Computer-Administered Surveys at Honolulu International Airport

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The management of the Honolulu International Airport (HIA) implemented a computerized user opinion survey system employing a touch-screen interface to elicit, on a continuing basis, data relating to user satisfaction. The substitution of the new system for paper-and-pencil surveys raised several questions, including whether the paper-and-pencil questionnaires and the touch-screen system obtained responses from the same subject pool, whether the respondents gave comparable answers to the same questions posed by way of the two survey modes, and whether any issues associated with the new method needed special attention. A study addressed these questions through (a) an exposure count to determine the number of persons exposed to the system and their characteristics, (b) a structured observation study to associate the specific categories of respondents with the response patterns recorded by the touch-screen system, and (c) an investigation of the effects of survey administration method and sample selection method. On the basis of the observation study, rules were established for filtering out of the computer-generated files the records created by unreliable self-selected respondents to the touch-screen survey. The study found that the sample selection protocol had a significant effect on the survey responses. Whereas the specific recommendations offered are applicable to HIA, the implications of the study will be useful to those contemplating similar uses of the new technology.

The degree to which users are satisfied with the services offered at major facilities such as shopping centers and airports is important to the management of these facilities. Collected on a continuing basis, related information can help management identify problem areas and assess the success or failure of operational decisions. Until recently, this task was accomplished through the conduct of user surveys that were of the paper-and-pencil variety. These surveys would typically be repeated at regular or irregular intervals to capture changes in user perceptions over time.

Computer-administered telephone surveys relying on mainframe systems can be traced to the early 1970s (*1–3*). With the recent proliferation of microcomputer hardware and software, computer-aided interviewing techniques are becoming increasingly accessible and cost-effective. In particular, touch-screen systems, where the respondent answers by pressing against active regions of the computer monitor, have a good potential to reduce the cost and inconvenience of paper-and-pencil methods.

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Typical applications of touch-screen systems at major public facilities entail the presentation of information to the user, such as the provision of directory assistance at shopping centers. A touch-screen survey method has been implemented at the Honolulu International Airport (HIA) to collect data on user satisfaction. As implemented at HIA, the system relies on self-selected participants who complete the survey unsupervised. Because of the novelty of the application, there is a need to understand how respondents interact with the new system and to assess its comparability to the earlier paper-and-pencil version used at HIA. To do this, two observational studies (an exposure count and a structured observation study) were conducted. The effect of two sample selection methods (self-selection versus facilitator-selection) and the effect of the two methods of survey administration (paper-and-pencil versus computer touch screen) were also compared. The findings of the study described in this paper will be useful to those contemplating similar real-world applications of this technology.

STUDY CONTEXT

One of the busiest airports in the United States, HIA is the major hub of the statewide airport system operated by the Hawaii Department of Transportation (HDOT). In a typical year, HIA processes more than 20 million enplaning and deplaning passengers (*4*).

Being responsive to the needs of airport users, the Programming, Planning, and Budgeting Office and the Airports Division of HDOT have been conducting user opinion surveys employing paper-and-pencil instruments administered to facilitator-selected respondents. In 1987 they decided to explore the possibility of using a computerized interviewing system. They obtained a touch-sensitive computer screen connected to a stand-alone microcomputer and hired an independent consultant to develop an illustrative survey to test the feasibility of this approach. On the basis of preliminary comparisons (*5*), HDOT expressed some concerns about the equivalence and compatibility of the data collected via the paper-and-pencil version and the results obtained via the touch-screen system. A research project was awarded to the University of Hawaii at Manoa to address the questions of whether (a) the previous paper-and-pencil questionnaires and the touch-screen system obtained responses from the same subject pool, (b) the respondents gave comparable answers to the same questions posed by way of the two survey modes, and (c) any issues intrinsic to the new method needed special attention.

The overall study was divided into three parts: an exposure count was conducted to determine the number of persons passing by the system and their characteristics, the number of computer records created during the same time, and the ways in which respondents interacted with the system. A structured observation study associated specific categories of respondents with the response patterns recorded by the touch screen–based system. Of particular relevance was the establishment of criteria for filtering out of the data files the records created by unreliable respondents. These included children who appeared to be using the system as a substitute for an arcade game. Finally, the findings of the structured observation study were incorporated in the selection of three respondent samples to investigate the effects of survey mode and sample selection method.

PAPER-AND-PENCIL INSTRUMENT

The paper-and-pencil questionnaire used for the study was a slightly modified version of the instrument developed by HDOT. Minor changes in the wording and sequence of the questions were made to render it identical to the computer version that was implemented at the airport. The three-page questionnaire consists of 18 questions, some of which are designed to be skipped by certain respondents.

The opening question asks why the respondent is at the airport; the choices of response are that they are leaving, arriving, picking someone up, or seeing someone off. Depending on the answer, the respondent is directed to the appropriate branches of the questionnaire. Departing passengers, for example, are asked to specify their destinations and to rate their experience at the agricultural and security checkpoints that apply to their situations. By contrast, arriving passengers are asked about their points of origin but not about the elements not experienced on that day.

All respondents are then asked to rate 13 aspects of the airport, including their overall opinion of HIA on 11-point scales ranging from 0 (very poor) to 10 (very good) and including a response of "don't know." The questionnaire then elicits several demographic characteristics, including the respondent's education level, age, household income, and place of residence. The respondents are then asked to specify the frequency with which they visited HIA in the last year and whether they had answered the survey in the preceding 3 months. Finally, an open-ended question asks for comments.

TOUCH-SCREEN INSTRUMENT

The touch-screen questionnaire is structurally identical to the paper-and-pencil survey. However, it incorporates colorful graphics, animation, and an alternative method of entering responses. For example, to answer questions relating to geography (i.e., origins and destinations), a respondent merely presses directly the desired location on a displayed color-coded map of the world rather than picking from a printed list of geographical regions. Another difference is that the computer program automatically skips to the appropriate branch given a particular response, preventing respondent errors in this respect. Comments are elicited via a simulated keyboard that is displayed on the computer screen. This requires the respondent to press individual simulated keys to form a response, as opposed to the more familiar written response required by the paper-and-pencil version. Discovering whether the collective differences between the two systems affect the obtained data was one of the objectives of the study.

The computer version incorporates two time-outs that operate as follows: when a duration equal to the first time-out elapses before the respondent answers a question, an audio warning is emitted and a prompt screen encourages the respondent to continue. If no response is given during an additional interval equal to the second time-out, the partly completed record is written to file and the system is returned to the opening screen.

The data files created by the system follow a basic structure. A record containing the date and the time is written when the computer system is started. This record is followed by normal transaction records, each consisting of 183 characters, beginning with its starting time, and ending with its completion time. It includes the responses to the 18 questions that make up the questionnaire and allows for a 120-character comment field. Aborted records can be identified by the presence of the code "8" in the remaining response fields.

EXPOSURE COUNT

An observer was positioned at some distance from the location of the computer system and recorded the volume and direction of people passing by the system. The observed persons were categorized as adult man, adult woman, male airport employee, female airport employee, and child. The category "undetermined" was used at certain times when the observer was unable to categorize individual members of very large groups. The beginning and end of each exposure count session were marked in the computer data file by creating easily identifiable opening and closing records, allowing an exact and objective count of the number of computer records created during the observation periods. This number was contrasted with the number of respondents, which as explained later, was not identical to the number of records created.

Eight sessions spread over 3 days were held, totaling 15 hr and 27 min. During this time, 9,864 persons passed directly in front of the system and 176 computer records were created. There were approximately equal numbers of adult men and women in the observed sample. Children composed fewer than 10 percent of the persons observed but they tended to visit the system more than once.

Only a small fraction of the observed persons interacted with the touch-screen system. Overall, an average of 1.78 records were created per 100 persons exposed to the system. Considering the high volume of people visiting HIA, however, the system produces an enormous amount of data that need processing. Approximately a third of the records created during the exposure count were started but not completed to any degree.

During the exposure count, the observers noticed that the interaction of the respondents with the machine and the creation of individual records was a complex matter that deserved further investigation to ensure the proper analysis and interpretation of the data obtained in this manner. For example,

some questionnaires were begun by one respondent but were completed by another. The reliability of the raw data collected via the touch-screen system could, therefore, be compromised. To address this problem, a detailed association between the persons contributing to the creation and to the content of these records was warranted, which led to the structured observation study and the record filtering rules described next.

STRUCTURED OBSERVATION

Method

The observational study was conducted on 10 days and yielded information corresponding to 224 records. An observer was stationed at a location with a clear view of the computer screen that also ensured unobtrusiveness. The observer recorded the characteristics of each respondent on a one-page special form. One form was sufficient in cases in which a respondent was singly responsible for the creation of a single transaction record in the data file. On the other hand, several forms were needed to keep track of multiple respondents to the same transaction record. In the cases of such "chained" records, the question posed on the computer monitor at the time when each respondent took control of the system was noted in the corresponding form. The beginning and ending times of each transaction were also noted. This permitted a one-to-one matching between the transaction records produced by the touch-screen system and the associated information obtained by the observer. Included among the respondent characteristics were gender and estimated age. The observed behaviors about the pattern of interaction of each respondent with the touch-screen system were also entered on the form.

As explained earlier, the number of respondents who participated in producing these records was different from the number of created records. In addition to chained records, some respondents completed the survey more than once ("repeats"). On this basis alone, it would be erroneous for an analyst of the data to assume a one-to-one association between a record collected via the touch-screen survey and an individual respondent. A record filtering process that can minimize the proportion of inappropriate records before data analysis is desirable. Given the potential unreliability of records generated by children, the use of age-related criteria for filtering was investigated.

Record Filtering

Only six age categories were included in the tally sheets completed by the observer rather than the eight categories found in the data file records because the estimation of age by observation involves judgment. The observed age brackets included the ranges 30 through 49 and 50 through 69 that, in the computer-written records, consist of two categories each.

The 10–19 age category included many persons between 10 and their early teens. Through annotation, the observer tried to capture the size of this subgroup and found that about 50 percent of the respondents observed to fall in the 10–19 category were estimated to be 16 or under. The presence of these respondents in the 10–19 category could possibly render the raw aggregated responses by the entire group unreliable.

Table 1 cross tabulates the ages of the respondents as estimated by the observer (rows) against the ages reported by the respondents in the data file records (columns). Two additional columns are included, one for transactions that were aborted before any of the survey questions were answered and one for partially completed records. Each cell of this table contains three entries corresponding to individual respondent records, chained records, and repeated records.

The region of Table 1 around the main diagonal that is delineated by heavy lines represents the region of "reasonable match" between the observed and recorded ages of the re-

TABLE 1 Observed Versus Reported Age

OBSERVED AGE	REPORTED AGE								ABORTED RECORDS	PARTIAL RECORDS
	< 10	10 - 19	20 - 29	30 -39	40 - 49	50 - 59	60 - 69	> 70		
< 10	2[a] 2[b] 5[c]	3 1 3			1 0 0			3 0 2	20 0 6	5 3 0
10 - 19		32 2 1	7 0 1	2 0 4	3 0 0			2 1 0	10 4 5	4 2 1
20 - 29		1 0 0	19 3 0	8 4 0				1 0 0	6 0 0	3 2 0
30 - 49	2 0 0	1 0 0	1 0 0	6 1 0	9 2 1	2 2 0			5 0 0	3 1 0
50 - 69						2 0 0			3 0 0	
≥ 70							1 0 0			

[a] Records created by individual respondents
[b] Chained records
[c] Repeated records

spondents. It shows that respondents are generally truthful in reporting their ages. Interestingly, all of the observed records that lie outside and to the left of the solid outline were cases in which older adults directed children to enter suggested responses. Some of the outliers to the right of the solid outline were also of this "instructional" type, but apparently in these cases the older adults directed the children to enter the adults' ages. The most pronounced age discrepancy is seen in the record category of 70 years of age and older, in which all observed entries were made by children under 10 and, particularly, by those on the younger side of the 10–19 group. Children in these brackets showed a tendency to repeat the survey and to also produce aborted and partial records at a higher frequency than adults.

Concern about the reliability of the responses given by children had motivated the HDOT to eliminate the under-10 category from their initial analyses of the data obtained via the touch-screen system (*5*). The findings of the observational study reinforce the need for this practice. Moreover, it appears prudent to also exclude the 10–19 and the over-69 age brackets and all partially completed records. This practice will neither ensure the reliability of all retained records nor guarantee the removal of only unreliable records, but it will eliminate a good portion of the unreliable records. With data filtering, the presence of children among the users of the survey is not as critical as it would first appear because they tend to abandon the survey midstream. Their transactions would thus be removed by retaining only completed surveys for subsequent analyses. The same is true with many repeated and chained records.

The effect of the filtering rule based on reported age on the computed mean ratings given to the 13 airport attributes was examined by a series of *t*-tests computed using sample sizes ranging from 2,500 to 3,400 responses to the rating scales. These analyses showed that the average ratings of the airport when using unfiltered data are different from the ratings obtained when filtering the raw data set. Consequently, the conclusions drawn regarding the airport would be different depending on which of the two data sets is used. All available evidence points to the reasonableness of using the filtered data set.

Other Filtering Options

Other ways of identifying potentially unreliable records were also investigated. These included attempts to discern internal inconsistencies in the responses, specific response patterns, and parsing of the comment field. Several special processing routines using the PROLOG language were written for this purpose. The general conclusion was that the vast majority of apparently inappropriate records would be removed by the age filtering rule just discussed. Nevertheless, removal of records containing indecorous or infantile comments and records indicating that the respondent has answered the questionnaire previously can eliminate additional unreliable records.

The application of these filtering criteria would define a "reference group," the responses of which could be used to track changes in airport user satisfaction over time. It can also capture the reactions of users to management actions intended to improve the airport.

METHOD AND SAMPLE EFFECTS

Purpose and Scope

The last part of the study examined the degree to which the method of survey administration influences the obtained responses. From a practical point of view, the comparison of interest to the airport's management entailed the paper-and-pencil survey versus the touch-screen method. However, as implemented at HIA, the former involved a facilitator-selected sample of respondents, whereas the latter allowed respondents to be self-selected. To isolate the effect of sample selection from the effects of survey administration method, three combinations of sampling and survey administration were contrasted: the computer-administered questionnaire completed by a randomly selected group (CA/R), the computer-administered questionnaire completed by a self-selected group (CA/S), and the paper-and-pencil questionnaire completed by a randomly selected group (PP/R).

This allowed for three sets of comparisons: the comparison of CA/R and CA/S would shed light on the effect of the sample selection method on the results obtained by the touch-screen system; the comparison of CA/R and PP/R would permit the examination of the compatibility of the two methods of survey administration, holding the sampling method constant; and the comparison of CA/S and PP/R would provide information on the results when both the administration and sampling methods varied.

Sample Selection Procedures

A systematic procedure was followed in selecting the three samples of respondents to ensure that the location and time frames were similar for the three cases. The two random samples were chosen by survey facilitators. The third adult passing by an unoccupied facilitator was asked to participate and, if agreeable, was either given a clipboard with the paper-and-pencil questionnaire or directed to the computer. The survey facilitators kept a contact record sheet for each person approached. Entered on the contact record sheet were the survey method, the date and time, the subject's gender and estimated age, and whether the person agreed or refused to participate. Numbering of the contact records facilitated the matching of particular transactions to individual respondents.

Thirty-six data collection sessions were conducted over 79 days to yield a sample size of 642 respondents: 330 completed paper-and-pencil questionnaires, and 312 completed valid computer records. The data collection sessions covered the hours from 8:00 a.m. to midnight, coinciding with the bulk of airline operations at HIA. χ^2 tests showed that the persons approached to do the survey by the two methods were statistically similar in terms of age, gender, and refusal rates. The age and gender similarity extended to the two groups that agreed to participate. Thus the sample selection process was successful in creating equivalent random samples (CA/R and PP/R) in terms of these variables.

The third sample that completed the touch-screen survey unsupervised (CA/S) was drawn from the offloaded computer data files. The CA/R record sets were taken from approximately the same time frames as the facilitator-selected sets.

On the basis of the results of the earlier observational study, the CA/S sample was reduced by filtering out incomplete records and records indicating age categories of younger than 20 and older than 69. For the sake of consistency, the same filtering was applied to the two randomly selected samples (CA/R and PP/R) as well.

Analysis and Findings

The responses obtained by the three groups were compared pairwise with respect to their responses to each of the 13 facility rating scales, the respondents' characteristics, and their propensity to offer comments. The comparison of rating responses was done via a series of *t*-tests, whereas the comparisons of respondent characteristics and their propensity to comment were done using χ^2 tests. Following is a summary of the principal findings of these comparisons (*6*). In the following sections, significance refers to the 0.05 level.

In terms of the available demographic characteristics, the groups associated with the three methods (i.e., CA/R, CA/S, and PP/R) were found to be of similar reported incomes and levels of educational attainment. The two randomly selected groups (CA/R and PP/R) were also similar in terms of age. Both included relatively older respondents as compared with the sample of self-selected respondents. The reported ages of the two randomly selected groups were in agreement with the ages estimated by the survey facilitators. This reinforces the finding of the earlier observation study, which found the reference group of respondents to be truthful in this respect.

The comparisons between the two randomly selected groups with respect to their responses to the 13 rating scales showed the PP/R slightly higher than the CA/R. However, statistical significance was reached only in 2 of the 13 airport attributes (Table 2). The preponderance of the findings supported the general conclusion that the responses obtained via the two instruments (i.e., computer and paper and pencil) were not different when respondents were selected randomly.

The self-selected group that answered the touch-screen survey, on the other hand, was found to be different than the two randomly selected groups. Table 2 indicates that the CA/S group gave significantly lower ratings than the PP/R group on 9 of the 13 airport attributes and significantly lower ratings than the CA/R group on 5 of the 13 scales.

TABLE 2 Comparability of Survey Methods

SCALE	CA/R vs. PP/R	CA/S vs. CA/R	CA/S vs. PP/R
Appearance	n.s.	n.s.	n.s.
Airport Roads	n.s.	n.s.	CA/S < PP/R
Airport Parking	n.s.	n.s.	n.s.
Shuttle Bus	n.s.	n.s.	n.s.
Loading Zones	n.s.	n.s.	CA/S < PP/R
Directional Signs	n.s.	CA/S < CA/R	CA/S < PP/R
Baggage Areas	n.s.	n.s.	CA/S < PP/R
Restaurant/Snackbars	CA/R < PP/R	n.s.	CA/S < PP/R
Gift Shops	CA/R < PP/R	CA/S < CA/R	CA/S < PP/R
Public Conveniences	n.s.	CA/S < CA/R	CA/S < PP/R
Visitor Information	n.s.	CA/S < CA/R	CA/S < PP/R
Cleanliness	n.s.	n.s.	n.s.
Overall	n.s.	CA/S < CA/R	CA/S < PP/R

n.s. = not significant at the 0.05 level.

With respect to the propensity of respondents to offer comments, the study found a great variability between the three methods: comments were entered by 50 percent of the self-selected respondents who used the touch-screen system, by 37 percent of the paper-and-pencil survey respondents, and by only 15 percent of the randomly selected respondents who answered the computer survey. Comments written on the touch-screen system were more difficult to decipher than those obtained via the paper-and-pencil questionnaire, partly because of difficulties in using a simulated keyboard on the computer monitor. However, the high volume of comments obtained under normal operation of the touch-screen system (CA/S) makes it a source of useful and continuously collected information, assuming that obviously improper comments are judiciously filtered out. In fact, the "suggestion box" feature of the touch-screen system is one of its strong points.

DISCUSSION OF RESULTS AND CONCLUSIONS

The use of computer-interactive survey systems in general and systems employing a touch-screen interface in particular is expected to increase considerably. For major activity centers such as airports, these systems offer a relatively inexpensive means of collecting, on a continuing basis, data relating to user perceptions and opinions.

Besides providing timely results, properly programmed computerized questionnaires can minimize certain respondent errors. In particular, providing automatic branching to the appropriate sections of the questionnaire on the basis of specific responses eliminates the difficulties encountered by respondents to paper-and-pencil questionnaires in this respect. This advantage of computer interviewing becomes more pronounced as the complexity of the questionnaire increases. In fact, since the skips are transparent to the respondent, it is possible to construct more refined questionnaires without fear that the complexity of the questionnaire will overwhelm the respondents. Furthermore, questions in computer interactive surveys "can be grouped either in a more intuitive manner or per the dictates of the research design" (*7*).

Another advantage of computerized questionnaires is that they can provide data in the form of ASCII files that are ready for further processing, which eliminates the step of transcribing the survey responses into computer files. Whether the translation is done by keypunching or by scanning of machine-readable forms, this operation often involves errors requiring costly and time-consuming checking.

The use of a touch screen–based interviewing system offers another advantage relevant to surveys related to the spatial aspects of transportation systems. Geocoding is greatly enhanced through the use of an on-screen touch-sensitive map. For the study described in this paper, the number of origins and destinations of respondents consisted of seven regions of the world (e.g., U.S. mainland, Canada, other Hawaiian islands, etc.). In the paper-and-pencil version, the respondents were asked to pick from a list, whereas touch-screen system respondents were simply required to touch the corresponding geographical area on a color-coded map. The limitation on the number of response choices to seven was imposed by a need to keep the paper-and-pencil questionnaire to a reasonable length. A more elaborate implementation would permit

a much finer designation of geographical zones. That case is typically treated by paper-and-pencil instruments as an open-ended question that requires extensive and costly geocoding.

The quality and reliability of the raw data obtained via the touch-screen system would depend, among other factors, on the characteristics of the application and on the respondent selection procedures. For the HIA application described in this paper, a self-selection protocol was deemed appropriate by the airport's management because of a desire to collect data continuously while avoiding the costs associated with supervised surveys. The reliability of the computer-created records, however, could be judged only minimally. Consequently, HIA management wanted to assess the potential effect of unreliable respondents on the results obtained via the touch-screen system and possible ways to reduce this effect without requiring the constant attention of a survey supervisor. Also of concern was the methodological question of the comparability of the results derived through the new system to those obtained via commonly administered paper-and-pencil surveys that rely on facilitator-selected random samples.

To address the first issue, a structured observation study associated information about a sample of self-selected respondents to the computer records they created. On the basis of the comparison between the two, several filtering rules were established that can remove a considerable number of spurious records. In order of importance, these rules were to eliminate records reporting ages under 20 and over 69, to retain only complete records, and to eliminate records containing incongruous and other improper comments.

The issue of comparability between paper-and-pencil surveys relying on facilitator-selected random samples and touch screen–based surveys of self-selected respondents required isolation of the effects of survey administration method (paper-and-pencil versus computer) and the effects of sample selection (random versus self-selection).

The analysis showed that for similar facilitator-selected random samples the responses obtained via the touch-screen system were statistically comparable with the responses derived from the structurally identical paper-and-pencil survey. The introduction of a self-selected group of respondents, however, resulted in statistically significant differences. The largest differences were found between CA/S and PP/R, the two methods that are customarily employed at the HIA. An implication of practical relevance to the management of the HIA is that the two commonly used methods are not directly comparable. Proper comparisons of the PP/R ratings obtained in earlier years with the CA/S obtained after the installation of the touch-screen system would require adjustments of the mean ratings of one or the other. This would avoid, for example, an erroneous conclusion that the level of satisfaction of airport users declined in 1987, the year when the touch-screen system was put into operation. The ratios of the mean ratings obtained in the study reported here can serve as first-cut adjustment factors.

Although significant differences were found between the two facilitator-selected samples on one hand and the self-selected sample on the other, there are advantages to continued operation of the touch-screen system on a self-selection basis. As operated at the HIA, the system can record the perceptions of airport users continuously, 24 hr a day, and in real time. It is possible, therefore, to assess the reactions of airport users to particular events or changes in airport operations and conditions as they occur. For example, overbooking by airlines during certain periods, uncomfortable conditions during parts of the year, and responses to schedule changes can be detected through the contemporaneous data obtained by the system. Some of these occurrences would be unanticipated and very difficult to capture by occasional supervised surveys that require advanced planning.

In addition, some planned one-time surveys could happen to coincide with the occurrence of atypical conditions at the airport and thus could result in conclusions that may not be applicable under normal circumstances. Nevertheless, the use of the touch-screen system with self-selected respondents does not obviate occasional facilitator-supervised surveys, whether administered by computer or not. Such surveys would be necessary to address issues not covered by the touch-screen system and also in control studies similar to that described in this paper.

Whereas these findings are directly applicable and relevant to the specific system installed at HIA, a transferable lesson derived from this study is that the raw data obtained by similar computer-administered surveys should not be accepted at face value. Instead, they should be explicitly evaluated within their specific contexts. Collectively, the accumulation of application-specific experiences will enhance the understanding and effective use of emerging survey research technologies.

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REFERENCES

1. Nicholls, W. L., and R. M. Groves. The Status of Computer Assisted Telephone Interviewing: Part I: Introduction and Impact on Cost and Timeliness of Survey Data. *Journal of Official Statistics*, Vol. 2, 1986, pp. 93–115.
2. Fink, J. C. CATI's First Decade: The Chilton Experience. *Sociological Methods and Research*, Vol. 12, 1983, pp. 153–168.
3. Shanks, J. M. The Current Status of Computer-Assisted Telephone Interviewing: Recent Progress and Future Prospects. *Sociological Methods and Research*, Vol. 12, 1983, pp. 119–142.
4. *The State of Hawaii Data Book, A Statistical Abstract*. Hawaii Department of Business, Economic Development, and Tourism, Honolulu, 1991.
5. Okimoto, G., M. Tamanaha, and E. Asato. *Measuring the Effectiveness of Hawaii's Airports*. Hawaii Department of Transportation, Honolulu, 1987.
6. Synodinos, N. E., C. S. Papacostas, and G. M. Okimoto. *Evaluation of Computer Interactive Data Collection at the Honolulu International Airport*. Contract 23181. University of Hawaii at Manoa, Honolulu; Hawaii Department of Transportation, Honolulu, 1989.
7. Synodinos, N. E., and J. M. Brennan. Computer Interactive Interviewing in Survey Research. *Psychology and Marketing*, Vol. 5, 1988, pp. 117–137.

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