we received on our second pretest survey instruments from our technical review panel and GBNEP staff. In particular, GBNEP staff felt that the final survey should focus more on program components of the management plan and not on the environmental outcomes that would result from the management plan. The GBNEP staff and our technical panel felt that it was best to let the respondents make their own judgments about how environmental conditions would change as a result of implementing the management plan described.

The revised management plan for this third pretest included two types of components: (1) regulatory actions and (2) new programs to improve the environmental quality of the bay. The regulatory actions centered on new or more stringent regulations on discharges into the bay, and increased monitoring and enforcement of existing legislation. The new programs in the management plan described clean-up programs for shoreline areas, creation and protection of

habitat areas, regular seafood testing, and a rapid response program for cleaning up spills. Half of the sample in the pretest received Management Plan 1 with only regulatory actions included; the other half of the sample received Management Plan 2 which included both regulatory actions and the new programs.

A sample of 120 households was selected at random around Northwest Mall in northwest Houston. We employed a professional sampling firm, Survey Sampling, Inc., to draw the sample. Our intention was to use this firm to select the sample for our final survey, and we wanted to have a trial run working with them. Since the final sample would require a complex procedure involving three different interview locations (i.e., three malls), this trial run was used to help us estimate necessary lead time for final sample preparation and preparation of mailings.

All respondents in this pretest were sent a video, and the referendum questions were identical over the whole sample. We offered to pay the respondents \$20 to participate in the survey (traveler's checks were available in denominations of \$20; we were prohibited by the site administration from dispensing cash to participants). Our assessment of the previous pretest's response rate led us to believe that the timing and duration of our interview times had been inconvenient for people. We allowed for one additional weeknight of interviewing during the third pretest to address this.

The response rate to this final pretest was again disappointing: only 12 percent. Our enumerators reported that they felt respondents did not perceive much difference between the two management plans. The main features for which they were willing to pay appeared to be included in Plan 1, but the sample size was much too small to draw definitive conclusions.

Lessons Learned from Combined Pretest Results

After the completion of all three pretests, we were able to study the combined information from all the respondents. We obtained two insights from this analysis. The first concerned preferences for different payment mechanisms that could be used to pay for the management plan. Table 2.1 shows the results of questions asked in each pretest that elicited preferences for different possible payment mechanisms. Respondents were asked to register their opinion on as many payment mechanisms as desired, so the total does not correspond to the number of respondents in the pretests. The results show that user fees were preferred. However, user fees are not borne by all members of the population; they might have the support of nonusers because the latter would not be affected by increased user fees. We decided to use increased water and sewer charges because this was the most popular payment vehicle that almost everyone would actually have to pay, regardless of how much they used the bay, and it was disliked the least of all that we had listed.

Second, the pooled data on the socioeconomic characteristics of the pretest respondents indicated that we had a sample selectivity bias. In comparison with the 1990 US Census data available for the five-county area, our respondents were more highly educated, had a higher mean annual income, and were more likely to be homeowners and Caucasian than would be suggested by a

random sample of the general population (see Table 2.2). Since a biased sample has important implications for the results of a study, we took several additional steps for the final survey execution to increase the response rate and to include types of persons who did not participate in the pretests. Most important, these steps included a decision to raise the payment to respondents to \$50.

Table 2.1 Payment Mechanism Results, All Pretests Combined		
	Preferred (Number of times mentioned)	Disliked (Number of times mentioned)
Fees at beaches, boating launches and parks	20	9
Increased license fees for fishing and boating	15	6
Increases in monthly sewage treatment costs	16	4
Higher prices on goods produced that impact the bay or are transported through the bay	21	10
Sales Tax	6	19
Increases in Property Taxes	3	28
Other	8	1

Table 2.2 Pretest Respondent Profiles

Pretest	Number of Respondents	Mean Age	% Male	Years of School	% Home-owners	Median Income	Mean Income	% Caucasian	% African-American	% Hispanic
Pretest 1	22	43	70	15.8	70	\$55,000	\$73,636	82	5	9
Pretest 2	24	46	71	14.9	75	\$45,000	\$47,916	71	8	17
Pretest 3	12	58	75	15.7	75	\$35,000	\$48,750	92	0	0
Combined	58	43	72	15.4	74	\$45,000	\$57,845	79	5	10
Census	N/A	41	50	12.9	54	N/A	\$41,064	57	18	21

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CHAPTER 3: FINAL QUESTIONNAIRE DESIGN AND SURVEY IMPLEMENTATION

3.1 Introduction

This chapter describes the design of the final contingent valuation questionnaires and the survey implementation procedures used in carrying out our research. We decided to split the data collection effort into two parts: (1) a mail survey followed up by an in-person interview (followed by a short second written questionnaire), and (2) a mail-only survey. We refer to the former as the *mail/in-person follow-up* survey and to the latter as the *mail-only* survey. A graphic representation of the survey design is provided in Figure 3.1. The use of these two survey approaches allowed us to compare the effect of survey format on respondents' answers. Such a comparison offers one check on the robustness of the valuation estimates.

The two survey instruments contained many of the same questions. However, the mail-only survey had to be shorter in order to increase its response rate (i.e., not exhaust respondents' patience). The questionnaires for the mail/in-person follow-up are first described in detail. We then describe how the mail-only questionnaire differed from the mail/in-person follow-up. Where possible, we used the Dillman Total Design Method (Dillman, 1978) to prepare our survey materials and mailings. Other important sources contributing to the design of these questionnaires were Carson et al., 1992; Mitchell and Carson, 1989; and NOAA, 1993.

3.2 Questionnaire Design

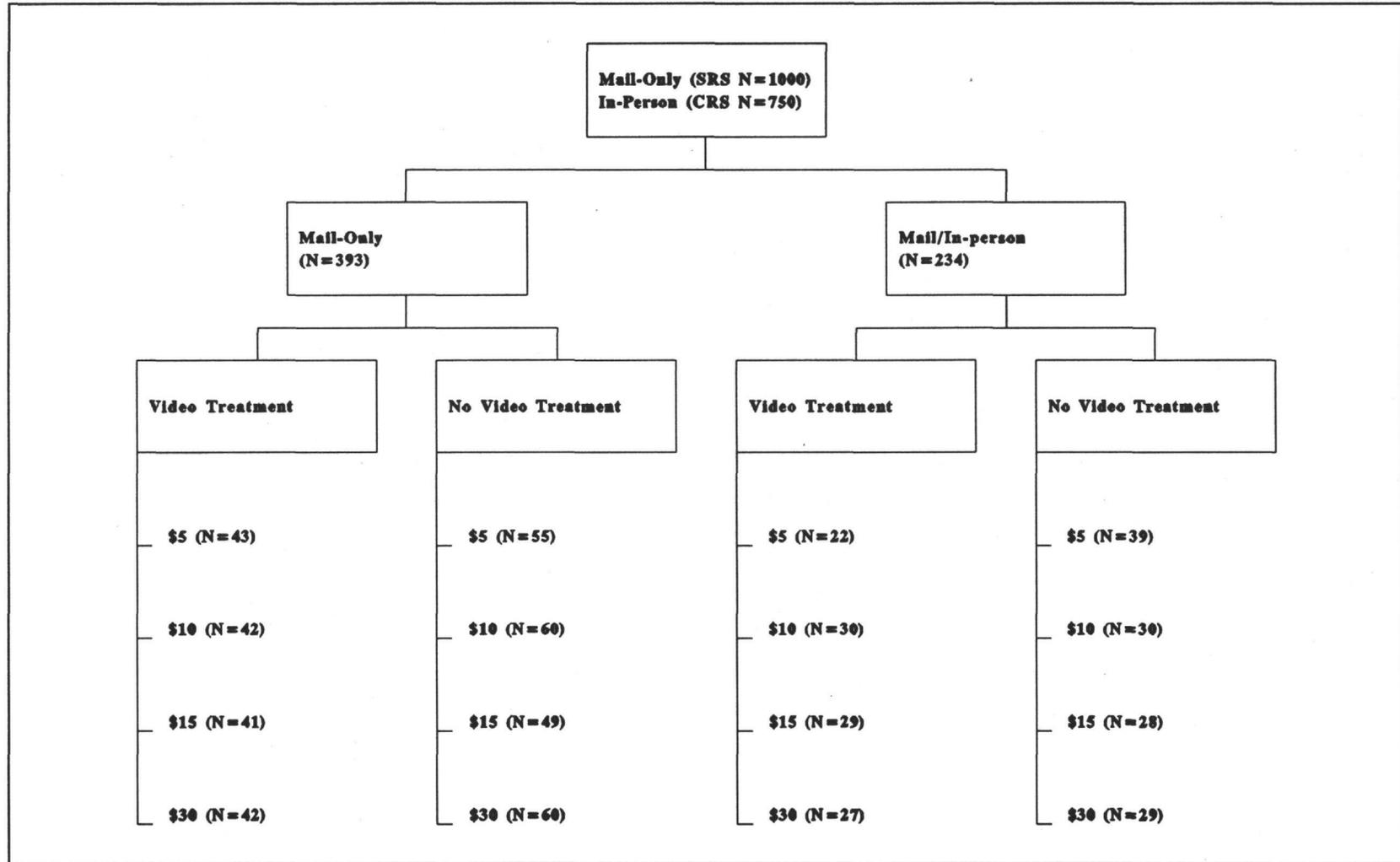
3.2.1 The Mail/In-Person Follow-up Survey

The data collection effort for the mail/in-person follow-up survey consisted of three main steps. First, a survey packet was sent to each household in a sample of 750 households.⁷ This packet contained a letter of introduction, a questionnaire booklet, and for one half of the respondents, a 13-minute videotape.⁸ The second step of the data collection effort was to conduct in-person interviews with respondents. The third step was a brief written questionnaire that respondents were asked to complete after they finished the in-person interview; it concerned their demographic characteristics and recreational use of Galveston Bay.

⁷ The subject of sampling and location of potential respondents will be taken up briefly in Section 3.3, Survey Implementation, and in depth in Appendix 2.

⁸ The contents of the survey packet, including the questionnaire (but excluding the video), are provided in Appendix 3.

Figure 3.1:
Research Design of the Contingent Valuation Study



In the cover letter, respondents were asked to read the enclosed information (and watch the video, if applicable) and then to complete the enclosed written questionnaire. They were then asked to return the completed written questionnaire to one of our three interview locations during any of a specified set of dates and times. The three interview locations were all safe, familiar places near their homes.⁹ After arriving at the designated location, they participated in an in-person interview. In this 30-40 minute interview we asked respondents whether they would vote for or against the management plan described in the mail questionnaire, as well as questions regarding attitudes, recreational travel costs, and personal profile questions. In the following sections we describe in detail the rationale for the questions and wording that we chose.

The Survey Packet

The letter of introduction was our first interaction with potential respondents. After identifying ourselves and the purpose of our research, we invited the recipient to participate in the study. The written questionnaire that was included in the survey packet consisted of three sections. The first asked questions about the respondent's attitudes and priorities for social, economic, and environmental issues. The second section included questions about the respondent's recreational use of the bay. In the third section we provided the respondent with background information about the current state of the bay and expected trends, and described a set of management actions proposed for the bay. Finally, we asked respondents to think about how much they might be willing to pay for a management plan such as the one described, allowing them time to think about the plan and their response prior to the in-person interview. To maximize the likelihood of their participation, respondents were told in the initial correspondence that they would be paid \$50 for their participation in the study.

In constructing the questionnaire booklet, we wanted the respondents to not only answer the questions, but also to be motivated by the questions into thinking about the bay and their existing and potential uses of its resources. We thus began with general questions about social priorities. The first question asked respondents to rank their first and second choices for government action on current issues affecting residents in the Greater Houston-Galveston Area. This question was intended to place the respondent's concerns for the environment in the larger context of other social priorities. The list of problems from which they were to select their priorities was adapted from both Carson et al., 1992, and Stephen Klineberg's Texas-wide environmental attitudes survey (1993).

Next, we asked respondents to prioritize a list of environmental problems in Galveston Bay. This served partly as a means of testing which aspects of the pollution problem in the bay had the most salience with respondents and also as a means of reminding them of the various sources of degradation of the bay's environment. Likewise, the remaining questions in the section elicited information on how aware respondents were of environmental problems in the bay and provided us with several measures of respondents' attitudes towards environmental protection

⁹ Two of the enumeration sites were shopping malls; one was a community center.

in general.

In the second section of the questionnaire, we asked respondents about their recreational uses of the bay. The pretests indicated that respondents tended to include the beaches along the Gulf Coast (Galveston Island and the Bolivar Peninsula) when asked to report on their use of beaches on Galveston Bay. In the final survey versions, these questions were reworded to specifically exclude those areas. Respondents were asked to recollect how many times over the past 12 months they had gone swimming, bird-watching, hunting, fishing, boating, or to a beach in or around Galveston Bay.

The third, final section of the written questionnaire presented the valuation scenario. In order to ensure that respondents all had at least some basic information about the bay, we began with background information that explained the various uses of the bay (shipping and port facilities, oil and gas refining, oyster production and other estuarine life support, and recreational use). The effects of changes in population and economic growth on the area over the past 50 years were described, and these changes were related to their impact on the environment of the bay.

Using this depiction of the existing situation in the bay, we projected these trends 20 years into the future to provide a plausible description of the state of the bay if no management plan were implemented. In our portrayal, water quality remained at current levels while the area of habitat loss was increased. This representation of the expected future state of the bay was based on conservative assumptions about trends in water quality and habitat loss. The purpose of providing this information was not only to motivate serious consideration of the management plan but also to develop a uniform expectation about an uncertain future.

The final section of the valuation scenario described a proposed set of management actions that included regulatory changes as well as new programs designed to improve the environmental quality of the bay. As noted in the previous chapter, due to the uncertainty surrounding the effects of such a set of actions and programs, we were discouraged by the Galveston Bay National Estuary Program from presenting potential outcomes of the plan. We thus kept our description of expected outcomes somewhat vague. Respondents' answers were expected to be significantly influenced by their expectations of plan efficacy.

At the end of the description of the hypothetical management plan, respondents were instructed to think about how much they would be willing to pay per month to support such a proposed management plan for Galveston Bay. They were again encouraged to participate in the in-person interview (the available times and dates were reiterated at the end of the survey form) and thanked in advance for their participation.

The In-Person Interview

The follow-up in-person interviews were arranged so that respondents had 10-20 days from the time of receipt of the initial survey packet until the time of the in-person interview. This period allowed them time to think about the components of the plan and their uses of the bay

(Whittington, et al., 1992).¹⁰ During the in-person interview, the enumerator read instructions and asked questions aloud that were orally answered by the respondent. Aside from the valuation question itself, we used this interview to explore motivations for the valuation responses. In particular, we wanted to know whether or not respondents accepted the described management plan as viable or considered the proposed management changes important. In addition, attitudes toward the proposed management plan and motivations for their responses were explored.

After a brief introduction and statement of appreciation for the respondent's participation, we provided some general guidelines for the interview process. The enumerators stressed that there were no correct or incorrect answers to the questions, and that only the respondent's honest feelings and opinions were being sought. In addition, the enumerator assured respondents that if the content of any question made them uncomfortable, they were permitted to skip the question.

The enumerators then introduced the subject of support for the management plan. They began by reminding the respondents of their budget constraint and current expenses as well as the availability of substitute recreational locations (outside of Galveston Bay). To refresh respondents' memory of the plan they had received in the mail, they were asked to take a few minutes to re-read the components of the management plan that we had described. The enumerators responded to any questions that the respondent had about the management plan.

The next step was to explain the referendum market by describing how the respondent's preferences would be recorded (i.e., by voting, as in a municipal bond referendum), and the payment mechanism. To minimize interviewer bias, we adopted the following wording as employed by Carson et al. (1992), that tried to assure the respondent of the acceptability of whatever the respondent's reaction to the management plan might be:

We have found that some people would vote for the management plan because they feel that it is worth the money it would cost them to improve the environmental quality of Galveston Bay. Others that would vote against the management plan usually mention one of the following reasons. The first is that they are concerned that it would reduce economic growth in the region. Another is that they feel there is not enough information available about how to clean up Galveston Bay. Others think that the money they would have to pay for the management plan is more than they can afford.

As a final precursor to the valuation question, we explained that the payment would be collected either as a surcharge to the respondent's water bill or, if the respondent did not pay a water bill, as a surcharge to another utility bill.

The precise wording of the valuation question was:

Suppose that government officials estimated that the management plan would cost your household

¹⁰ Respondents also had time to call and verify the validity of the study if they wished.

\$5 per month for five years, (i.e. a total of \$60 per year for five years).¹¹ This money would only be used to pay for implementing the Galveston Bay management plan, and would be administered by state and local government agencies. Assume that industries would pay the cost of cleaning up the pollution that comes from their facilities.

Given your current income and expenses, if implementing the management plan cost your household \$5 per month for five years, would you vote for the management plan or against it?

Respondents indicated whether or not they would vote for the plan at the specified amount, and the enumerator recorded any open-ended comments that were made by the respondent. The open-ended comments were later used to help understand respondents' motivations for their responses.

After respondents answered the first referendum question, the enumerator posed a second question to the respondents. If the answer to the first question had been affirmative, respondents were asked if they would vote for or against the management plan if the cost were revised upward. Likewise, if the answer to the first question was negative, the estimates were decreased and the referendum question was posed again.¹² Table 3.1 shows the schedule of starting point values and the price revisions offered to respondents in each starting point category.

Table 3.1 Schedule of Referendum Points for Double-Bounded Dichotomous Choice Elicitation Questions		
Referendum Starting Value	Increased Cost of Management Plan	Decreased Cost of Management Plan
\$5	\$10	\$2
\$10	\$15	\$5
\$15	\$30	\$10
\$30	\$50	\$15

Respondents who answered no to both referendum questions were asked an open-ended question: "What is the maximum that you would be willing to pay per month over a five-year period to

¹¹ Five dollars is one of the four referendum points that were randomly assigned to respondents as they came in for an interview. The other three points were \$10, \$15, and \$30 per month for the five-year period. Annual figures were adjusted accordingly.

¹² This elicitation procedure is termed the double-bounded dichotomous choice approach.

support the management plan?" The reason for this question was to separate respondents who truly were willing to pay nothing for the plan from those whose WTP value was simply less than the amounts offered to them by their random selection into one of the four starting value groups.

Those who expressed zero willingness to pay were subsequently asked an open-ended question about why they voted against the management plan. The purpose of this question was to examine the motivations behind such a response, particularly to determine if the respondent did not think the implementation of the management plan was believable or credible. Likewise, those who offered a positive response to either of the referendum questions were asked to explain their reasons for supporting the management plan described in the questionnaire. Responses to this question were used to assess the believability of respondents' answers and their comprehension of the components of the management plan.

Respondents who voted for the plan were then asked to divide their maximum willingness to pay between the amount they were willing to pay to support their own and members of their households' uses of the bay, and the amount that "was just for . . . other households in the Galveston Bay area, as well as future generations, to use and enjoy the bay." This question is a highly simplified version of questions explored in the pretests to elicit passive use values. The distinction between self's and others' uses (including future generations) was the simplest, most comprehensible distinction that we could employ. It did not, however, explicitly distinguish existence values. Respondents whose percentages did not sum to 100 percent were informed about this and asked, "Would you like to change your response, or is there something else you were considering?"

To determine existence value, another set of questions was asked of those who had indicated a positive valuation for the plan. We asked respondents if they would still be willing to pay the same amount for a management plan for Galveston Bay if they no longer lived in Texas. If they were not willing to pay the same amount, we asked them how much they would be willing to pay, and why.

Subsequent questions attempted to explore respondents' attitudes, beliefs, and expectations of the proposed management plan's effectiveness. We asked a question to elicit respondents' awareness of their own impact on the water quality of Galveston Bay. If the respondent acknowledged impacting the bay (either positively or negatively), he or she was asked two questions. The first was an open-ended "How?" The second question asked the respondent to judge if the impact that their household makes on water quality is more than, less than, or the same as other households in the Greater Houston-Galveston Area.

Another question explored respondents' perceptions of their own responsibility to pay for a management plan. Persons who indicated that they thought there should be a management plan for the bay were asked the open-ended question, "Who else should be responsible for paying for a management plan for the bay?" They were then asked to indicate, on a scale from 1 to 10, how responsible they felt for financially supporting a management plan for Galveston Bay, and why. Respondents were also asked to assess on a scale from one to ten how likely they thought

it was that the management plan described in the questionnaire would actually result in improved environmental quality (with 1 being not very likely and 10 being very likely).

Another set of questions explored how important the various features of the management plan were to each respondent and probed the respondent for features he or she thought should be added or deleted from the plan. Answers indicate the features that were central to the valuation responses and those that were peripheral.

Remaining questions asked those respondents who had received a video if they had watched it and when; whether they felt it was biased in its presentation of issues; and if they felt the video influenced their willingness to pay for the management plan. We also asked respondents if they felt that the questionnaire that they received in the mail was biased in any way.

Written Follow-up Questionnaire

At the end of the in-person interview, the enumerator determined which sections of the written follow-up questionnaire to administer to the respondent by asking several questions about the respondent's recreational use of the bay. This written follow-up questionnaire consisted of two parts: a personal and household demographic profile and, for individuals who had engaged in recreational boating or fishing in the last 12 months, questions about the time spent and the expenses they incurred while participating in these activities. The household profile included questions regarding the respondent's personal political views on a number of controversial social issues. These included questions about attitudes toward government intervention and abortion.

3.2.2 Mail-Only Survey Questionnaire

The mail-only survey questionnaire was designed to be comparable to the mail/in-person follow-up survey in terms of the questions asked. However, for several reasons we were unable to precisely replicate the mail/in-person follow-up design in the mail-only survey. First, in a mail survey there is little control over the order in which people read and answered the questions. Second, we did not have the resources to offer comparable financial incentives to participants in the mail-only survey. As a result, the questionnaire itself had to be considerably shorter, allowing for comparability between the two survey types only on a restricted number of questions.

Simplification of the survey instrument required that only the most important questions be retained for comparison between the two survey types. Open-ended questions were practically eliminated in the mail-only survey to reduce the effort required of respondents. The questions that were included in the mail-only survey appeared exactly as in the mail/in-person follow-up survey.

The mail-only survey instrument was comprised of six sections: social, economic and environmental issues; uses of the bay; the commodity description and valuation question;

demographic information; opinions about the survey materials; and travel cost information. Section 1, questions on social, economic, and environmental issues, was essentially the same as in the mail portion of the mail/in-person follow-up survey. Section 2, on recreational use of the bay, and the first part of Section 3, background information about Galveston Bay and the description of the management plan, were likewise identical to the questions included in the mail/in-person follow-up survey.

The end of Section 3 contained the elicitation question and several of the attitudinal questions from the in-person interview. Again the elicitation question was a referendum-style question, but only a single dichotomous choice question was asked. The starting point values for the referendum were the same as in the mail/in-person follow-up survey (\$5, \$10, \$15, and \$30), as was the payment mechanism and term of payments. We omitted questions about why the respondent voted for or against the plan; questions that probed for likes, dislikes, and deficiencies of the management plan; and several others.

Section 4, which requested demographic information, included most of the questions from the mail/in-person follow-up survey. We did delete the four questions that probed political views on sensitive social issues since they appeared out of context in the mail-only survey.

Section 5 was mainly used to determine whether or not respondents who had received the video had in fact watched it. An open-ended question allowing for general comments on our research and survey materials ended the main survey form. Respondents were requested to complete the final page of questions (Section 6) about recreational travel costs only if they had fished in Galveston Bay within the past 12 months. All others were thanked for their assistance and asked to return the form in the stamped envelope provided.

3.3 Survey Implementation

3.3.1 Implementation of the Mail/In-Person Follow-up Survey

The description of the implementation of the mail/in-person follow-up survey that follows consists of three parts. We will begin by explaining the in-person interview procedure and the rationale behind our decision to carry out the survey implementation in this manner. Next, a brief description of the sampling procedure used to obtain the 750 names, addresses, and phone numbers used in our sample for the in-person follow-up survey will be provided. (An in-depth exposition of the sampling procedures, rationale, and results can be found in Appendix 2.) The procedures followed for the mailings and interview administration will be the subject of the final part of this section. This will include quality control and enumerator supervision during the interview process.

In-Person Interview Procedures

Perhaps the most notable feature of our experimental design for the mail/in-person follow-up survey was that we chose to have respondents come to a safe, familiar, and convenient location near their homes to be interviewed, instead of sending enumerators into neighborhoods to interview respondents in their homes. Given our resource constraints, we were limited in the number of such enumeration sites that we could staff effectively. We chose to have three sites, dispersed widely over the study area, to allow for differentiation in types of respondents and distances from the bay.

The three enumeration sites were Northwest Mall, located in northwest Houston; Mall of the Mainland, located between Houston and Galveston, near Texas City and La Marque; and the Baytown Community Center, located in Baytown, near the Houston Ship Channel. Each of these locations offered us the opportunity to reach different segments of the population. In particular, Northwest Mall, the site farthest from the bay, yielded the highest percentage of respondents who had little to no contact with or awareness of the regional importance of the bay. In contrast, respondents from around Mall of the Mainland and Baytown came from both rural and heavily industrialized areas near the bay and consequently were more aware of its significance.

Numerous means were used to maximize the response rate and minimize sample selection bias. Dillman-style moral inducements (Dillman, 1978) that offered respondents an opportunity to contribute to an important policy debate were employed in the cover letter, our first contact with a potential respondent. In addition, a \$50 payment for participation was offered to increase the response rate. The sample selection procedure (described below) was designed to minimize travel time from respondents' homes to the enumeration site in order to minimize the cost (in time and money) that the respondents would have to incur to participate. Interviews were held over a period of nine days, including two weekends, to increase the number of convenient interview times available. We mailed the cover letters, surveys, and videos (where applicable) to respondents in large red, white, and blue two-day Priority Mail envelopes that contributed to the sense of importance of the study. Finally, during the week of the in-person interviews, enumerators made telephone calls to all potential respondents to encourage them to participate. They were reminded of the times that we were interviewing and of the \$50 payment for their participation.

Sample Selection Procedure

Our first concern was to find several suitable enumeration sites located near populated areas in different parts of the study area. Our site selection was constrained because many malls in the Greater Houston-Galveston Area prohibited carrying out surveys on their premises. We succeeded in obtaining permission to use the three sites finally selected for our study (Northwest Mall, Mall of the Mainland, and the Baytown Community Center). Given these fixed locations, we used 1990 census data for the five-county area to compare the demographic profiles of persons who lived in census tracts around the sites with those of the whole five-county area.

A simple proportionate random sample would have resulted in a significantly biased sample.

To minimize the chances of obtaining a biased sample of respondents, we used a linear programming model to select the number of households that should be chosen from each of 13 census tracts around each enumeration site. The model allowed us to select a sample of respondents with expected socioeconomic and demographic characteristics almost identical to the population of the Greater Houston-Galveston Area. It also enabled us to choose a sample from census tracts such that the expected travel distances to the enumeration sites were minimized.

The results of the sampling model were in the form of the number of households to be selected from each of 39 tracts. We used these results to order a random sample of households for each of the census tracts from a professional sampling firm (Survey Sampling, Inc.). This procedure was a significant improvement over proportional and stratified sampling for the case of nonrandom enumeration points, both in terms of minimizing overall demographic differences between the sample and study populations, and minimizing travel distances for respondents to the enumeration sites.

Data Collection

Each of the three enumeration sites was staffed with two enumerators; an additional roving enumerator allowed for breaks and peak load problems at a particular site. The enumerators themselves were a group of faculty and graduate students from the University of North Carolina at Chapel Hill, most of whom had been working on the project since its inception. Interviews were held daily from Saturday, May 15, through Sunday, May 23, 1993. At least one of the enumerators at each site had participated in interviewing during one of the two in-person pretests and was thus experienced with the procedures involved. The most important instructions to the enumerators were written out on the in-person interview form in order to facilitate uniform administration of the survey instruments.

The interview process consisted of a greeting, an expression of appreciation for the respondent's participation, a narrative explaining the procedure of the interview, and then the verbal questions themselves. After the in-person interview, while the respondent completed the written follow-up questionnaire, the enumerator completed questions assessing the quality of the interview and checked over the mail survey form returned by the respondent. Enumerators were instructed to check the mail survey form for completeness and to ensure that responses related directly to the question concerned. Once the respondent had completed the written follow-up section of the interview, the enumerators were instructed to clarify and correct any problems in the mail survey.

At the end of the interview, respondents were given a traveler's check for \$50, and their participation was noted on a master list of potential respondents. In order to ensure confidentiality, the names and addresses of respondents were never associated with their questionnaires.

3.3.2 Implementation of the Mail-Only Survey

For the mail-only survey we followed a much more conventional approach. We arranged with the professional sampling firm to use a simple random sampling procedure to select 1000 potential respondents from the five-county study area. The sample was drawn from a list of names and addresses available from telephone books, driver's license listings, and voter registrations. We needed telephone numbers for respondents in order to call them and request that they return the survey. This meant that our sample frame was restricted to the 70 percent of the households in the Greater Houston-Galveston Area that have listed telephone numbers. Survey Sampling, Inc. provided us with mailing labels and ASCII files that included phone numbers of the sample households.

Procedures for questionnaire design, mailings, and follow-up reminders were, for the most part, taken from Dillman (1978). The first mailing, which included a cover letter, questionnaire form, and video (where applicable), was sent out on May 12, 1993. A follow-up postcard was sent one week later to thank those who had already completed and returned the questionnaire, and to urge those who had not yet done so to complete the form as soon as possible. Dillman recommends an additional mailing three weeks after the original mailing. Instead, we attempted to telephone all sample respondents whose survey forms we had not yet received. One of our primary motivations for this effort was to provide potential respondents an opportunity to ask any questions about the objectives of the survey or the contents of the survey materials themselves. We had found this telephone conversation to be very effective in encouraging respondents to participate in the mail/in-person follow-up survey.

Seven weeks after the original mailing date, we sent our final mailing to all remaining respondents. We used two-day red, white, and blue Priority Mail envelopes to lend a sense of importance and urgency to this final contact. The contents of this final mailing included a new cover letter stressing the importance of their participation, a new survey form, and another video (where applicable).

PART III. STUDY RESULTS

CHAPTER 4: OVERVIEW OF STUDY RESULTS

4.1 Survey Response Rates and Profile of Sample Respondents

This first section of the chapter presents a profile of the respondents who participated in our study. First, we detail the response rate for each of the survey approaches (mail/in-person follow-up and mail-only). We then present demographic profiles of the respondents and compare their socioeconomic characteristics to those of the general public in the Greater Houston-Galveston Area (as depicted in the 1990 census results).

As discussed in Chapter 3, two different samples were selected: one that received a questionnaire in the mail and was invited to participate in an in-person interview (mail/in-person follow-up), and another that received only a questionnaire to be returned by mail (mail-only). The size of the mail/in-person follow-up sample was 750 households, and the size of the mail-only sample was 1000 households. In both cases, a substantial portion of the questionnaires were returned immediately by the post office as undeliverable (slightly more than 10 percent).

For both the mail/in-person follow-up and mail-only surveys, we made a considerable effort to increase our participation rate with follow-up phone calls and mailings. During these efforts, we examined the reasons why some of the people in the sample did not respond to our request to participate in the study. These are summarized in Tables 4.1 and 4.2. The tables also indicate the number of subjects in each sample that were selected to receive the videotape as part of our investigation of the effect of providing respondents with additional information.

In Table 4.1 the response rates for the mail/in-person follow-up sample are summarized. By the end of the study, 234 interviews were completed. Of the 750 questionnaires sent out, 181 were either (1) never received by the subjects, or (2) received by subjects who chose not to participate and could not be contacted by us (usually due to a disconnected phone or a wrong number). If we remove these 181 subjects from the mail/in-person follow-up sample, the response rate among the remaining subjects was 41 percent ($234/(750-181)$).