Session 7

COMPUTER ASSISTED SURVEY INFORMATION COLLECTION

REDESIGNING A QUESTIONNAIRE FOR COMPUTER-ASSISTED DATA COLLECTION: THE CURRENT POPULATION SURVEY EXPERIENCE

Cathryn Dippo and Anne Polivka
Bureau of Labor Statistics

Kathleen Creighton, Donna Kostanich, and Jennifer Rothgeb
Bureau of the Census

Over the last decade, there have been two new factors that have significantly influenced the design of survey data collection--the computer and the theories and methods of cognitive psychology. When, in 1986, staffs of the Bureau of Labor Statistics (BLS) and the Bureau of the Census initiated a process for redesigning the Current Population Survey (CPS), incorporating these two new factors was made a top priority. In the paper[1], the authors[2] illustrate how, by concentrating on the cognitive processes of respondents and interviewers, computer-assisted interviewing was used as a tool for reducing measurement error.

The following topics are covered in the paper: background material on questionnaire design and computer-assisted interviewing methodologies, development of the CPS questionnaire over the last 50 years and how redesigning the CPS questionnaire for the 21st century has brought together the two new methodologies, using the computer in evaluating alternative questionnaire designs, examples of the new CPS questionnaire's design features which aid the cognitive processes of the respondent and interviewer and are primarily dependent on the use of the computer, the effects of the new questionnaire and collection procedures on labor force estimates, and a discussion of issues for the future.

The Current Population Survey is a monthly survey of approximately 60,000 households. The CPS survey, conducted for BLS by the Bureau of the Census, is the primary source of information on the U. S. labor force. Each month BLS analyzes and publishes information from the CPS, such as the unemployment rate, demographic characteristics of individuals in the labor force, and the number of hours individuals work. The survey began in 1940 under the auspices of the Works Projects Administration and was called the Monthly Report of Unemployment. The current CPS questionnaire has remained essentially

---

[1] The presentation by Cathryn Dippo at the Seminar on New Directions in Statistical Methodology was based on a paper currently under review for publication in a refereed journal. Thus, only a brief synopsis is being published here, along with a detailed bibliography of papers related to the CPS redesign.

[2] The new CPS questionnaire is the result of a team effort which involved many staff members from both BLS and Census. Space does not allow us to recognize everyone. The other members of the BLS-Census Questionnaire Design and Overlap Analysis Steering Committees over the years were Chester Bowie, John Bregger, Shail Butani, Lawrence Cahoon, Kennon Copeland, Harvey Hamel, Elizabeth Martin, Michael McMahon, Thomas Scopp, Clyde Tucker, Ronald Tucker, and Alan Tupek.

unchanged since the last major revision in January 1967. With only minor exceptions, the concepts measured have remained constant since the late 1940's.

Over its 50+-year history, the CPS has continued to be a model for survey designers. It was the first national probability sample of households, and many of the statistical methods for sampling and estimation now considered common practice were originally researched and implemented in CPS. Two of the six research areas identified in 1986 related to data collection--computer-assisted interviewing and the questionnaire. A Questionnaire Design Task Force was established to identify the cognitive and conceptual problems in the existing questionnaire, to suggest possible solutions for identified problems, and to develop a research plan to design and test a new questionnaire, along with related survey procedures. A separate task force was established to investigate the potential uses of computer-assisted interviewing. When a final consolidated research plan was approved in 1988, a major premise of the plan was that all interviews would be conducted using a computer. Following a period of questionnaire development and extensive testing, Census began collecting all CPS data using a new fully-automated questionnaire in January 1994.

The data produced from the CPS are closely-watched by economic forecasters and policy analysts. Therefore, all changes had to be carefully researched prior to implementation. By concentrating on facilitating the cognitive processes used by respondents and interviewers, research on alternative measurement processes resulted in reduced nonsampling errors. By capitalizing on the power and versatility of the computer, new research tools were developed to provide the evidence needed to understand the effects of changes in data collection procedures. We hope that the approach used for developing the new measurement process for CPS will serve as a model for future survey redesign projects.

For details on the 8 years of research that went into redesigning the CPS, please consult the papers listed in the following bibliography.

1994 CPS REDESIGN BIBLIOGRAPHY

Bienias, J. L. (1988). Preliminary laboratory research on Current Population Survey questionnaire with employed persons. *American Statistical Association Proceedings of the Section on Survey Research Methods*, 185-190.

Bienias, J. L., Dippo, C. S., and Palmisano, M. (Eds.) (1987). *Questionnaire design: Report on the 1987 BLS Advisory Conference*. Washington, DC: U.S. Bureau of Labor Statistics.

Boehm. L. E. (1989). Reliability of proxy response in the Current Population Survey. *American Statistical Association Proceedings of the Section on Survey Research Methods*, 486-489.

Boehm, L. E. (1989, August). The relationship between confidence, knowledge, and performance in the Current Population Survey. Paper presented annual meeting of the Southeastern Psychological Association, Washington, DC.

Bowie, C., Cahoon, L., and Martin, E. (1993). Overhauling the Current Population Survey: Evaluating changes in the estimates. *Monthly Labor Review, 116(9)*, 29-33.

Bregger, J. (1977). Establishment of a new Employment Statistics Review Commission. *Monthly Labor Review, 100 (3)*, 14-20.

Bregger, J. (1984). The Current Population Survey: A historical view and BLS's role. *Monthly Labor Review, 107 (6)*, 8-14.

Bregger, J. (1994, May). *Raising the Nation's unemployment rate*. Paper presented at the Seminar on New Directions in Statistical Methodology, Bethesda, MD.

Bregger, J., and Dippo, C. S. (1993). Overhauling the Current Population Survey: Why is it necessary to change? *Monthly Labor Review, 116(9)*, 3-9.

Bushery, J. M., Weidman, L., Briley, S. M., and Ciochetto, S. (1987). Using CATI in the Current Population Survey. *American Statistical Association Proceedings of the Section on Survey Research Methods*, 778-783.

Butani, S., Cahoon, L., Fay, R., and Kostanich, D. (1994, in press). Measurement of different design effects. *American Statistical Association Proceedings of the Section on Survey Research Methods.*

Butz, W. P., and Plewes, T. J. (1989). A Current Population Survey for the 21st century. *Bureau of the Census Proceedings of the Fifth Annual Research Conference*, 3-13.

Cohany, S. R., Polivka, A. E., and Rothgeb, J. M. (1994). Revisions in the Current Population Survey effective January 1994. *Employment and Earnings, 41-2*, 13-37.

Cahoon, L. S. (1990, 1991, 1992, 1993). *Results of the CPS CATI Phase-in analysis*. Series of internal memoranda (issued quarterly). Washington, DC: Bureau of the Census.

Cahoon, L. S., and Russell, G. (1991, October). *Effects of CATI on estimates from demographic surveys conducted by the Bureau of the Census*. Paper presented at the

Joint Census Advisory Committee Meeting of the American Marketing Association and the Committee on Population Statistics, Alexandria, VA.

Campanelli, P. C., and Esposito, J. L. (1992, May). *The use of behavioral coding to identify problematic questions on alternative questionnaires*. Paper presented at the annual American Association for Public Opinion Research Conference, St. Petersburg, FL.

Campanelli, P. C., Martin, E. A., and Creighton, K. P. (1989). Respondents' understanding of labor force concepts: Insights from debriefing studies. *Bureau of the Census Proceedings of the Fifth Annual Research Conference*, 361-374.

Campanelli, P. C., Martin, E. A., and Rothgeb, J. M. (1991). The use of respondent and interviewer debriefing studies as a way to study response error in survey data. *The Statistician, 40*, 253-264.

Campanelli, P. C., Rothgeb, J. M., and Martin, E. A. (1989). The role of respondent comprehension and interviewer knowledge in CPS labor force classification. *American Statistical Association Proceedings of the Section on Survey Research Methods*, 425-430.

Cantwell, P. J., and Ernst, L. R. (1993). Short-term changes to the CPS composite estimator in January 1994. *American Statistical Association Proceedings of the Section on Survey Research Methods*, 724-729.

Cantor, D., and Esposito, J. L. (1992). Evaluating interviewer style for collecting industry and occupation information. *American Statistical Association Proceedings of the Section on Survey Research Methods*, 661-666.

Collins, C. L. (1975). *Comparison of month-to-month changes in industry and occupation codes with respondent's report of change: CPS job mobility study.* Response Research Staff Report No. 75-5. Washington, DC: U.S. Bureau of the Census.

Copeland K. R., and Rothgeb, J. M. (1990). Testing alternative questions for the Current Population Survey. *American Statistical Association Proceedings of the Section on Survey Research Methods*, 63-71.

Couper, M. P., and Burt, G. (1993, in press). Interviewer reactions to computer-assisted personal interviewing (CAPI). *Bureau of the Census Proceedings of the Annual Research Conference*, 429-443.

Department of Labor. (1981). *Final report of the Secretary of Labor on the Recommendations of the National Commission on Employment and Unemployment Statistics*. Transmitted to Congress, October 26.

Dippo, C. S. (1993). Designing an instrument for computer-assisted data collection in the Current Population Survey. *Bulletin of the International Statistical Institute*, Contributed Papers 49th Session, 1, 373-374.

Dippo, C. S., Kostanich, D. L., and Polivka, A. E. (1994, in press). Effects of methodological change in the Current Population Survey. *American Statistical Association Proceedings of the Section on Survey Research Methods.*

Dippo, C. S., Polivka, A. E., Creighton, K. P., Kostanich, D. L., and Rothgeb, J. M. (1994). *Redesigning a questionnaire for computer-assisted data collection: The Current Population Survey experience*. Paper submitted for publication.

Edwards, W. S. (1991, May). *Measuring question comprehension and its effects on response error: An "hours worked" case study*. Paper presented at the annual meeting of the American Association for Public Opinion Research, Phoenix, AZ.

Edwards, W. S., Levine, R. and Cohany, S. (1989). Procedures for validating reports of hours worked and for classifying discrepancies between questionnaire reports and validations totals. *American Statistical Association Proceedings of the Section on Survey Research Methods*, 496-501.

Esposito, J. L., Campanelli, P. C., Rothgeb, J. M., and Polivka, A. E. (1991). Determining which questions are best: Methodologies for evaluating survey questions. *American Statistical Association Proceedings of the Section on Survey Research Methods*, 46-53.

Esposito, J. L., and Hess, J. C. (1992, May). *The use of interviewer debriefings to identify problematic questions on alternative questionnaires*. Paper presented at the annual American Association for Public Opinion Research Conference, St. Petersburg, FL.

Fisher, R. (1994, in press). Logistic regression analysis of CPS Overlap Survey split panel data. *American Statistical Association Proceedings of the Section on Survey Research Methods*.

Fisher, R., Thompson, J., Robison, E., and Welch, M. (1993). Variance estimation in the CPS Overlap Test. *American Statistical Association Proceedings of the Section on Survey Research Methods*, 802-807.

Fracasso, M. P. (1989). Reliability and validity of response categories for open-ended questions in the Current Population Survey. *American Statistical Association Proceedings of the Section on Survey Research Methods*, 481-485.

Fracasso, M. P. (1989, August). *A procedure for the development of an alternative set of category choices using the open-ended questions in the Current Population Survey*. Paper presented at the annual meeting of the Southeastern Psychological Association, Washington, DC.

Gaertner, G. H., Cantor, D., Gay, N. L., and Shank, S. E. (1989). Tests of alternative questions to elicit occupational information in the CPS. *American Statistical Association Proceedings of the Section on Survey Research Methods*, 490-495.

Hamel, H. (1979). Two fifths of discouraged workers sought work during prior six month period. *Monthly Labor Review, 102*, 58-60.

Hess, J. (1993). *Results of the MLS Interviewer Knowledge Concepts Test*. Memorandum for the CPS Questionnaire Evaluation Steering Committee. Washington DC: Bureau of the Census.

Kojetin, B. A., and Cashman, E. R. (1994, May). *Prior interviewing and computer experience and evaluation of CAPI training*. Paper presented at the annual Field Technologies Conference, Danvers, MA.

Kominski, R., and Siegel, P. M. (1993). Measuring education in the Current Population Survey. *Monthly Labor Review, 116(9)*, 33-38.

Kostanich, D. L., and Cahoon, L. S. (1994). *Effect of design differences between the parallel survey and the new CPS*. CPS Bridge Team Technical Report 3, dated March 4.

Lent, J., Miller., S, and Cantwell, P. (1994, in press). Composite weights for the Current Population Survey. *American Statistical Association Proceedings of the Section on Survey Research Methods.*

Martin, E. A. (1987). Some conceptual problems in the Current Population Survey. *American Statistical Association Proceedings of the Section on Survey Research Methods*, 420-424.

Martin, E. A., Campanelli, P. C., and Fay, R. E. (1991). An application of Rasch Analysis to questionnaire design: Using vignettes to study the meaning of "work" in the Current Population Survey. *The Statistician, 40*, 265-276.

Martin, E. A., and Polivka, A. E. (1992). The effect of questionnaire redesign on conceptual problems in the Current Population Survey. *American Statistical Association Proceedings of the Section on Survey Research Methods*, 655-660.

Martin, E. A., and Polivka, A. E. (1994). *Diagnostics for redesigning survey questionnaires: Measuring work in the Current Population Survey*. Paper submitted for publication.

McKay, R. B. (1992). Cultural factors affecting within household coverage and proxy reporting in Hispanic (Salvadoran) households. *American Statistical Association Proceedings of the Section on Survey Research Methods*, 614-618.

McKay, R. B. (1993). Undercoverage of Hispanics in household surveys. *Monthly Labor Review, 116(9), 38-42.*

McKay, R. B. (1994, in press). The Spanish translation of the redesigned CPS: Lessons learned. *American Statistical Association Proceedings of the Section on Survey Research Methods.*

McKay, R. B. (1994, in press). Touch-tone data entry for CPS sample expansion. *American Statistical Association Proceedings of the Section on Survey Research Methods.*

McKay, R. B., and LaVallee, A. (1993, May). *The Hispanic version of the redesigned CPS questionnaire: Applying sociolinguistic and survey research methods to translating survey questionnaires*. Paper presented at the annual meeting of the American Association for Public Opinion Research, Pheasant Run, IL.

McKay, R. B., Malik, A., and Tupek, A. (1992, May). *Potential use of touch-tone recognition technology in the Current Population Survey*. Paper presented at the annual Field Technology Conference, St. Petersburg, FL.

McKay, R. B., and Sangster, R. L. (1994, May). *Touch-tone data entry for household reporters*. Paper presented at the annual Field Technologies Conference, Danvers, MA.

Miller, S. M. (1994). *What would the unemployment rate have been had the redesigned Current Population Survey been in place from September 1992 to December 1993? : A measurement error analysis*. CPS Bridge Team Technical Report 1, dated March 3.

Miller, S. M. (1994, in press). Measurement error modeling of the CPS and parallel survey data. *American Statistical Association Proceedings of the Section on Survey Research Methods.*

Mullin, P. A., and Tonn, B. E. (1993). Factors associated with proxy knowledge of employment-related information. *American Statistical Association Proceedings of the Section on Survey Research Methods*, 948-953.

National Commission on Employment and Unemployment Statistics. (1979). *Counting the Labor Force*. Washington, DC: Government Printing Office.

Palmisano, M. (1988). *Some results on the application of laboratory research techniques to survey methodology*. Paper presented at the meetings of the American Association for the Advancement of Science.

Palmisano, M. (1989, August). *Respondent understanding of key labor force concepts used in the CPS*. Paper presented at the annual meetings of the American Statistical Association, Washington, DC. (Not published in conference proceedings).

Polivka, A. E. (1994). *Comparisons of labor force estimates from the parallel survey and the CPS during 1993: Major labor force estimates*. CPS Overlap Analysis Team Technical Report 1, dated March 18.

Polivka, A. E., and Martin, E. A. (1992, May). *The use of vignettes in pretesting and selecting questions*. Paper presented at the annual meeting of the American Association for Public Opinion Research, St. Petersburg, FL.

Polivka, A. E., and Miller, S. M. (1994, December). *The CPS after the redesign: Refocusing the economic lens*. Paper to be presented at the Bureau of Economic Research conference.

Polivka, A. E., and Rothgeb, J. M. (1993). Overhauling the Current Population Survey: Redesigning the questionnaire. *Monthly Labor Review, 116(9)*, 10-28.

President's Committee to Appraise Employment and Unemployment Statistics. (1962). *Measuring employment and unemployment*. Washington, DC: U.S. Government Printing Office.

Rothgeb, J. M. (1982). *Summary Report of July Follow-up of the Unemployed*. Unpublished memorandum. Washington, DC: Bureau of the Census.

Rothgeb, J. M. (1994). *Revisions to the CPS questionnaire: Effects on data quality*. CPS Overlap Analysis Team Technical Report 2, dated April 6.

Rothgeb, J. M., and Cohany, S. R. (1992). The revised CPS questionnaire: Differences between the current and proposed questionnaires. *American Statistical Association Proceedings of the Section on Survey Research Methods*, 649-654.

Rothgeb, J. M., and Hess, J. C. (1992, May). *The role of response distribution and item non-response analyses in evaluating alternative question wordings during the redesign of the Current Population Survey*. Paper presented at the annual meeting of the American Association for Public Opinion Research, St. Petersburg, FL.

Rothgeb, J. M., Polivka, A. E., and Creighton, K. P. (1992). *Measurement changes in the redesigned CPS questionnaire*. Paper presented at the Joint Committee Meeting of the Census Advisory Committee of the American Statistical Association and the Census Advisory Committee on Population Statistics.

Rothgeb, J. M., Polivka, A. E., Creighton, K. P., and Cohany, S. R. (1991). Development of the proposed revised Current Population Survey questionnaire. *American Statistical Association Proceedings of the Section on Survey Research Methods*, 56-65.

Schwartz, N. (1987, June). *Cognitive aspects of labor surveys in a multi-national context*. Paper prepared for the OECD Working Party on Employment and Unemployment Statistics.

Shoemaker, H. H. (1993). Results from the Current Population Survey CATI Phase-In project. *American Statistical Association Proceedings of the Section on Survey Research Methods*, 710-714.

Shoemaker, H. H., Bushery, J. M., and Cahoon, L. S. (1989). Evaluation of the use of CATI in the Current Population Survey. *American Statistical Association Proceedings of the Section on Survey Research Methods*, 361-366.

Stein, R. L., and Levine, D. B. (1965). Research in labor force concepts. *American Statistical Association Proceedings of the Social Statistics Section*, 218-226.

Tanur, J. M., and Lee, J. (1992). Youth unemployment measured by the CPS. *American Statistical Association Proceedings of the Section of the Section on Survey Research Methods*, 667-671.

Tanur, J. M., Lee, J., and Shin, H. (1991). Intensity and conceptualizations of job search among youths. *American Statistical Association Proceedings of the Section on Survey Research Methods*, 391-396.

Tanur, J. M., Lee, J., and Shin, H. (1992). Reports of youths' job searches in the CPS. *Bureau of the Census Proceedings of the Annual Research Conference*, 317-352.

Tanur, J. M., and Shin, H. (1990). Reporting job search among youths: Preliminary evidence from reinterviews. *Bureau of the Census Proceedings of the Annual Research Conference*, 746-776.

Tanur, J. M., and Shin, H. (1990, August). *Youths, reporting job search, and the Current Population Survey*. Paper presented at the annual meetings of the American Statistical Association, Anaheim, CA. (Not published in conference proceedings).

Thompson, J. (1994). *Mode effects analysis of major labor force estimates*. CPS Overlap Analysis Team Technical Report 3, dated April 14.

Thompson, J., and Fisher, R. (1994, in press). Two-sample McNemar Tests for complex survey data. *American Statistical Association Proceedings of the Section on Survey Research Methods*.

Thompson, J., and Parmer, R. (1994, in press). A comparison of nonparametric methods with parametric methods for the CPS CATI/CAPI mode effects analysis. *American Statistical Association Proceedings of the Section on Survey Research Methods*.

Tiller, R. (1994, in press). Predicting the National unemployment rate that the old CPS would have produced. *American Statistical Association Proceedings of the Section on Survey Research Methods*.

Tiller, R., and Welch, M. (1994). *Predicting the national unemployment rate that the "old' CPS would have produced*. CPS Bridge Team Technical Report 2, dated March 15. (See also addenda dated March 4 and April 1)

U.S. Bureau of Labor Statistics. (1986). *Report of the BLS-Census Bureau Questionnaire Design Task Force*. Staff report dated November. Washington, DC: U.S. Department of Labor, Bureau of Labor Statistics.

U.S. Bureau of Labor Statistics. (1987). *Second Report of the BLS-Census Bureau Questionnaire Design Task Force*. Staff report dated February. Washington, DC: U.S. Department of Labor, Bureau of Labor Statistics.

U.S. Bureau of Labor Statistics. (1988, June). *Response errors on labor force questions based on consultations with Current Population Survey interviewers in the United States*. Paper prepared for the OECD Working Party on Employment and Unemployment Statistics.

U.S. Bureau of Labor Statistics and National Center for Education Statistics. (1979). *Feasibility study for a project on improvement of occupational information*. Report of the National Occupational Information Coordinating Committee, U.S. Department of Commerce Contract No. AO-A01-788-00-1349. Washington, DC: U.S. Bureau of Labor Statistics and National Center for Education Statistics.

U.S. Bureau of the Census. (1988). *Final report on planning for a post-1990 redesign of the Current Population Survey*. Unpublished report.

Waksberg, J., and Pearl, R. B. (1965). New methodological research on labor force measurements. *American Statistical Association Proceedings of the Social Statistics Section*, 227-237.

Walsh T., et al. (1988). *Evaluation of CATI data quality and costs in the Current Population Survey*. Unpublished research report dated October 27. Washington DC: Bureau of the Census.

Westat, Inc., and AIR, Inc. (1989). *Research on hours of work questions in the Current Population Survey*. Final Report, Bureau of Labor Statistics Contract No. J-9-J-8-0083. Rockville, MD: Westat, Inc.

Westat, Inc., and AIR, Inc. (1989). *Research on industry and occupation questions in the Current Population Survey*. Final Report, Bureau of Labor Statistics Contract No. J-9-J-8-0083. Rockville, MD: Westat, Inc.

Westat, Inc., and AIR, Inc. (1992). *Summary of activities to evaluate the dependent interviewing procedure on the Current Population Survey*. Final Report, Bureau of Labor Statistics Contract No. J-9-J-8-0083. Rockville, MD: Westat, Inc.

AN OVERVIEW OF THE 1992 CENSUS OF AGRICULTURE CATI SYSTEM

Jeanette K. Mon
Bureau of the Census

I. Introduction

Computer assisted telephone interviewing, or CATI, is an enumeration methodology in which responses received by telephone are interactively entered, edited, and coded into data files. The CATI system adopted by the Bureau of the Census provides call scheduling management, contains manager search functions, and produces various monitoring/progress reports.

Uses of the CATI system can vary from collecting present indicators for research polling to accepting detailed enumeration for surveys and/or censuses. Responses can be used to produce skip patterns and are subjected to consistency and magnitude checks. In a typical situation, the interviewer reads the question displayed on the computer screen to the respondent and records the response by keying the appropriate entry; then, the computer performs checks (i.e., validity, comparative), stores the response, and proceeds to the next question. This process continues until all questions have been asked.

For the 1992 Census of Agriculture, the CATI system was used to perform follow-up action for specific nonrespondents. This paper is intended to provide an overview of the developmental and processing phases of this system as well as the handling of output resulting from the 1992 Census of Agriculture CATI System.

II. Background

In 1973, Census Bureau executives became interested in CATI after seeing a demonstration by a private research firm. After several years of research and consultation with other such firms, universities, and computer vendors, the Bureau tested CATI at the University of California's CATI site during the 1978 Current Population Survey. In the early 1980's, the Census Bureau established a CATI project. Hardware and software were acquired in order to construct the Bureau's own CATI system. During the project's first year, staff reviewed the design and capabilities of CATI systems at academic institutions and private firms. Working with the Berkeley and Michigan Survey Research centers, the staff prepared basic requirements for the Census CATI system. From 1982 through 1984, Census conducted CATI research and development surveys from a Telephone Bridge Facility set up in Suitland, Maryland headquarters. The first major testing of this system was conducted for followup of nonrespondents in the 1982 National Survey of Natural and Social Scientists and Engineers, and the 1982 Census of Agriculture.

The first Census Bureau telephone facility, the Hagerstown Telephone Center, (HTC), opened in January 1985. An additional telephone facility opened in Tucson, Arizona in early 1992.

The census of agriculture is required by law under Title 13, United States Code, section 142(a) and 191, which states that an agriculture census be taken in 1979, 1983, and in every fifth year after 1983, covering the prior year. As previously mentioned, Agriculture Division's initial use of the CATI system in the 1982 Census of Agriculture was part of a test to review the system as a viable method of data collection. Agriculture Division (AGR) selected approximately 10,000 delinquent large farm cases for enumeration using this system. The follow-up process for the remaining cases used a clerical unit of operators who called respondents and manually recorded data on an agriculture report form.

For the 1992 Census of Agriculture, a CATI system was developed primarily to address the "large farms" which had not responded to the mailed questionnaire as in 1982. The reasons for using the CATI system for followup were management efficiency, cost effectiveness, and availability of the operation (staff/hardware) from the decennial census. There were also other advantages such as eliminating the data keying step, promoting a paperless census, and using CATI's management capabilities for monitoring and scheduling cases.

III. Overview of the Agriculture CATI System

A. Agriculture Division's Use of CATI

In addition to large farm followup, the AGR CATI system was used for the Nonresponse Survey and low response county projects. The Nonresponse Survey involved contacting a sample of nonrespondents from the main agriculture census. Data collected for this survey was used to determine the proportion of nonresponse cases that are farms and to weight census totals to account for the nonresponse. In the low response county project, a sample of nonrespondents in counties that had not achieved a 75% response rate were selected for contact. The goal of this project was to ensure that published 1992 Census of Agriculture data were based on responses from at least 75% of each county's mailout cases. In the Nonresponse Survey a different (shorter) version of the interviewing instrument was used while the low response county project used the large farm follow-up instrument. Since the system used for large farm followup provided the groundwork for these two projects, this paper will deal only with AGR's experience with the large farm CATI system.

B. System Development

The development of the AGR CATI system was conducted by a Committee responsible for: writing system specifications; developing essential system components; administering tests; coordinating facility schedules; and providing training.

CATI Committee

The 1992 Census of Agriculture CATI Committee consisted of 15 knowledgeable individuals from five divisions within the Census Bureau that are familiar with the various parts of the system. Even though much effort went into the brainstorming, learning, and decisionmaking involved with the development phase, this group remained functional throughout the implementation process and, also assisted in the evaluation of the system. From the onset of the planning phase (August 15, 1991) to the close of the AGR CATI operations (September 30, 1993) several committee personnel changes occurred; however, in most instances, the strategic persons remained involved in this task. The Committee consisted of representatives from:

- AGR to specify the needs for data collection;
- Economic Programming Division (EPD) to facilitate the input and output data;
- Field Division (FLD) to implement the operation with Hagerstown and Tucson staffs;
- Demographic Surveys Division (DSD) to program the QISC interviewing instrument; and,
- Systems Support Division (SSD) to provide support of the CATI system.

For the first six months, the Committee held biweekly meetings to plan the development phase. During this period, the Committee prepared a flowchart and activity schedule; identified and assigned the required specifications; and, scheduled the project for testing and production at the CATI facilities. Attachments A and B are the processing flowchart and the Committee's activity schedule, respectively. After the planning phase, the Committee divided into workgroups to facilitate the development of their respective CATI tasks and reconvened monthly to assure the ongoing progress of each assignment.

During the remainder of 1992, AGR discussed aspects of the interviewing instrument such as sequence and wording of questions, availability and content of referral screens, and consistency checks between responses. This exchange of ideas

resulted in additional refinements in the instrument.

CATI Specifications

As required of all CATI projects, basic system specifications are necessary from the sponsor to provide the framework for system development. Such standard specifications were identified by FLD and SSD committee members and delegated to appropriate members for development.

Many of these specifications required AGR personnel to go through a "learning" period prior to development. In some instances, the concept and format for these documents as recognized by CATI system personnel were complex and involved considerable time for one to become knowledgeable enough to prepare the required documents.

Agriculture Division wrote several other CATI specifications and procedures to explain issues such as training, problem solving, and handling other details not addressed by the basic CATI system specifications. Attachment C is a list of the CATI specifications.

System Tests

Three tests were conducted to refine the system for production. These tests (September 28 & October 28, 1992 and January 14, 1993) were generally conducted in the same manner. Experienced interviewers at the Hagerstown CATI facility telephoned AGR personnel for enumeration. The "mock respondents" were comprised of AGR staff from several different areas of responsibility. Some were given scripts of varying situations (i.e., nonagriculture, refusal, complete) while others presented their own scenario. The tests checked for the following items:

- questions needing rewording and/or additional clarification;
- appropriate routing of interviewing screens from question to question;
- correct output coding for case types and responses (keycoded & nonkeycoded);
- appropriate transfer and installation of files;
- appropriate input file content;
- improvement ideas from interviewers and/or "mock" respondents; and,
- other aspects within the process requiring attention.

The tests also provided sample output files and status tables for review. The output files were passed on to EPD for subsequent reformat testing. The status tables were reviewed for format changes and/or programming errors.

Training

In addition to the usual CATI system training provided to interviewers, AGR supplemented the training with a 2-day intensive instruction course. This course included technical subject-matter learning, pronunciation of practical agricultural terms, a short session in unit conversion using a calculator, practice interviews, and other exercises needed for enumeration. Attachment D is the training schedule.

Training materials for the AGR CATI project were written in FLD's Training Branch based on information submitted by AGR. The materials included:

- Self Study Guide,
- Workbook for Training,
- Paired Practice Interviews Booklet,
- Final Review Exercises,
- Guide for Training CATI Interviewers, and
- Evaluation of Self Study and Classroom Training.

During the training sessions, a reference binder of general information was given to each participant. In view of the voluminous amount of technical detail involved with the AGR subject matter, interviewers were instructed to review this material and use it for assistance as needed. The contents of this binder included a report form guide, alphabetic crop listing, unit conversion chart, and glossary of terms.

Input File Preparation

Each state was processed as a separate file/survey. EPD was responsible for the creation of forty-nine state files to install at the CATI facilities. (Hawaii cases were called in Jeffersonville because of the unique nature of their products.) These files consisted of cases not received in the 1992 Census of Agriculture universe which were preidentified as a "large farm."

Each state file was then processed in directory assistance (DA) subunits at the CATI facilities to obtain missing telephone numbers and correct inconsistent area code/telephone number combinations. At the beginning of the CATI process, the cases which did not yield a "good" telephone number from the DA subunit were left in the state input file for appropriate output coding and to facilitate accounting of all cases in the output file. However, this procedure was modified during the first wave by assigning these cases the appropriate coding upon file installation and omitting them from the calling que.

In addition to correcting the state files for missing telephone numbers or inconsistent area code/telephone number combinations, the files were updated to reflect mail returns received after the creation of each preliminary state file. EPD produced a file of satisfied Census File Numbers or CFNs (i.e., mail-ins, other resolved). They updated this "alert" file daily for use in amending the respective state CATI file by removing satisfied cases from the calling que. This amendment process was conducted one day prior to interviewing and continued daily until state closeout.

C. CATI Processing

Large Farm CATI Schedule for 1993

In order for the entire large farm CATI follow-up process to run efficiently, AGR coordinated with EPD, FLD and SSD to develop a schedule that notified each division of their timely interaction within the process. Attachment E is the schedule showing state workloads and respective dates for each step of processing. The schedule was broken down into 5 waves with approximately 10 states in each wave. States were listed in priority order according to other AGR processing dates. FLD, together with AGR, divided the states between the two telephone centers (Tucson and Hagerstown).

AGR decided to have one state file installed at each site to test the system before installing all of wave 1--Delaware was installed at Hagerstown and Oregon was installed at Tucson. Interviewing began at Hagerstown and Tucson on February 22 and March 8, respectively. As interviewing progressed, FLD installed the remaining state files in both waves 1 and 2 to allow a backlog of available states to call. As the CATI sites ran low on available cases, CATI site managers notified FLD and AGR to approve installation of other states/waves. In May, for instance, Tucson requested more cases in the Pacific time zone to accommodate interviewers who worked late. Consequently, California and Alaska became wave 3A. Wave 4 was also divided into two waves--4 and 4A.

Approximately five weeks were allotted for the interviewing process. As the CATI interviewing progressed, it became necessary to extend some states' closeout dates so that the interviewing process for other states started later than originally scheduled. When this was done, the dates for EPD and Secondary Source Unit (SSU) processing were changed accordingly.

CATI interviewing stopped one day prior to CATI closeout to allow for instrument/output file manipulation. The output files were sent to EPD for reformatting which required three days before sending the files to SSU in Jeffersonville. The

SSU needed about 13 days to resolve these cases, i.e., determine whether or not they were in the scope of the agriculture census. All in-scope cases were then merged with general census processing while out-of-scope cases were coded as such and no further processing was needed.

This schedule was instrumental in keeping all aspects of the processing on track and meeting the goal to complete the entire CATI process by October 1. The CATI sites closed out all states by September 12; and, EPD and SSU processing were completed by September 22.

Field Division Support

During the CATI operations, feedback on problems related to the interviewing process, subject matter, or operational/system efficiency, was relayed from FLD to AGR by the Field Division liaison and resolved, in most cases, via the electronic mail system or telephone. For example, in the beginning of the operation, interviewers questioned whether crops grown in years prior to 1992 but sold in 1992 should be included as 1992 sales. The FLD liaison referred this concern to AGR. AGR personnel informed the FLD liaison that these sales should be included in 1992 sales totals. This was later reiterated in a "briefing note" or bulletin and distributed to supervisors at both CATI sites.

As with any problem posed to AGR, after finding a solution, AGR periodically prepared a briefing note to document/clarify changes to the interviewing or operating process. These changes were discussed at the pre-shift meetings at both CATI sites to keep the interviewers up-to-date on the CATI process. Attachment F is an example of a briefing note.

These notes were essential for transferring information between AGR and FLD at headquarters as well as supervisors and interviewers at the CATI sites. They were also helpful in accounting and documenting each problem's resolution.

Subject Matter Support

To keep members of AGR abreast of CATI status, a "CATI Newsletter" was developed and sent out about every six weeks from March 1992 to January 1993. The newsletter was written by AGR committee members and was distributed to Agriculture Division's Chief, Assistant Division Chiefs, and Branch Chiefs. These newsletters contained information such as status of specifications development; current CATI issues; and, schedules for CATI testing, training, and production. In response to these newsletters, division personnel were able to comment on the CATI process at hand.

Also, AGR analysts made several site visits to the telephone facilities throughout the AGR CATI operation--from initial testing to closeout--to observe the process, monitor interviews, answer technical questions, collect improvement ideas from facility personnel, as well as identify and resolve any instrument and/or processing problems. For example, prior to live interviewing, staff visited the facilities to monitor three tests and to conduct initial training on the Research Operation. Site visits were also scheduled at the start of interviewing at both the Hagerstown and Tucson sites. After this initial "getting started" stage, AGR scheduled site visits about once a month--usually at the start of a new wave of states or at closeout.

Monitoring

Monitoring was an important part of the CATI process. While site visits provided a method for AGR to monitor the flow of facility processing and handling of technical information, CATI management was responsible for monitoring the quality of the interviewing process. Also, AGR received system-generated reports that provided up-to-date workload status for monitoring CATI progress.

To monitor the quality of the interview, the CATI system contains a built-in network which allows supervisors or analysts to listen to an interview on the telephone while simultaneously viewing the computer screen to see how the information is recorded by the interviewer. The facilities maintain specific standards for such monitoring. During initial monitoring (the first three months interviewers are on the job), about 10% of an interviewer's interviewing time each month are monitored. After that, (systematic monitoring) supervisors monitor at least 2.5% of each interviewer's active interviewing time as well as any "special needs" monitoring. In half-hour monitoring sessions, supervisors were able to unobtrusively observe interviewers to identify their strengths and weaknesses. The supervisor would complete a monitoring report each time an interviewer was monitored and provide feedback to the interviewer.

FLD staff sent periodic monitoring reports to AGR via the electronic mail system. At each CATI site and for each wave of the survey, these reports showed: average number of interviewers; number of login hours; and number of monitoring sessions. In the early stages of interviewing, these reports indicated areas where monitoring was inadequate and notice was given to the facility to increase monitoring. At the end of the survey, a final report was received from FLD which included the overall monitoring rate. Attachment G is a copy of this final report.

Every day during processing, AGR received two system-generated reports reflecting the previous day's work for each active state--a Sample Status Report and an Interviewer Performance Report.

Attachment H is an example of a Sample Status Report. Each day AGR extracted and recorded pertinent totals from active state reports such as numbers of cases classified as in-scope, out-of-scope, and remaining active. Cumulative numbers were also extracted and recorded for the following case types: resolved; mail receipts; duplicates; secondary source; and, refused.

Attachment I is an example of an Interviewer Performance Report. This report showed each individual interviewer's call attempts categorized by outcome code and summarized all call attempts by interviewers excluding/including supervisors and managers. Each day AGR extracted from active state reports and recorded data for: number of interviewers used; login hours; and minutes of in-scope calls. At closeout, AGR received a cumulative interviewer's report for the entire period of the survey (i.e., Monday, March 22, 1993 - Sunday, May 2, 1993).

The extracted data from these reports was used in developing several spreadsheets, such as:

- CATI PROGRESS REPORT - A separate spreadsheet for each state (survey) showing the daily progress. For each state report, data is given for each active interviewing day plus state totals.

- LARGE FARM CATI WORKLOAD - A spreadsheet of all states at both telephone facilities by wave/state showing workload totals. The totals are shown for each telephone facility as well as for the U.S.

- CATI INTERVIEWER REPORT - A spreadsheet for each month showing active states (surveys) and giving the daily counts of interviewers working, login hours, and completed interviews for in-scope cases. These monthly reports helped to verify telephone company monthly charges.

Research Operation

When a respondent indicated that they received multiple forms under different names or CFNs for the same operation, the interview was handled as a "possible duplicate". The Research Operation was set up at both CATI facilities to review and/or verify the possible duplicate situations. This involved EPD support in acquiring access to various

agriculture databases for both CATI sites. In view of the security risk, CATI personnel were granted "read only" capability when accessing the AGR Research Menu network routines.

By accessing the "name & address" and "check-in" databases, trained CATI researchers were able to search for duplicate entries in the mail list and verify receipt of the duplicate report forms as needed. The training materials for this operation were developed by AGR analysts and required AGR personnel to conduct agriculture-specific training at both facilities due to FLD's unfamiliarity with this subject.

The benefits of this operation provided notable strides toward customer service as well as improved processing. In contrast to the spontaneous handling of possible duplicate situations in 1992, in 1987 these cases were referred to clerical reviewers after the conversation was ended; and, in cases where subsequent research indicated that an interview was still needed, the respondent was recontacted. The utility of the 1992 operation was invaluable since it resulted in the identification of about 12,000-18,000 duplicates on the AGR mail list and prevented callbacks to an estimated equal number of possible duplicate cases which were unverified by the researcher.

"Claims filed" cases, or situations in which the respondent claimed that they had already mailed their questionnaire, were not routed to the Research Operation since the alert file was updated daily and any mail returns were deleted from the calling que. In these cases, the interviewer prompted the respondent to complete the interview knowing that the form had not been received.

Other Production Processing

Several other details were handled during the CATI interviewing process. For example, specific procedures were established to process "send form" and "Title 13" requests. All other situations which were not predesignated in training were handled as "supervisor referrals."

"Send form" cases, in which the respondent would not agree to be interviewed by telephone but requested a form be sent for completion and mailing, were coded as such and systematically set for a callback 10 days later. The CATI supervisors would check the system daily to pick up all cases with send-form coding and refer them to AGR for form mailing. If the report form was received within 10 days, the CFN was automatically coded as resolved and deleted from the CATI calling que via the daily alert system. Otherwise, CATI interviewers would recontact the respondent to complete the

interview by telephone.

Some respondents requested a copy of the Census Law (Title 13 of the United States Code) that requires them to respond. Again, the interviewer was directed to relay this information to the supervisor who consequently notified AGR of these cases on a daily basis.

D. CATI Output/Results

The results of the CATI attempts were transmitted to Economic Programming Division (EPD) in the form of four files:

- o Answer file - interviewer coding including respondent data and/or interviewer remarks for resolved cases;
- o F7 file - interviewer remarks made during the interviewing process for resolved cases;
- o History file - "snapshot" of installed cases showing each time accessed; and,
- o Case Master file - system management information for each installed case.

Every interviewing day, an Answer and F7 file for each active state were transmitted to EPD for their subsequent reformatting. At each state's closeout, a cumulative version of all four files was transmitted to EPD. EPD was responsible for assuring the receipt of these files and subsequent processing for merging these files into the 1992 Census of Agriculture operations.

Daily Processing

The daily state answer files were the source of in-scope and out-of-scope records.

For in-scope records, besides the answers collected which referred to the farm unit, some data items were created based on interviewer responses to reflect:

- o CATI processing codes,
- o flag indicators of "zero" or "none" responses for specific items,
- o summing of valid duplicate items,
- o geographic changes, and,
- o section indicators.

In addition, these in-scope records were used to update various AGR databases. Whenever there were verbatim responses made during the interview (i.e., "other" crops/livestock not

listed, state or county changes, etc.), they were retrieved and loaded onto the "notes" database for analyst review. A check-in status code indicating "CATI satisfied" was assigned to each record in the "check-in" database. Corrections, if any, in the name, address, and/or telephone number fields were carried to the "name & address" database.

Out-of-scope records identified in the daily answer files were updated in the check-in database by assigning the appropriate status code.

Confirmed refusal cases were also included in the daily answer files to make these cases available for the next processing step (Secondary Source Unit), and, to alleviate storage space in the respective state's active case file. However, in all states, the confirmed refusal cases were processed by EPD from the cumulative state answer file.

The daily F7 files, which consisted of auxiliary notes made by the interviewer during the interview, were reformatted and loaded onto the notes database to provide analysts with supplemental information for in-scope cases.

Closeout Processing

The closeout answer file was cumulative and provided a single source of confirmed refusals and other unresolved cases requiring SSU processing. Cases routed to SSU were identified by specific final code. Attachment J is a list of these case types and the respective final codes.

Similar to the reformatting of in-scope records, interviewer comments, if any, and processing data items were created for each SSU case and forwarded to the Jeffersonville facility for assistance in determining the resolution.

Other Output Processing

The history file consisted of one record for each time a case was accessed. This file was transmitted to EPD at the closeout of each state survey. A separate history record was created for each case to show all the calls that were made as well as other actions where calls were not made (such as, when one "quits out" of a case before dialing). This file was routinely used by facility management to track the progression of a particular case. From this file, AGR manipulated information using SAS software to produce tables and graphs for management analysis. See Attachments K through N for examples of AGR charts produced from various history files. These state history files are in storage for potential studies at a later date.

A case master file was also transmitted to EPD at the closeout of each state survey. This file consisted of one record per case which contained essential information for that case for case-management purposes. Information in the case master file was always kept current--former values of variables were not retained. CATI facility personnel usually accessed this file as a convenient source for specific case details. For the purpose of analyzing the system, data from this file could be used for reviewing number of call attempts for specific outcomes, callback time preferences, and so on. Since AGR's plans for CATI evaluations are not complete at this time, these state case master files are being stored for possible later use.

IV. Summary of Agriculture CATI System Results

A. Final Case Accounting

Of the 152,815 cases installed for CATI resolution, 57,708 cases (37.8%) were enumerated as in the scope of the agriculture census while 15,148 (9.9%) were out-of-scope. Through research, 4,924 cases (3.2%) were determined to be duplicates of satisfied cases. After CATI file installation, 29,312 cases (19.2%) were omitted from the interviewing process as they were received in the mail. A total of 45,723 unresolved cases (29.9%), including 3,188 confirmed refusals, were routed to SSU for additional processing.

The results of the 1992 large farm CATI followup with comparative statistics from the 1987 nonCATI operation are shown in Attachment O, Table 1, Results of the 1992 and 1987 Delinquent Large Farm Followup.

When comparing the results of the 1987 clerical and 1992 CATI operations, one notices the higher in-scope rate (+5.2%) and slightly lower out-of-scope rate (-1.3%) in 1992. In both operations, a large number of cases were unresolved requiring SSU processing. These SSU cases (29.9% in 1992 and 31.7% in 1987) include respondent-contacted situations (i.e., insufficient partial interviews, refusals, callbacks) as well as noncontact cases (i.e., busy, no answer, never tried). Since the level of mail receipts is independent of operation type (nonCATI or CATI), these numbers only reflect the timely creation of the input call file prior to the telephoning process.

Another observation which is evident upon review is the difference in processing claims filed and possible duplicate situations. As mentioned previously, in 1992 these cases received spontaneous handling versus 1987's procedure to discontinue the telephone call, perform research, and, if

necessary, recontact the respondent. Claims filed cases resulted in prompting for an interview in 1992 (since the calling que was updated daily by the alert file). Possible duplicate cases were verified by the Research Operation and appropriate action was taken.

The different environments provided by the 1992 and 1987 systems make it difficult to conclude whether operation type is responsible for the resulting differences. Dissimilar management philosophies, physical locations/office set up, and experience level of interviewers are some factors which inhibit any attempt to denote collection methodology as the single reason for varying results.

B. Cost Analysis

The cost of the 1992 delinquent large farm followup amounted to almost $2.1 million or $13.56 per case. This amount included staffing for supervision/interviewing, system development (excluding AGR analysts), communications, equipment, and general administrative support.

Attachment P, Table 2, shows data for comparing the cost of the 1992 and 1987 delinquent large farm follow-up operations. When the 1987 operation cost is adjusted to show 1993 dollars, the 1992 CATI system cost savings is $2.17 or 13.8% less per case than the 1987 nonCATI operation. The overall cost of the 1992 CATI followup shows an approximate increase in expenses of $146,000 or 7.6% more than the 1987 nonCATI followup.

It would be misleading to use these statistics to make any conclusions concerning cost savings between the two operations. The expenses shown in Table 2 are actual charges made to the respective projects. Costs for general staff time (AGR and other), questionnaire design, use of previously procured hardware, and communication expenses covered by blanket costs are some of the factors which need to be addressed in making a system comparison. In addition, there are operational differences (i.e., quality control, supervisor/interviewer ratio) and post-interview processing (i.e., data entry needs, file reformatting) which should be addressed to gauge the benefits of each operation's yield versus cost.

V. Evaluation of the Agriculture CATI System

Reactions to the CATI system are necessary for the proper assessment of the operation. They provide valuable input towards building future CATI systems. To develop an improved efficient data collection system, AGR requested feedback from various persons

involved with the 1992 CATI operation.

A. Feedback from CATI Committee/Site Staff

After interviewing concluded, the CATI Committee was asked to submit any ideas or comments on the entire CATI developmental and operational process. In general, the suggestions consisted of need for: 1) more lead time for system development; 2) additional in-depth testing; 3) periodic retraining for interviewers during the process; 4) tracking of file transmissions; and, 5) prompt downloading of closed out state files.

In conjunction with AGR, FLD held five debriefing sessions at both CATI sites. These open forum meetings were conducted by the FLD liaison with AGR personnel present to answer questions and monitor delivery of the presentation.

To gather feedback for all three AGR CATI projects (i.e., large farm, nonresponse, low response counties), general questions as well as separate questions pertaining to the specific project were asked. The time set for these sessions was such that the majority of the states/surveys were closed out or approaching close-out. Large farm interviewing officially ended on September 12. Nonresponse and low response county projects closed out on August 20 and September 30 respectively.

The three debriefing sessions at the Tucson CATI facility were held on August 31 (10:00 AM and 2:00 PM) and September 1 (10:00 AM). Nine people attended the first morning session and eight people attended each of the other two sessions. In Hagerstown, two sessions were held on September 9 with nine attendees at 10:00 AM and seven attendees at 2:00 PM.

All personnel involved with the CATI operation (interviewers, supervisors, directory assistance callers, researchers, on-site analysts) were given an opportunity to complete the handout of questions (Attachment Q). However, a sample of these persons were invited to attend the debriefing sessions for extended discussions on the AGR CATI operation.

Overall, the sessions yielded many constructive suggestions for improving the system. The majority of problems cited were repeated in each of the sessions. A detailed summary of the responses and comments were consolidated into the 1992 Census of Agriculture Manual for reference. Such documentation will be useful to AGR in prospective CATI systems.

B. Evaluation Documentation

As traditionally conducted for the majority of census processing systems, AGR staff is currently documenting the CATI process in an evaluation paper. This paper will include: 1) system development and processing details; 2) CATI merge processing; and, 3) 1992 CATI versus 1987 nonCATI data review. Aspects of CATI recognized by CATI Committee members, CATI site staff, and AGR subject matter analysts as requiring "enhancements" or additional address are also noted in this synopsis for improvement of future AGR CATI systems.

Other CATI-associated studies in AGR are underway as well. A 1997 Census of Agriculture planning team has been formed to establish criteria for a CATI system for the next census based on review of CATI versus nonCATI data in the 1992 census. For example, this team has solicited feedback from AGR subject matter analysts to isolate problematic data items in CATI cases. Subsequently, the team will create and evaluate tallies of these suspect items for CATI and nonCATI records to verify their source.

C. CASIC Presentation

After the AGR CATI operations concluded in September 1993, AGR presented a brief overview to the Computer Assisted Survey Information Collection (CASIC) group. This group at the Census Bureau is dedicated to the automation of data collection through computerized technologies. In view of the fact that CATI is undergoing "redesign" in the Bureau to produce a centralized computer assisted data entry system across three sites (present facilities: Hagerstown and Tucson; new third site: Jeffersonville, IN.), and that the 1992 Census of Agriculture was the largest single project to use the CATI system, CASIC requested feedback from AGR to identify system strengths and weaknesses. Many of the comments submitted to CASIC are also included in this paper.

VI. Suggestions for Future Agriculture CATI Systems

Based on the success of the 1992 AGR CATI System, especially the processing phase, it is my opinion that CATI can be an efficient tool for follow-up data collection. Considering the 1992 incurred cost, beneficial automated features, paperless reporting, and installation of the Research Operation, this system is a viable method of enumeration. However, AGR's large scale encounter with this processing technology has lent itself to many improvement ideas.

As a result of this experience with CATI, the following are suggestions for enhancing prospective AGR CATI systems:

A. Developmental Recommendations

- Learn the CATI system to become aware of its potential. Sponsors should be knowledgeable of the capabilities to maximize its use and deal with system shortcomings properly for other processing coordination.

- Allow adequate time for testing. If possible, mock respondents not associated with the survey should be used in the tests.

B. Processing Recommendations

- Search for continual improvement ideas during processing. For example, review of case management files could possibly show significant "trends" toward specific callback times. In this case, interviewer scheduling should be adjusted accordingly.

- Acknowledge retraining needs. Even though AGR training was perceived to be complete, several interviewers indicated in the debriefing sessions that they had additional questions and/or situations requiring reverification after initial interviewing.

- Acquire on-site support staff for communications problems. Operations can be severely hampered awaiting personnel from headquarters to address problems.

C. Systems Recommendations

- Allow for customized output answer files. Files with standardized CATI output pose inefficient storage/handling situations when only a portion of the data is needed.

- Allow for customized progress reporting. System generated reports are primarily used by facility management and are difficult for sponsors to use.

- Develop interviewer paths for various situations. Allow for regional crops/livestock, basic information collection for reluctant respondents, and easy-skip paths for respondents indicating involvement with few commodities.

- Permit sponsor "read only" access to CATI management system. Since full access can be a security problem "read only" capabilities would allow the sponsor to make spontaneous status checks, track specific case

responses, etc. without FLD intervention.

- Automate system file transmissions. Routing of input and output files was manually monitored requiring much attention for operations consisting of numerous files/surveys.

- Explore hardware/software for CATI enhancements such as automated dialing to prevent misdialing, instrument software to allow for word processing capabilities, etc.

VII. Conclusion

Due to the use of the CATI system, improvements in this census' followup of delinquent large farms are apparent in the production phase regarding more interactive features and in eliminating subsequent processes.

Recognizing the long-term goals of the Bureau to use the latest technologies for more efficient and productive systems, CATI has offered several improved features over the 1987 Census of Agriculture clerical follow-up unit. Most notable of these are the systematic call scheduler, management research capabilities, and automated status report generation. In addition, other attributes yielded by CATI usage are savings from eliminating a separate data keying phase, omitting the need for paper questionnaires and their handling/storage, and providing better customer service through spontaneous research of possible duplicate cases requiring fewer recontacts.

Comparing the CATI to nonCATI follow-up operations is difficult. As mentioned in Section IV, part B, Cost Analysis, incurred costs are an unfair indicator of cost savings between 1992 CATI and 1987 nonCATI since savings and production efficiencies are not considered. Also, to conclude that any data disparity is a result of the collection methodology would be a misinterpretation in view of operational differences. Because of these factors which make comparison of CATI versus nonCATI systems very complex, AGR will be cautious in drawing conclusions--other than the realized progress achieved in process automation and better service to the respondent.

Aside from the deficiencies in comparing CATI and nonCATI operations for conclusive statements, AGR plans to review CATI-originated data with nonCATI data in the 1992 Census of Agriculture by examining the level of edited and/or imputed statistics. Rather than conclude that the operation source is the cause of any differences, the 1997 Census of Agriculture CASIC planning team will use these comparisons to detect dissimilarities in the data capture (i.e., wording and/or sequence of questions).

In summary, the 1992 Census of Agriculture CATI System was successful in terms of completing the follow-up phase in an efficient and timely manner. The automated features including the customized Research Operation provided many enhancements over the 1987 clerical operation. AGR hopes to build upon their experience with this initial system and use CATI in the 1997 Census.

REFERENCES

Ferrari, Pamela W. "An Evaluation of Computer-Assisted Telephone Interviewing Used During the 1982 Census of Agriculture," Research Paper, Agriculture Division, January 1986.

Mon, Jeanette K. and King, Elizabeth A. "Evaluation of the 1992 Census of Agriculture CATI System," in 1992 Census of Agriculture Manual, Project Manual MC, Chapter 27, Subchapter A, Document 2, Draft version, April 1994.

LIST OF ATTACHMENTS

A. Agriculture Division Large Farm CATI Flowchart

B. CATI Committee Schedule

C. 1992 Agriculture Census CATI Specifications

D. Schedule of Training

E. Large Farm CATI Schedule for 1993

F. Large Farm Followup Briefing Note (sample)

G. Monitoring Report as of 9/25/93

H. Sample Status Report (sample)

I. Interviewer Performance Report (sample)

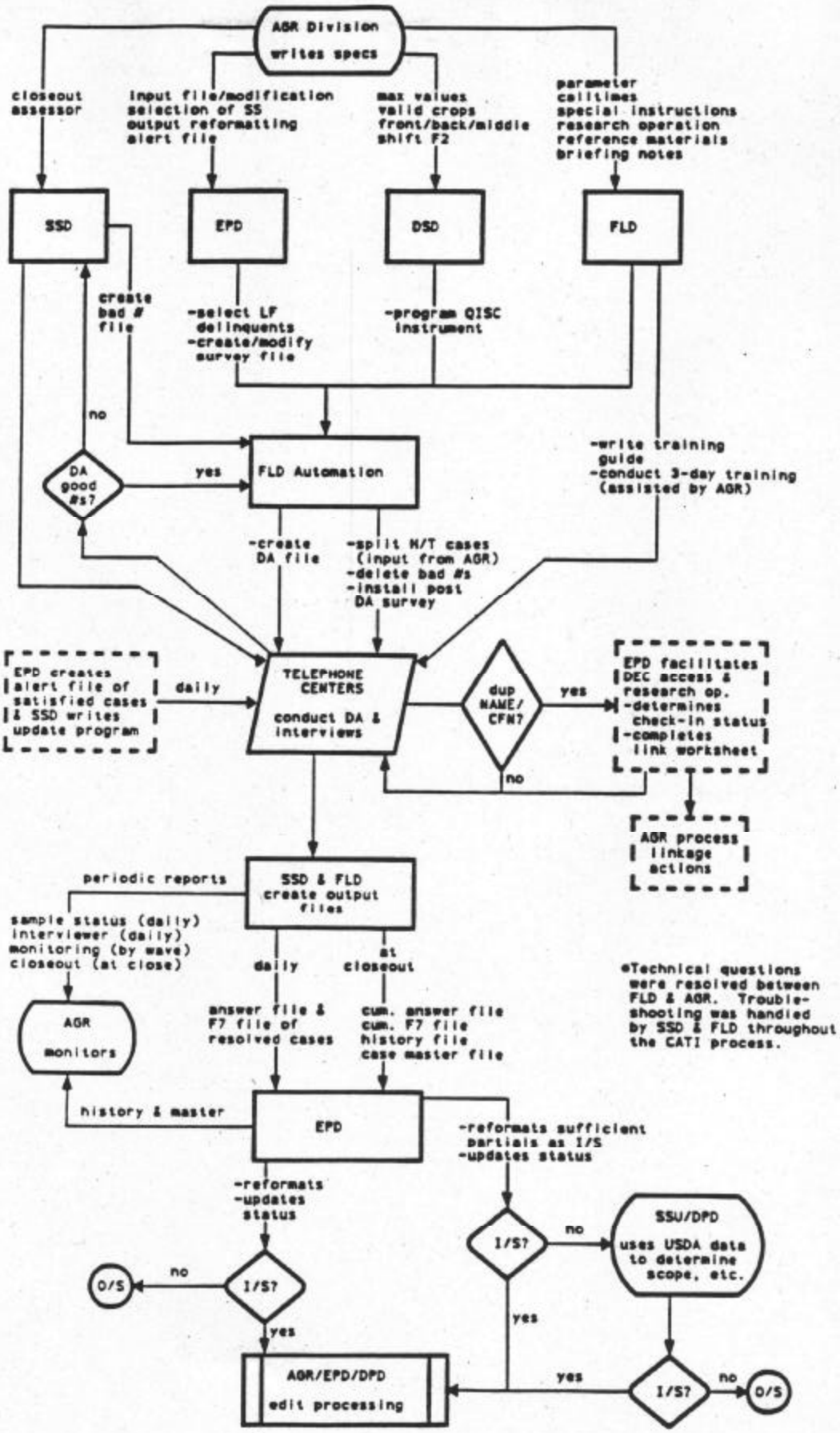
J. List of SSU Designated Case Type by Final Code

K-N. Agriculture charts/graphs from history record data

O. Table 1, Results of the 1992 & 1987 Delinquent Large Farm Followup

P. Table 2, Cost Comparison of the 1992 and 1987 Large Farm Followup

Q. Telephone Center Debriefing Handout


AGR Division writes specs
closeout assessor
input file/modification selection of SS output reformatting alert file
max values valid crops front/back/middle shift F2
parameter calltimes special instructions research operation reference materials briefing notes
SSD
EPD
DSD
FLD
create bad # file
-select LF delinquents -create/modify survey file
-program QISC instrument
no
DA good #s?
yes
FLD Automation
-write training guide -conduct 3-day training (assisted by AGR)
-create DA file
-split H/T cases (input from AGR) -delete bad #s -install post DA survey
EPD creates alert file of satisfied cases & SSD writes update program
daily
TELEPHONE CENTERS conduct DA & interviews
dup NAME/ CFN?
yes
EPD facilitates DEC access & research op. -determines check-in status -completes link worksheet
no
AGR process linkage actions
periodic reports
SSD & FLD create output files
sample status (daily) interviewer (daily) monitoring (by wave) closeout (at close)
daily
at closeout
AGR monitors
answer file & F7 file of resolved cases
cum. answer file cum. F7 file history file case master file
•Technical questions were resolved between FLD & AGR. Trouble-shooting was handled by SSD & FLD throughout the CATI process.
history & master
EPD
-reformats sufficient partials as I/S -updates status
-reformats -updates status
I/S?
no
SSU/DPD uses USDA data to determine scope, etc.
O/S
no
I/S?
yes
yes
AGR/EPD/DPD edit processing
yes
I/S?
no
O/S

Revised 3/2/92

CATI COMMITTEE SCHEDULE

Activity	Start Date	Complete Date	Responsible Person/Div
1. QISC Specs	9/91	3/92	Battle/King Mon
Modifications	11/91	8/92	DSD/AGR
2. Testing			
a. QISC	3/92	8/92	Battle/King/ Mon/DSD
b. Transmission to/from EPD	6/92	1/93	FLD/SSD/AGR/ EPD
c. Complete system (Pretest)	8/92	8/92	AGR/FLD/SSD/ DSD
d. State test	2/93	2/93	AGR/FLD/SSD/ EPD/DSD
3. Other Specifications	2/92	12/92	AGR/FLD/SSD/ EPD/DSD
4. Training Package/ Personnel	6/92	2/93	AGR/FLD
5. Implementation of System	3/93	8/93	FLD/AGR/SSD/ EPD
6. Evaluation	9/93	5/94	Committee

Attachment C

1992 AGRICULTURE CENSUS CATI SPECIFICATIONS

Manual Number	Title (explanation)
92EAG-A-MC-10-E-04	CATI Specs for Large Delinquent Telephone Followup (QISC programming specs for middle of interview--sections 1-31 of report form--designating outcome codes)
92EAG-A-MC-10-E-06	CATI Input File Specs (components and layout of the input file)
92EAG-A-MC-10-E-08	Valid Crop Listing for CATI QISC Specs (listing valid crops for each state)
92EAG-A-MC-10-E-10	CATI Assessor Specs (assignment of agendum and final codes which designate the next action)
92EAG-A-MC-10-E-12	CATI Front/Back for Delinquent Large Farm Followup (QISC programming specs for introduction and closing portions of the interview designating outcome codes)
92EAG-A-MC-10-E-13	CATI Test File Specs (input file specs for testing)
92EAG-A-MC-10-E-14	CATI Closeout Specs (assignment of final, outcome and agendum codes which designate whether sufficient partial or secondary source processing)
92EAG-A-MC-10-E-15	CATI Parameter Specs (a consolidation of several specs for a file used to pass individual survey info to the CATI system and specifies other file management requirements)
92EAG-A-MC-10-E-19	CATI Responses to Commonly Asked Questions (shift F2 option available to interviewers during interview)
92EAG-A-MC-10-E-22	Research Operation for Large Farm CATI (instructions for accessing AGR database to verify "claims filed" or "duplicate" situations)
92EAG-A-MC-10-E-23	Special Instructions for CATI Supervisors (supervisor duties regarding the research operation and certain agendums, i.e., refusals, language barrier, etc.)

92EAG-A-MC-10-E-24	CATI Output Reformatting Specs (info concerning the raw CATI answer file and needed reformatting/data manipulation)
92EAG-A-MC-10-E-30	CATI Calltimes Specs (setting times and days for making calls)
92EAG-A-MC-10-E-31	Large Farm CATI Schedule for 1993 (dates set for each step of processing)
92EAG-A-MC-10-E-38	Selection of Secondary Source Cases (specs for creating SSU file)
92EAG-A-MC-10-E-40	Change in CATI Interviewing Process for Acres (K787)
92EAG-A-MC-10-E-41	CATI Workbook for Training (interviewer training)
92EAG-A-MC-10-E-42	CATI Self Study for Interviewers (part of interviewer training)
92EAG-A-MC-10-E-43	CATI Final Review Exercise (part of interviewer training)
92EAG-A-MC-10-E-44	Large Farm CATI Briefing Notes (notes to supervisors/interviewers instructing how to handle particular situations)
92EAG-A-MC-10-E-45	Large Farm CATI Newsletters (information to keep AGR staff abreast of what was happening regarding AGR CATI)

Schedule of Training

Day 1

Chapter	Topic	Estimated Length	Total Elapsed Time
Chapter A	Introduction to the 1992 Census of Agriculture	1/2 hr.	1/2 hr
Chapter B.	Using the Agriculture Census Reference Materials	1 hr.	1 1/2 hrs
	Break	1/4 hr.	1 3/4 hrs
Chapter C	Farm Operations	1 1/2 hrs.	3 1/4 hrs
	Break	1/4 hr.	3 1/2 hrs
Chapter D	Walk-through Training Interview	3/4 hrs.	4 1/4 hrs
Chapter E	Concepts and Procedures	3/4 hrs.	5 hrs
Chapter F	Two Paired Practice Interviews	1 1/4 hrs.	6 1/4 hrs

Day 2

Chapter G	Another Walk-through Interview	1 1/4 hrs.	1 1/4 hrs
	Break	1/4 hr.	1 1/2 hrs

Day 2 (continued)

Chapter	Topic	Estimated Length	Total Elapsed Time
Chapter H	Additional Concepts and Procedures	3/4 hr.	2 1/4 hrs.
	Break	1/4 hr.	2 1/2 hrs.
Chapter I	Two Paired Practice Interviews	1 1/4 hrs.	3 3/4 hrs.
	Break	1/4 hr.	4 hrs.
Chapter J	Final Review Exercise	3/4 hr.	4 3/4 hrs.

Attachment E

Revised 10/5/93

LARGE FARM CATI SCHEDULE FOR 1993

WAVE	STATE	ESTIMATED MAXIMUM WORKLOAD	ACTUAL WORKLOAD	ACTUAL DATES FOR: CREATE FILE	DIR'Y ABST.	BEGIN INTVIEW	END INTVIEW	CATI CLOSEOUT	EPD PROCESS	SECOND. SOURCE	DATA KEY'D CLOSEOUT
1-H	DE (51)	726	1,147	2/4	2/8	2/22	3/27	3/28	5/4	5/7	5/19
1-H	IN (32)	4,001	3,882	2/25	2/26	3/2	4/17	4/18	5/5	5/7	5/18
1-T	OR (82)	3,482	3,866	2/25	3/1	3/8	4/10	4/11	5/21	5/24	6/3
1-T	WI (35)	3,152	3,026	3/4	3/8	3/16	4/17	4/18	5/14	5/14	5/28
1-T	WA (91)	3,528	3,528	3/4	3/8	3/23	5/1	5/2	5/27	5/27	6/10
1-T	IA (42)	5,966	5,796	3/4	3/8	3/23	5/1	5/2	5/18	5/19	6/1
1-T	MO (43)	4,789	5,251	3/4	3/8	3/30	5/13	5/14	5/25	5/27	6/9
1-H	OH (31)	3,562	3,475	3/4	3/8	3/16	5/1	5/2	5/26	6/7	6/15
1-H	MD (52)	1,376	1,577	3/4	3/8	3/16	5/1	5/2	6/9	6/10	6/24
1-H	WV (55)	825	857	3/4	3/8	3/16	4/17	4/18	6/10	6/11	6/25
2-H	VA (54)	3,018	3,007	3/4	3/8	3/22	5/1	5/2	6/11	6/15	6/28
2-T	KS (47)	3,394	3,282	3/4	3/8	4/2	5/8	5/9	6/16	6/21	7/7
2-T	IL (33)	4,158	3,830	3/4	3/8	4/6	5/8	5/9	6/25	6/28	7/14
2-H	MI (34)	3,069	3,282	3/4	3/8	3/22	5/1	5/2	7/6	7/6	7/26
2-T	WY (83)	2,352	2,606	3/4	3/8	4/7	5/8	5/9	7/16	7/21	8/5
2-H	ME (11)	718	830	3/4	3/8	3/29	5/1	5/2	7/11	7/14	8/2
2-H	NH (12)	234	243	3/4	3/8	3/29	4/17	4/18	7/11	7/14	8/2
2-H	VT (13)	1,020	1,217	3/4	3/8	3/29	5/1	5/2	7/12	7/15	8/2
2-H	CT (16)	427	534	3/4	3/8	3/29	5/1	5/2	7/12	7/15	8/2
2-H	MA (14)	597	685	3/4	3/8	3/29	5/1	5/2	7/17	7/20	8/2
2-H	RI (15)	84	113	3/4	3/8	3/29	4/17	4/18	7/17	7/20	8/2
3-T	CO (84)	2,695	2,249	4/8	4/12	5/3	6/10	6/11	7/20	7/23	8/13
3-T	ID (82)	2,790	2,406	4/8	4/12	4/22	6/1	6/2	7/24	7/27	8/18
3-H	NJ (22)	1,800	1,805	4/8	4/12	4/22	5/22	5/23	7/24	7/27	8/18
3-H	PA (23)	6,084	4,940	4/8	4/12	4/22	6/5	6/6	7/31	8/3	8/20
3-H	NY (21)	4,550	4,053	4/8	4/12	4/22	6/5	6/6	7/25	7/28	8/20
3-H	KY (61)	3,672	3,472	4/8	4/12	4/22	6/5	6/6	7/27	7/30	8/24
3-H	TN (62)	3,414	3,407	4/8	4/12	4/22	6/5	6/6	7/29	8/3	8/30
3-T	UT (87)	2,404	2,391	4/8	4/12	5/1	6/1	6/2	7/30	8/5	8/6
3-T	NE (46)	5,661	5,064	4/8	4/12	4/19	6/14	6/15	8/2	8/5	8/3
3-T	MN (41)	8,247	7,515	4/8	4/12	4/21	6/24	6/25	8/3	8/12	8/20
3-T	MT (81)	4,480	3,950	4/8	4/12	5/10	6/24	6/25	8/4	8/13	8/24
3A-T	CA (93)	8,803	7,627	5/5	5/10	6/4	7/17	7/18	8/5	8/10	8/17
3A-T	AK (94)	825	789	5/5	5/10	6/4	7/17	7/18	8/7	8/10	12/10
4-H	TX (74)	9,311	8,022	6/3	6/4	6/15	6/14	6/15	8/17	8/25	10/5
4-H	NC (56)	4,018	3,105	6/3	6/4	6/15	7/17	7/18	8/13	8/17	10/22
4-H	FL (59)	5,755	5,396	6/3	6/4	6/15	7/17	7/18	8/25	9/2	11/24
4-T	NV (88)	800	525	6/3	6/15	6/21	7/17	7/18	8/4	8/12	10/5
4A-H	ND (44)	4,006	3,419	6/3	6/11	6/15	7/31	8/1	8/16	8/19	11/3
4A-H	SD (45)	3,787	3,480	6/3	6/11	6/15	7/31	8/1	8/18	8/31	11/3
4A-T	AR (71)	6,374	4,870	6/3	6/15	6/22	7/17	7/18	8/19	9/1	11/5
4A-T	AZ (86)	1,432	1,141	6/3	6/10	6/22	7/17	7/18	8/23	9/1	11/19
4A-T	NM (85)	3,040	2,578	6/3	6/10	6/22	7/17	7/18	8/24	9/7	12/1
5-T	AL (63)	3,805	2,717	7/12	7/14	7/20	8/11	8/12	8/14	8/20	12/3
5-H	MS (64)	2,867	2,241	7/12	7/26	8/2	8/11	8/12	8/13	8/15	12/2
5-T	OK (73)	5,770	4,822	7/12	7/14	7/20	8/11	8/12	8/16	8/22	12/3
5-T	LA (72)	3,213	2,727	7/12	7/14	7/19	8/11	8/12	8/13	8/15	12/6
5-H	SC (57)	1,934	1,717	7/12	7/26	8/2	8/11	8/12	8/14	8/17	12/21
5-H	GA (58)	4,841	4,291	7/12	7/26	8/2	8/11	8/12	8/18	8/21	12/5
	TOTAL	166,778	152,815								

H = Hagerstown

T = Tucson

*Each state was updated for mail receipts the night before interviewing began

1992 Census of Agriculture CATI System
Large Farm Followup Briefing Note #5 - March 16, 1993

Thank you for your continued efforts in our data collection phase! Please note the following points:

- If the respondent indicates he/she has grapes, please read "grape vines" instead of "grape trees" as shown on the screen. (This will be corrected ASAP.)

- If respondent indicates he has peppermint, select "mint for oil" in section 2 or 7. They are the same.

- Only call the Research Operator when there is an actual duplicate situation (duplicate forms received for one operation with DIFFERENT names and/or CFNs). Remember to read the second sentence on the >multiforms< screen and the >claimsfile< screen before accepting a response.

- When "READ LISTING" appears on the screen, read the entire list.

  When "READ, IF NECESSARY" appears, you may use information previously given in the interview to decide if you need to read the entire list. For instance, in S9 the letter "P" appears next to the crops produced, so you want to probe for those particular items and then ask "Any others?" (it may not be necessary to read the entire list). If in doubt, read the entire list.

- The Shift F1 option brings up the >info-ref< screen which gives you the name and full address of the respondent. This option is useful for the interviewer in filling out the top portion of the worksheet when research is unavailable.

  After getting into the middle of the interview (beginning with S1), the Shift F1 >info-ref< screen will also give you the option "C" to change the respondent.

- Any CFNs reported as duplicates on the >check< screen will be displayed on the >research< screen. If the CFN is displayed, MOVE THE CURSOR by pressing enter to get to where you indicate whether the dup was found. DO NOT type in anything else on the line where the cursor first appears, unless there was no CFN displayed and you need to enter a CFN found by the Research Operator.

- On the >hello-2< screen, if you enter "11" (deceased & sold farm) you go to the >intro-b< screen where you should enter "8" (sold farm). The next question asks if operated during any part of 1992--if yes, the interview continues; if no, the interview ends.

Below find the requested Ag monitoring data as of September 25:

Hagerstown:

	Ave. # Intvrs.	Login Hours	Mon. sessions	Mon. rate
Wave 1	88	5757	311	5.4
Wave 2	73	4524	236	5.2
Wave 3	146	9550	269	2.8
Wave 4 & 5	73	14424*	375	2.6
Wave 5	198	3538	204	5.8

* these login hours include an underestimated amount of 14.7 for state 74

Tucson:

	Ave. # Intvrs.	Login Hours	Mon. sessions	Mon. rate
Wave 1	107	9283	144	1.55
Wave 2	122	4176	71	1.7
Wave 3	153	12281	440	3.6
Wave 4	141	9094	335	3.7
Wave 5	93	7200	243	3.4

TTC has included AG Model Drop in their counts.

ACRLF57 CREATED: 09/06/93 01:52:05

SAMPLE STATUS REPORT

FOR: SUNDAY SEPTEMBER 5, 1993

REMAINING ACTIVE CASES BY TIME ZONE

		TOTAL	EASTERN	CENTRAL	ROCKY	PACIFIC	YUKON	HAWAII
NO TELEPHONE NUMBER	(1)	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00
NEW CASE	(0,2)	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00
UNREACHED CASE	(3)	1 0.02	1 0.02	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00
DIRECTORY ASSISTANCE NEEDED	(4)	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00
CONTACT, RESP NOT REACHED	(6)	4 0.07	3 0.06	1 0.14	0 0.00	0 0.00	0 0.00	0 0.00
CONTACT, RESP REACHED	(7)	11 0.20	10 0.21	1 0.14	0 0.00	0 0.00	0 0.00	0 0.00
AWAITING MAILBACK	(8)	9 0.16	8 0.17	1 0.14	0 0.00	0 0.00	0 0.00	0 0.00
REFUSAL/NO PROGRESS	(9)	5 0.09	5 0.10	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00
PARTIAL INTERVIEW	(14)	25 0.45	21 0.44	4 0.57	0 0.00	0 0.00	0 0.00	0 0.00
HOSTILE BREAK/OFF REFUSAL	(15)	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00
OTHER	(5,10-13,16-20)	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00
TOTAL/MARK	(0-20)	55 1.00	48 1.00	7 1.00	0 0.00	0 0.00	0 0.00	0 0.00

TODAY'S RESOLVED CASES BY TIME ZONE

		TOTAL	EASTERN	CENTRAL	ROCKY	PACIFIC	YUKON	HAWAII
COMPLETE (ALL ITEMS)	(1)	5 0.83	4 0.80	1 1.00	0 0.00	0 0.00	0 0.00	0 0.00
PARTIAL TYPE 1	(2)	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00
PARTIAL TYPE 2	(3)	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00
PARTIAL TYPE 3	(4)	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00
PARTIAL TYPE 4	(5)	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00
PARTIAL TYPE 5	(6)	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00
MAILED FORM/SAME CFN	(7)	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00
MAILED FORM/DUP CFN	(8)	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00
OTHER DELETION	(9)	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00
DECEASED/NO REFERRAL	(10)	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00
LANDLORD ONLY	(12)	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00
NONAGRICULTURE	(13)	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00
NONAGRICULTURE = 10 AC	(14)	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00
SOLD FARM	(15)	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00
SOLE OPERATOR MOVED/NO REFERRAL	(17)	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00
SOLE OPERATOR ILL/NO REFERRAL	(18)	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00
OTHER NONINTERVIEW	(19)	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00
UNCONVERTIBLE LANGUAGE BARRIER	(21)	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00
UNPUBLISHED NUMBER	(22)	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00
NO LISTING (LEARNED FROM DA)	(23)	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00
NO INITIAL NUMBER SUPPLIED	(24)	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00
CONFIRMED REFUSAL	(25)	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00
SEARCH CUTOFF	(26)	1 0.17	1 0.20	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00
CLAIMS FILED/UNCONFIRMED	(35)	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00
MAIL RETURN UPDATE	(104)	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00
CLOSEOUT CUTOFF	(115-127)	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00
OTHER	(11,16,28,27-34,36-103,105-114, 128-200)	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00
TOTAL/FINAL	(1-200)	6 1.00	5 1.00	1 1.00	0 0.00	0 0.00	0 0.00	0 0.00

CUMULATIVE RESOLVED CASES BY TIME ZONE

	TOTAL	EASTERN	CENTRAL	ROCKY	PACIFIC	YUKON	HAWAII

COMPLETE (ALL ITEMS)	(1)	818	0.49	781	0.54	37	0.18	0	0.00	0	0.00	0	0.00	0	0.00
PARTIAL TYPE 1	(2)	9	0.01	9	0.01	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
PARTIAL TYPE 2	(3)	2	0.00	2	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
PARTIAL TYPE 3	(4)	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
PARTIAL TYPE 4	(5)	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
PARTIAL TYPE 5	(6)	103	0.06	97	0.07	6	0.03	0	0.00	0	0.00	0	0.00	0	0.00
MAILED FORM/SAME CFN	(7)	65	0.04	61	0.04	4	0.02	0	0.00	0	0.00	0	0.00	0	0.00
MAILED FORM/DUP CFN	(8)	79	0.05	78	0.05	1	0.00	0	0.00	0	0.00	0	0.00	0	0.00
OTHER DELETION	(9)	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
DECEASED/NO REFERRAL	(10)	3	0.00	3	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
LANDLORD ONLY	(12)	30	0.02	26	0.02	4	0.02	0	0.00	0	0.00	0	0.00	0	0.00
NONAGRICULTURE	(13)	73	0.04	71	0.05	2	0.01	0	0.00	0	0.00	0	0.00	0	0.00
NONAGRICULTURE = 10 AC	(14)	75	0.05	75	0.05	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
SOLD FARM	(15)	17	0.01	16	0.01	1	0.00	0	0.00	0	0.00	0	0.00	0	0.00
SOLE OPERATOR MOVED/NO REFERRAL	(17)	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
SOLE OPERATOR ILL/NO REFERRAL	(18)	7	0.00	7	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
OTHER NONINTERVIEW	(19)	11	0.01	11	0.01	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
UNCONVERTIBLE LANGUAGE BARRIER	(21)	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
UNPUBLISHED NUMBER	(22)	18	0.01	17	0.01	1	0.00	0	0.00	0	0.00	0	0.00	0	0.00
NO LISTING (LEARNED FROM DA)	(23)	261	0.16	110	0.08	151	0.72	0	0.00	0	0.00	0	0.00	0	0.00
NO INITIAL NUMBER SUPPLIED	(24)	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
CONFIRMED REFUSAL	(25)	17	0.01	16	0.01	1	0.00	0	0.00	0	0.00	0	0.00	0	0.00
SEARCH CUTOFF	(26)	23	0.01	22	0.02	1	0.00	0	0.00	0	0.00	0	0.00	0	0.00
CLAIMS FILED/UNCONFIRMED	(35)	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
MAIL RETURN UPDATE	(104)	51	0.03	50	0.03	1	0.00	0	0.00	0	0.00	0	0.00	0	0.00
CLOSEOUT CUTOFF	(115-127)	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
OTHER(11,16,20,27-34,36-103,105-114, 128-200)		0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
TOTAL/FINAL	(1-200)	1662	1.00	1452	1.00	210	1.00	0	0.00	0	0.00	0	0.00	0	0.00

AGRLF57 CREATED: 09/06/93 01:52:05

SAMPLE STATUS REPORT

FOR: SUNDAY SEPTEMBER 5, 1993

CUMULATIVE RESOLVED CASES SPECIFIC BY FINAL

		TOTAL	EASTERN	CENTRAL	ROCKY	PACIFIC	YUKON	HAWAII
COMPLETION SERIES	(1-6)	932 0.56	889 0.61	43 0.20	0 0.00	0 0.00	0 0.00	0 0.00
FORM REC/OTH DEL	(7-9)	144 0.09	139 0.10	5 0.02	0 0.00	0 0.00	0 0.00	0 0.00
CONTACT MADE/NO DATA	(10,12-15,17-19)	216 0.13	209 0.14	7 0.03	0 0.00	0 0.00	0 0.00	0 0.00
UNREACHABLE	(21-24)	279 0.17	127 0.09	152 0.72	0 0.00	0 0.00	0 0.00	0 0.00
CONFIRMED REFUSAL	(25)	17 0.01	16 0.01	1 0.00	0 0.00	0 0.00	0 0.00	0 0.00
SEARCH CUTOFF	(26)	23 0.01	22 0.02	1 0.00	0 0.00	0 0.00	0 0.00	0 0.00
UNCONFIRMED CLAIMS FILED	(35)	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00
MAIL RETURN UPDATE	(104)	51 0.03	50 0.03	1 0.00	0 0.00	0 0.00	0 0.00	0 0.00
CB SCHEDULED/SUFF PARTIAL	(115)	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00
PREREFUSAL/HOS BREAKOFF	(116)	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00
NEEDS RESEARCH WORK	(117)	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00
CB SCHEDULED/PARTIAL INT	(118)	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00
TEMP UNAVAILABLE	(119)	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00
UNCOMPLETED CALL	(120)	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00
LANGUAGE BARRIER	(121)	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00
UNCONFIRMED CLAIMS FILED (HOLD)	(122)	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00
WILL FILE/SEND FORM	(123)	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00
NEW CONT/CONF NUMBER	(124)	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00
NEW CONT/UNCONF NUMBER	(125)	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00
ANSWER SERV/MACH. LEFT MESSAGE	(126)	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00
NEVER TRIED	(127)	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00
OTHER	(11,16,20,27-34,36-103,105-114,128-200)	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00
TOTAL/FINAL	(1-200)	1662 1.00	1452 1.00	210 1.00	0 0.00	0 0.00	0 0.00	0 0.00

Attachment H (cont'd)

INTERVIEWER PERFORMANCE REPORT

September 6, 1993 01:52:42

Sunday, September 5, 1993

Survey: AGRLF97

TOTAL ALL INTERVIEWERS
(Excluding supervisors/managers)

OUTCOME OF CALL ATTEMPTS		COUNT OF CASES	PERCENT OF TOTAL CASES	TOTAL TIME (MINUTES)	PERCENT OF TOTAL TIME	MEAN TIME (MINUTES)
A. Complete interviews	(01)	5	0.08	128	0.54	25.60
B. Partial interviews	(02-06)	0	0.00	0	0.00	0.00
C. SUBTOTAL, COMPLETES AND PARTIALS	(01-06)	5	0.08	128	0.54	25.60
D. Other call progress	(40)	0	0.00	0	0.00	0.00
E. Out of scope	(07-16)	0	0.00	0	0.00	0.00
F. HH refusals and hostile breakoffs	(30-34)	1	0.02	8	0.03	8.00
G. Other noncooperation	(35-39)	2	0.03	2	0.01	1.00
H. Other noninterviews	(17-29)	0	0.00	0	0.00	0.00
I. No contact	(80-89)	24	0.41	33	0.14	1.38
J. Other outcomes	(41-79)	27	0.46	67	0.28	2.48
K. TOTALS	(01-89)	59	1.00	238	1.00	4.03

L. Total login time (minutes).....	369	
M. Total login time (hours).....	6.15	
N. Call progress/login hours ((C+D)/M).....	0.81	
O. Ratio of household refusals and hostile breakoffs to call progress (F/(C+D)).....	0.20	
P. Call progress rate ((C+D+E+F+G+H+J)/K).....	0.59	
Q. First refusal rate.....	0.13	
R. Total refusal/hostile breakoff conversion attempts with contact...		0
RESULTS OF CONVERSION ATTEMPT:		
S. Complete or Partial interview..		0
T. Out-of-Scope.....		0
U. Second refusal.....		0
V. Other noninterview.....		0
W. Refusal/Hostile breakoff conversion rate ((S+T+V)/R).....		0.00

INTERVIEWER PERFORMANCE REPORT

September 6, 1993 01:52:42

TOTAL ALL STAFF
(Including supervisors)

Sunday, September 5, 1993

Survey: AGRLF57

OUTCOME OF CALL ATTEMPTS		COUNT OF CASES	PERCENT OF TOTAL CASES	TOTAL TIME (MINUTES)	PERCENT OF TOTAL TIME	MEAN TIME (MINUTES)
A. Complete interviews	(01)	5	0.08	128	0.54	25.60
B. Partial interviews	(02-06)	0	0.00	0	0.00	0.00
C. SUBTOTAL, COMPLETES AND PARTIALS	(01-06)	5	0.08	128	0.54	25.60
D. Other call progress	(40)	0	0.00	0	0.00	0.00
E. Out of scope	(07-16)	0	0.00	0	0.00	0.00
F. HH refusals and hostile breakoffs	(30-34)	1	0.02	8	0.03	8.00
G. Other noncooperation	(35-39)	2	0.03	2	0.01	1.00
H. Other noninterviews	(17-29)	0	0.00	0	0.00	0.00
I. No contact	(80-89)	24	0.41	33	0.14	1.40
J. Other outcomes	(41-79)	27	0.46	67	0.28	2.48
K. TOTALS	(01-89)	59	1.00	238	1.00	4.04

L. Total login time (minutes).....	369
M. Total login time (hours).....	6.15
N. Call progress/login hours ((C+D)/M).....	0.81
O. Ratio of household refusals and hostile breakoffs to call progress (F/(C+D)).....	0.20
P. Call progress rate ((C+D+E+F+G+H+J)/K).....	0.59
Q. First refusal rate.....	0.13

R. Total refusal/hostile breakoff conversion attempts with contact...	0
RESULTS OF CONVERSION ATTEMPT:	
S. Complete or Partial interview..	0
T. Out-of-Scope.....	0
U. Second refusal.....	0
V. Other noninterview.....	0
W. Refusal/Hostile breakoff conversion rate ((S+T+V)/R).....	0.00

Attachment I (cont'd)

INTERVIEWER/FACILITY SUMMARY PAGE — September 6, 1993 01:52:42

Sunday, September 5, 1993 — Survey: AGRLF57

INTERVIEWER CODE	LOGIN TIME (MINUTES)	LOGIN TIME (HOURS)	COMPLETED INTERVIEWS	COMPLETES PER LOGIN HOURS	CALL PROGRESS PER LOGIN HOUR	RATIO OF HH REF TO CALL PROGRESS	REFUSAL CONVERSION RATE
FACILITY	369	6.15	5	0.81	0.81	0.20	0.00
ALL INTERVIEWERS	369	6.15	5	0.81	0.81	0.20	0.00
IM38	369	6.15	5	0.81	0.81	0.20	0.00

NUMBER OF INTERVIEWERS LISTED IN SUMMARY : 1

NUMBER OF SUPERVISORS/MANAGERS LISTED IN SUMMARY : 0

TOTAL NUMBER OF ALL USERS LISTED IN SUMMARY : 1

Attachment I (cont'd)

Attachment J

LIST OF SSU DESIGNATED CASE TYPE BY FINAL CODE

	TYPE OF CASE	FINAL CODE
1.	Insufficient partial	06
2.	Unconvertible language barrier	21
3.	Unpublished number	22
4.	No listing of telephone number	23
5.	No initial number supplied	24
6.	Confirmed refusal	25
7.	Search cutoff	26
8.	Callback scheduled, sufficient partial	115
9.	Prerefusal/hostile breakoff	116
10.	Needs research work	117
11.	Callback scheduled, insufficient partial	118
12.	Temporarily unavailable	119
13.	Uncompleted call, no contact on callback	120
14.	Language barrier	121
15.	Unconfirmed claims filed	122
16.	Will file, send form	123
17.	Never contacted, confirmed number	124
18.	Never contacted, unconfirmed number	125
19.	Answering service/machine, left message	126
20.	Never tried	127

1992 Census of Agriculture
Length of Call for Completed CATI Cases

OHIO (31)

MINUTES	1-15	16-30	31-45	46-60	>60	TOTAL
NUMBER OF CASES	118	719	348	115	7	1,307
	9.0%	55.0%	26.6%	8.8%	0.5%	

NORTH CAROLINA (56)

MINUTES	1-15	16-30	31-45	46-60	>60	TOTAL
NUMBER OF CASES	148	803	447	73	1	1,472
	10.1%	54.6%	30.4%	5.0%	0.1%	

NEW YORK (21)

MINUTES	1-15	16-30	31-45	46-60	>60	TOTAL
NUMBER OF CASES	135	1,048	451	100	9	1,743
	7.7%	60.1%	25.9%	5.7%	0.5%	

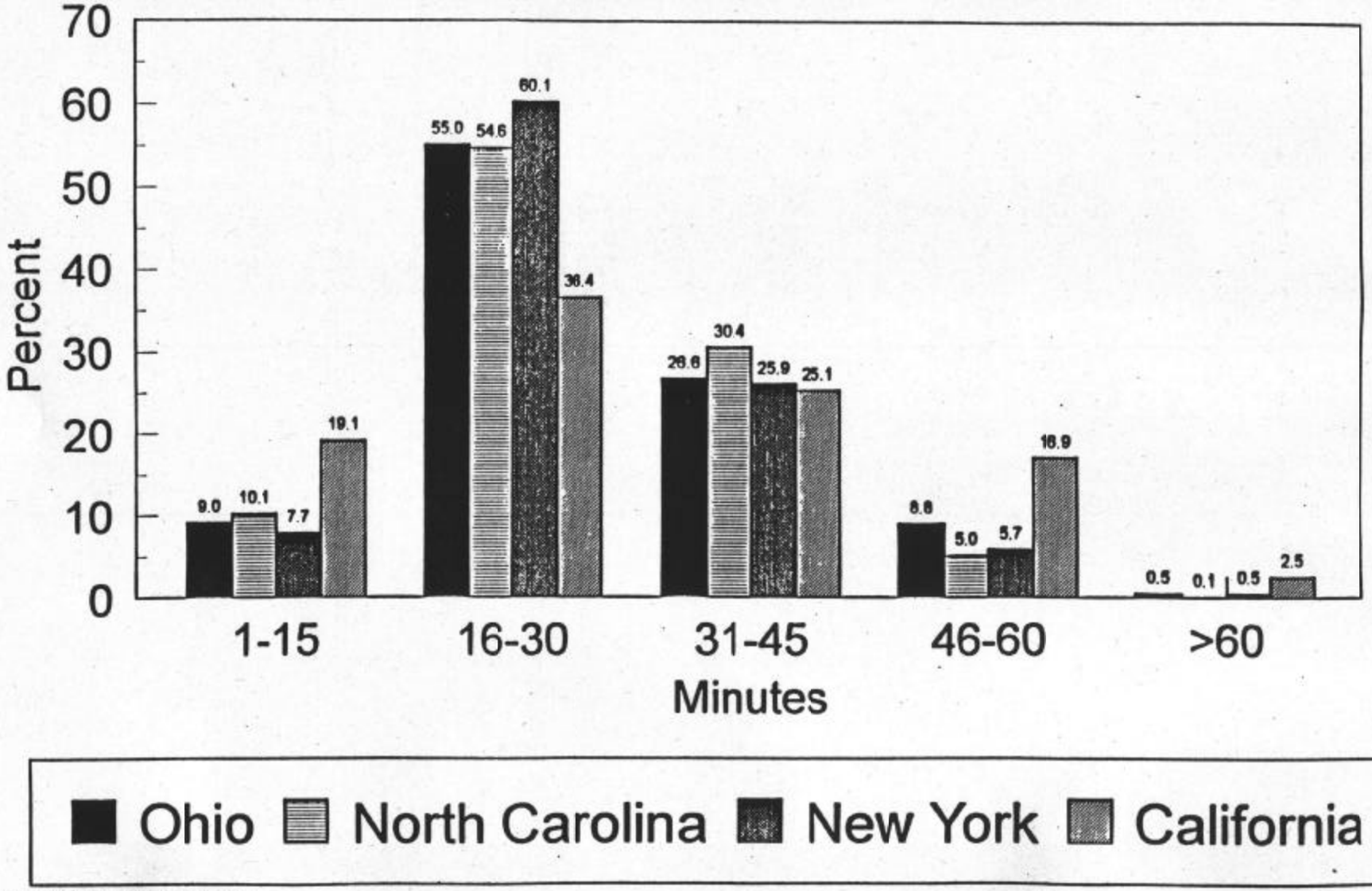
CALIFORNIA (93)

MINUTES	1-15	16-30	31-45	46-60	>60	TOTAL
NUMBER OF CASES	204	389	268	180	27	1,068
	19.1%	36.4%	25.1%	16.9%	2.5%	

AG CENSUS USA

1992 Census Of Agriculture CATI System

% of Completed Cases by Length of Call



Source: US Bureau of the Census
Agriculture Division

(Rev. 6/94)

1992 Census of Agriculture
Respondent Time for Completed CATI Cases

OHIO (31)

6:00 am to 6:59 am	7:00 am to 7:59 am	8:00 am to 8:59 am	9:00 am to 9:59 am	10:00 am to 10:59 am	11:00 am to 11:59 am	12:00 to 12:59 pm	1:00 pm to 1:59 pm	2:00 pm to 2:59 pm	3:00 pm to 3:59 pm	4:00 pm to 4:59 pm	5:00 pm to 5:59 pm	6:00 pm to 6:59 pm	7:00 pm to 7:59 pm	8:00 pm to 8:59 pm	9:00 pm to 5:59 am
2	106	103	86	81	64	98	95	86	90	95	98	97	92	97	17
0.2%	8.1%	7.9%	6.6%	6.2%	4.9%	7.5%	7.3%	6.6%	6.9%	7.3%	7.5%	7.4%	7.0%	7.4%	1.3%

TOTAL = 1,307

NORTH CAROLINA (56)

6:00 am to 6:59 am	7:00 am to 7:59 am	8:00 am to 8:59 am	9:00 am to 9:59 am	10:00 am to 10:59 am	11:00 am to 11:59 am	12:00 to 12:59 pm	1:00 pm to 1:59 pm	2:00 pm to 2:59 pm	3:00 pm to 3:59 pm	4:00 pm to 4:59 pm	5:00 pm to 5:59 pm	6:00 pm to 6:59 pm	7:00 pm to 7:59 pm	8:00 pm to 8:59 pm	9:00 pm to 5:59 am
0	180	115	71	63	60	113	94	78	66	84	81	113	109	123	72
0	12.7%	8.1%	5.0%	4.4%	4.2%	7.9%	6.6%	5.5%	4.6%	5.9%	5.7%	7.9%	7.7%	8.6%	5.1%

TOTAL = 1,422

NEW YORK (21)

6:00 am to 6:59 am	7:00 am to 7:59 am	8:00 am to 8:59 am	9:00 am to 9:59 am	10:00 am to 10:59 am	11:00 am to 11:59 am	12:00 to 12:59 pm	1:00 pm to 1:59 pm	2:00 pm to 2:59 pm	3:00 pm to 3:59 pm	4:00 pm to 4:59 pm	5:00 pm to 5:59 pm	6:00 pm to 6:59 pm	7:00 pm to 7:59 pm	8:00 pm to 8:59 pm	9:00 pm to 5:59 am
0	175	139	160	164	175	135	132	95	103	139	92	94	117	108	14
0.0%	9.5%	7.5%	8.7%	8.9%	9.5%	7.3%	7.2%	5.2%	5.6%	7.5%	5.0%	5.1%	6.4%	5.9%	0.8%

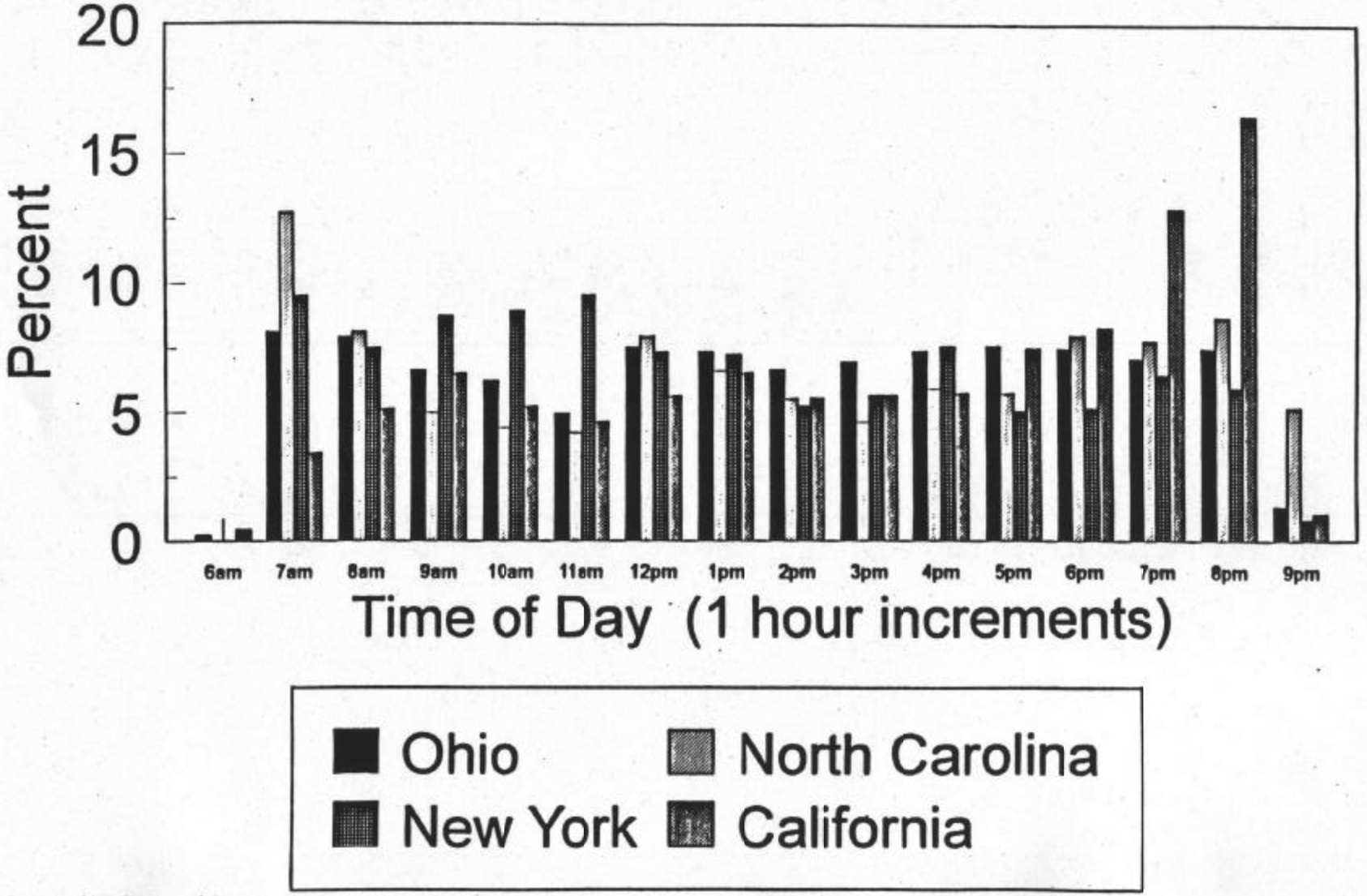
Total = 1,842

CALIFORNIA (93)

6:00 am to 6:59 am	7:00 am to 7:59 am	8:00 am to 8:59 am	9:00 am to 9:59 am	10:00 am to 10:59 am	11:00 am to 11:59 am	12:00 to 12:59 pm	1:00 pm to 1:59 pm	2:00 pm to 2:59 pm	3:00 pm to 3:59 pm	4:00 pm to 4:59 pm	5:00 pm to 5:59 pm	6:00 pm to 6:59 pm	7:00 pm to 7:59 pm	8:00 pm to 8:59 pm	9:00 pm to 5:59 am
8	72	109	140	112	99	121	140	118	119	123	159	175	274	352	21
0.4%	3.4%	5.1%	6.5%	5.2%	4.6%	5.6%	6.5%	5.5%	5.6%	5.7%	7.4%	8.2%	12.8%	16.4%	1.0%

1992 Census of Agriculture CATI System

% of Completed Cases by Respondent Time of Day



Source: U.S. Bureau of the Census
Agriculture Division

Attachment N
(Rev. 6/94)

Table 1

Results of the 1992 and 1987 Delinquent Large Farm Followup

CATEGORY	1992	1987
In-scope cases	57,708 (37.8%)	39,893 (32.6%)
Out-of-scope cases	15,148 (9.9%)	13,677 (11.2%)
Claims filed cases	NA[1]	20,030 (16.4%)
Duplicates	4,924 (3.2%)	NA[2]
Mail receipts	29,312 (19.2%)	10,000 (8.2%)
Secondary source	45,723 (29.9%)	38,800 (31.7%)
Total Workload	152,815	122,400

[1]Number of claims filed cases was not recorded in 1992. In these situations, if the respondent indicated mailing took place within the last week, a callback was systematically set for 7 days later. If mailing took place prior to the last week, the respondent was prompted to proceed with the interview. Any resulting refusals were sent to SSU.

[2]Number of duplicates was not recorded in 1987.

Table 2

Cost Comparison of the 1992 and 1987 Large Farm Followup

CATEGORY	1992	1987
Facility supervisory staff	$889,266	
Interviewing staff	$264,797	$626,000[1]
Benefits, other applied costs	$315,327	$323,000
Communications	$500,048	$122,000
Equipment, micro-computers	$49,982	$20,000
Facility administrative support, training, travel	$2,761	$158,000
Data Keying		$106,500
Other	$50,619	$210,795
TOTAL COST	$2,072,800	$1,566,295, $1,926,543[2]

FINAL COST PER CASE:	
1992	1987
$13.56	$12.79
	$15.73[2]

[1]Includes supervisory staff

[2]inflated by 23% to reflect 1993 dollars

1992 CENSUS OF AGRICULTURE CATI SYSTEM

TELEPHONE CENTER DEBRIEFING HANDOUT

Name:_____

Position: (check all that apply)

- ☐ Interviewer
- ☐ Research Operator
- ☐ Supervisor
- ☐ Directory Assistance

Date started working on Ag CATI:

_____

AGENDA

I. Introduction

II. Debriefing on Training

III. Debriefing on the Interviewing Instrument

IV. Debriefing on Special Processing

V. Other

I. INTRODUCTION

II. DEBRIEFING ON TRAINING

Large Farm:

1. Did the training prepare you for conducting interviews?

2. Were AG concepts and definitions sufficiently covered during training?

3. Were the reference materials you received sufficient? Were they necessary? Did you use them?

4. Were the practice interviews helpful? Were there enough?

5. Do you have any ideas for improving training in the future?

6. Is there anything you would like to see covered in the training that was not included?

7. Were there topics in training that needed more or less time? If so, what were they?

Nonresponse:

1. Did you think the self-study was adequate for nonresponse training? If not, what other types of training would you suggest?

2. Did you feel that the nonresponse self-study prepared you for conducting nonresponse survey interviews adequately? Did you need more or less time?

3. Did the 4 practice interviews provide enough practice?

Low Response:

1. Was the purpose of the Low Response County follow-up surveys made clear to you?

2. Was the introductory briefing of this survey sufficient for your interviewing? If not, what other types of training/information would be helpful?

III. DEBRIEFING ON THE INTERVIEWING INSTRUMENT

Front of Instrument:

1. In the >review< screen, information about the operation (1987 acreage, value of sales, type of organization, and so on) was available for the interviewer.

   Did you find this information useful?

2. Did you find that the "front" screens accommodated for most situations?

3. Were the screens for "claims filed" or "multiforms" situations sufficient?

Large Farm/Low Response Middle of Instrument:

1. Are there any general screen changes that you would recommend for the next census' instrument?

2. Included in the instrument were "menu" screens in which selection was made from a listing.

   Were these screens difficult to collect responses? Any problems with these screens?

3. There were screens for verification of responses.

   Were there any problems with using these screens?

4. There were screens with indication of prior responses.

   Were these hints helpful?

5. For some "menu" screens, the "other" option was available for selection 3 times.

   Was this sufficient? Did you need more than 3 "other" selections at times?

6. Many of the basic screens presented a question followed by an "If Necessary" statement which offered more detail. These were to be used in case the respondent needed more explanation of the basic question.

   Were these "If Necessary" statements helpful? Did you need to read these often, sometimes, or rarely?

7. Were there any differences between the Low Response and Large Farm surveys? (Differences such as, amount of respondent cooperation, kinds of respondent reactions, wording in the instrument that did not apply, unique problems, etc.)

8. There were screens in which more than one response was requested.

   Are these types of screens preferable to asking for a single item per screen?

9. There were screens available for "help or further explanation."

   Did you use these screens often, sometimes, or rarely?

10. The "F7" key was available for additional note taking. Did you use this often, sometimes, or rarely?

11. Did you find the "Shift F2" Q & A function helpful? Did you use this often, sometimes, or rarely? Were other Q & A needed? If so, give some examples.

12. Did you find it necessary to use the "F1" key to back up often? Did this function work well when needed?

Nonresponse Middle of Instrument:

1. Were the skip patterns logical? If not, what would you suggest?

2. Was the instrument adequate in terms of collecting all pertinent informatin to areas covered?

3. Were there any specific types of agricultural production for which the instrument did not adequately provide questions and/or answers?

4. Were there any questions which were not clear to the respondents? What questions were they, and how could the question(s) be reworded?

5. Was the instrument sufficient in questioning "small" and/or borderline farms? If not, explain.

Back of Instrument:

1. Were the callback screens sufficient for making a callback?

2. Was the >inotes< screen sufficient?

3. Was there any confusion as to whether a callback was a "soft" or "hard" appointment? If so, explain.

IV. DEBRIEFING ON SPECIAL PROCESSING

1. Did you find it difficult to connect with a research operator? Was it often, seldom, or rarely that a research line was busy or unavailable?

2. Were the roles of the respondent, researcher, and interviewer clear whenever research was being conducted?

3. Was the procedure clear as to what was to be done if a fax number instead of a telephone number was identified?

4. Did you find it helpful to have a calculator for the data collection process?

5. Were the periodic "Briefing Notes" informative?

V. OTHER

QUESTIONS FOR SUPERVISORS

- Were you given adequate training for your job as supervisor? If no, what type of training would have been helpful?

- Do you have any other comments in regards to your supervisory function?

QUESTIONS FOR RESEARCH OPERATORS

- Were you given adequate training for your job as research operator? If no, what type of training would have been helpful?

- What was the most serious problem encountered?

- Do you have any suggestions for improving the computerized research operation or the research process?

- Do you have any other comments in regards to your research operator function?

QUESTIONS FOR DIRECTORY ASSISTANCE CALLERS

- Do you have any suggestions for improving your job in calling DA for telephone numbers? If yes, what are they?

- Do have any comments in regards to your job in calling DA for telephone numbers? If yes, what are they?

TABLE OF CONTENTS

		Page
I.	Introduction	1
II.	Background	1
III.	Overview of the Agriculture CATI System	2
	A. Agriculture Division's Use of CATI	2
	B. System Development	3
	C. CATI Processing	6
	D. CATI Output/Results	11
IV.	Summary of Agriculture CATI System Results	13
	A. Final Case Accounting	13
	B. Cost Analysis	14
V.	Evaluation of the Agriculture CATI System	14
	A. Feedback from CATI Committee/Site Staff	15
	B. Evaluation Documentation	16
	C. CASIC Presentation	16
VI.	Suggestions for Future Agriculture CATI Systems	16
	A. Developmental Recommendations	17
	B. Processing Recommendations	17
	C. Systems Recommendations	17
VII.	Conclusion	18
	References	19
	List of Attachments	20

DISCUSSION: WHAT CAN CAI LEARN FROM HCI?

Mick P. Couper
Joint Program in Survey Methodology

1. Introduction

This discussion will not focus on the papers presented in this session. These are two good papers that demonstrate the feasibility of computer-assisted interviewing (CAI) for large-scale data collection, both CAPI (computer-assisted personal interviewing) and CATI (computer-assisted telephone interviewing). Instead, this discussion will take to heart the "New Directions" part of the title of this seminar, and attempt to take a glimpse at the future of CAI or, more broadly, CASIC. In doing so, I will focus on certain aspects of computer-assisted interviewing, and particularly the question of the user interface.

Sixty years ago, writing about the industrial revolution, Lewis Mumford (1934: 6) wrote: "So far we have embraced the machine without fully understanding it...". I believe the same may be said of CAI at its present stage of development. We know that CAI "works", as these two papers ably demonstrate, and we are enthusiastically advocating the application of computer technology to virtually all areas of survey data collection. The CASIC movement is well-established in government, academic and private survey research organizations. But how much do we understand this new method of data collection, and its impact on the data collected, on the people who provide it, and on the people who collect and process it?

To quote further from Mumford, "In order to reconquer the machine and subdue it to human purposes, one must first understand it and assimilate it" (1934: 6). This is a view of the machine as a tool in the hands of the user. Rather than making the human conform to the machine, attention should be turned to the needs of the user. There are many areas of research in CASIC that remain unexplored (see Couper, Groves and Kosary (1989), Groves and Nicholls (1986) and Baker (1992) for some examples), and much work that needs to be done to optimize the use of such systems. I will focus on only one of these areas, namely the question of usability.

Whereas feasibility addresses the question "Can it be done?", usability focuses rather on "How best can it be done?". "Best" in this case should be defined in part from the perspective of the users of the system. It is in this area that I believe we have a great deal to learn from the field of human computer interaction research or HCI. Marchionini and Sibert (1991) define HCI research as being "concerned with the design of interfaces that allow easy and efficient use of computer systems." Hix and Hartson (1993) offer a less formal definition of usability: "If your computer were

a person, how long 'til you punch it in the nose?".

The Dippo et al. paper in this session talks at length about the "new methodology" of using cognitive psychological theories and methods in questionnaire development. A similar opportunity presents itself with the application of HCI research methods and findings to CAI. There is much we can learn about usability, both in terms of findings from existing research in other domains, and in terms of methods for usability testing and evaluation of user interfaces.

By usability is meant simply that the focus of our attention turns from the system to the user. This means person-centered design rather than system-centered design. At present, the capabilities and limitations of the hardware and software we use are driving the design of CAI systems. We are making the user adapt to idiosyncracies of the system rather than the other way around. The notion of "user-friendliness" or the subjective reaction of the user to the system, is only one component of usability. Shneiderman (1992: 18) defines usability in terms of the following five measurable components:

(a) time to learn
(b) speed of performance
(c) rate of errors by users
(d) retention over time
(e) subjective satisfaction

In the spirit of continuous quality improvement, if we focus on measurable aspects of usability, we will be able to demonstrate concrete improvements in the design, development and implementation of computer-assisted survey instruments. In doing so, we should achieve measurable gains in data quality, defined by Kalton (keynote address, this conference) to include not only accuracy, but also timeliness, cost effectiveness, relevance and accessibility.

2. Types of Users of CAI Systems

In promoting a user-centered view in CAI, we need to define who the users are. I have four sets of people in mind: (a) the programmer or instrument designer, (b) the interviewer, (c) the manager or supervisor, and (d) the end-user or analyst. To this list could be added a fifth set of users, the respondents[1]. Each of these users faces a different set of usability and other issues. Some of these concerns, and areas for further research and development, are as follows:

---

[1]I thank Judith Lessler for reminding me of this group of users.

2.1. Programmer/author/instrument designer

Part of the ambivalence about what to call the people who create the CAI instrument reflects uncertainty regarding the combination of people and skills needs for this work. Should non-programmers be able to create and test a CAI instrument? What is the role of questionnaire designers versus computer programmers in instrument design? What do we mean by "programmers"? Developing an understanding of the process of instrument design will facilitate identification of the optimal skill combinations required to enhance the product of the CAI design process. Some exploratory work has been done in CAI on the development of new software tools or application of existing tools to facilitate the instrument development process (see for example Baker, 1988; Balestrino, Fortunato and Montagna, 1992; Dibbs and Hale, 1993; Pierzchala, 1993). Another area that needs further development is in the tools for testing and debugging CAI instruments (see Connett, Mockovak and Uglow, 1994).

In part, the mix of skills required for these tasks may be dictated by the design of the CAI systems used. Some CAI systems may use more natural language interfaces, while others use cryptic code in authoring specifications. Should we be expecting this group of users to adapt to the complexities of the systems being used? A human factors perspective would argue not. The first generation CAI software was relatively unsophisticated in its design interface, but we should expect more of future CAI systems.

2.2. Interviewer

In some senses this is the most critical group of users for a number of reasons. The large number of interviewers and the diversity of their computer skills and knowledge relative to other groups of users, the minimal training they receive on the computer hardware and software they will use with little close supervision, and the potential they have to impact the data collection process (in terms of both costs and errors), all make it imperative to design systems to maximize interviewer efficiency and minimize errors. We will return to this group later.

2.3. Manager and/or supervisor

This set of users requires detailed information on the process of data collection, including cost and production data. While CAI can provide vast amounts of timely information that were previously not available in paper-and-pencil data collection, we have yet to devise methods to manage the information flow in ways that would facilitate the work of these users. This group has the potential for information overload unless such tools are provided.

2.4. End-user, analyst

The production of analytic data sets in a form that analysts can readily use, and in a way that they can understand how the data were collected is an important area of usability. This includes both the data itself and the metadata (codebook, variable labels, information on skips and edits, etc.). Is the analyst provided with a hard copy version of the questionnaire to review, or are all users expected to load the interviewing software on their system to look at a particular set of questions they may wish to analyze? Some of the information that may be needed by this group of users includes: (a) where did this question appear (what questions came before or after)? (b) which respondents were asked this question (skip patterns)? (c) what edit, range and consistency checks were built into this question? and (d) how was this variable created (recode, combination of multiple questions, etc.)?

These needs speak to the integration of the survey data collection process with the production of useful data sets. This view acknowledges that CAI systems are more than just a set of interviewing tools, and are (or should be) a fully integrated system of data collection, management and data preparation (see Kreighton, Matchett, and Landman, 1994).

2.5. Respondent

In interviewer-administered surveys respondents may have little direct contact with the computer, other than through the interviewer. However, in a variety of self-administered surveys using CAI (such as CASI, CSAQ, TDE, VRE, etc.; see Weeks (1992) for a review), respondents may interface with the system directly. These respondents may have had little or no training on the use of the system, may have limited prior experience with computers, and may not be highly motivated to participate in the survey. Thus, in addition to concerns about interacting with the computer, they may be uncertain about the nature of the interview task itself. For these reasons, the design of the interface is especially critical for this group of users.

All of these sets of users (and there are others) vary in their information needs, the tools they need to access or use this information, their computer skill levels and/or knowledge of the particular system being used, and so on. Much of our energy seems to have gone into the task of getting working CAI instruments up and running. We have expected the various groups of users to adapt to the idiosyncracies and shortcomings of the systems we currently have at our disposal. A more user-oriented approach would be to systematically determine what the needs of each set of users are and understand the nature of their work, then design systems that specifically meet those needs or that facilitate the completion of their tasks.

One of the critical lessons from HCI or human factors research is the importance of involving users in the design and evaluation process (see Galitz, 1993; Gould and Lewis, 1983; Norman, 1983). This cannot be emphasized enough. Users are a valuable resource that we have tended to ignore or pay only lip service to in CAI. We often proceed from the assumption that we know best, and design systems with little regard for those who will attempt to use them. As Powell (1990: 31) notes caustically, "Dumbo the elephant used his ears to fly. Use yours to listen to the users."

In the remainder of this discussion, I will focus my remarks on the second group of users, the interviewers. This is not because the other users are less important, but rather that some of the problems they face may be relatively intractable in the short run, whereas measurable improvements can be made to the instruments used by interviewers will relatively little investment.

3. Design Principles for CAI

Thus far, I have talked in the abstract about the need to pay attention to the human-computer interface, and of the importance of designing for usability. Note that usability is more than simply screen design, it is the entire system as experienced by the users. As Jagodzinski (cited in Davis and Bostrom, 1992) notes, to most users (and this would certainly include interviewers), the interface <u>is</u> the system. Usability considerations cannot be separated from other aspects of system design and development (see Gould and Lewis, 1983; Gould, 1988).

Because usability or "user friendliness" can be a quite nebulous concept, let me offer a set of design guidelines for CAI systems. These are adapted from a variety of sources in the HCI literature, including Hix and Hartson (1993), Galitz (1993), Mayhew (1992), Norman (1983), Powell (1990), Ravden and Johnson (1989), and Shneiderman (1992). Some of these are empirically-based principles, others are more prescriptive. Nonetheless, these are a set of desirable qualities of computer systems generally agreed upon in the field of HCI that may be applicable to CAI. This list may serve as a starting point to focus our attention on some of the issues that need to be addressed in terms of enhancing the usability of the systems we use for CASIC. A well-designed CAI system should exhibit the following qualities:

4.1. Functionality

The system should meet the needs and requirements of users when carrying out the tasks (Ravden and Johnson, 1989). Note that this is functionality from a usability perspective. It is not what the designer thinks the users should do, but rather what the user needs to do in order to complete the task correctly and efficiently. Furthermore, it is not enough that the <u>system</u> can do

X; the critical question is whether the user can do X with the system.

Functionality is a necessary but not sufficient condition for any CAI system. Shneiderman (1992: 10) notes that if the functionality of a system is inadequate, it does not matter how well the human interface is designed. The remaining guidelines or principles are essentially ways in which system functionality can be presented to the user to facilitate successful completion of the task.

4.2. Consistency

This refers to the look and feel of the system. At its simplest level, consistency refers to the placement of items on screens, including the use of fonts, upper or lower case, color, highlighting, etc., to distinguish between questions, interviewer instructions, response options, and so on. However, consistency should also include input modes, mapping of function keys and movement and navigation around the instrument.

Consistency can be viewed at a number of different levels:

(a) Consistency within a particular survey instrument. There are probably few who would disagree with this in principle, but I have seen a number of production CAI instruments where this is not achieved in practice.

(b) Consistency between the instrument and other interviewer tools (case management, transmission software, e-mail, etc.). We give interviewers a variety of tools to use, often without taking much effort to integrate them in a consistent fashion. Do the function keys assigned to operations in case management, for example, have consistent effects when used in the survey instrument? Many of the case management systems used by survey organizations (see Nicholls and Kindel, 1993) are written in-house, usually with little consideration of the CAI interface with which they will be used.

(c) Consistency across different surveys instruments within a particular organization. This is an area where organizational standards or guidelines in the authoring of CAI instruments would be beneficial (see Hunter, 1993). It appears that many programmers or authors have a particular style, which may be internally consistent within the instrument (or module) they develop, but differs from other survey instruments interviewers have used. An extension of this is interviewers actually using different CAI systems for different surveys.

(d) Consistency across organizations. Although I am not advocating that this be done, we ought to acknowledge that interviewers may work for multiple organizations using different hardware and software systems. There are no universally accepted design guidelines for CAI systems, and this may impact on the transferability of knowledge.

The first of these levels may be the most easy to implement, but

the other levels are no less important to consider in CAI.

Another component of consistency is predictability. System actions should be expected within the context of actions that are performed by the user (Galitz, 1993). In other words, if the interviewer does X, the system should always do Y. Thus, there is not only consistency in terms of what the user sees and does, but also consistency in terms of what the system does in response to user inputs.

Although consistency is probably the most universally endorsed principle, there are those who caution against its rigid application without consideration of other design principles. Grudin (1989) shows examples of how blindly following the maxim of consistency to the exclusion of other interface considerations can lead to poor usability design decisions (see also Reason, 1990).

4.3. Informative feedback

For every user action there should be some system feedback (Shneiderman, 1992: 73). This may take the form of immediate execution, change in state or value, correction message, confirmation message or in-progress message (see Ravden and Johnson, 1989: 56). System feedback is especially critical when system time is slow. Such feedback should be clear, concise and intelligible to the user.

4.4. Transparency

The system should permit the user's attention to be focussed entirely on the task being performed, without concern for the mechanics of the system (see Galitz, 1993). The computer is ideally suited for automating routine functions, and these should not detract from those activities requiring human attention. In CAI these may include time stamps, range and consistency checks, read-write operations, and other system functions. The interviewer's focus should be on the interviewing task, rather than on the operation of the CAI system.

However, there may be times when it is necessary for the user to see what the system is doing. One example in CAI may concern skip patterns. Usually these would be transparent to the interviewer, but there may be times when s/he needs to make judgements about an appropriate response to a root question. Without knowing the logic of the skip and the outcome of a particular choice, the interviewer cannot make an informed judgement as to the appropriate response.

4.5. Explicitness

Whereas the actions that the system performs without human intervention should be transparent to the user, the steps that the

user needs to take should be obvious. Norman (1988) uses the notion of affordances in evaluating the design of everyday objects. Essentially, affordances are properties of objects that suggest what sort of operations and manipulations can be done. For example, the design of a door handle suggests the operation to be performed, by affording pulling, pushing, turning or twisting actions. Affordances can be similarly applied to the human-computer interface: the computer screen should make the required user actions explicit or self-evident. Norman (1983) also cautions against the "tyranny of the blank screen" in DOS, where the "c:\" prompt provides the user with no clue as to what operation need to be performed. Many CAI systems assume that the user knows what to do in a particular situation, sometimes without providing any hints as to the expected action or guidance on where to find help to complete the task. Well-designed systems should make both the semantics (what can be done) and the syntax (how to do it) of the system explicit (Mayhew, 1992).

4.6. Comprehensibility

Systems should be understandable to users. Jargon, idiosyncratic language and abbreviations should be avoided. Norman (1988: 179) suggests ways to violate this guideline: "Be arbitrary. Use nonobvious command names or actions. Use arbitrary mappings between the intended action and what must actually be done." Where possible, natural language and real-world analogies should be used (Hix and Hartson, 1993). Ravden and Johnson (1989: 32) note that "The way the system looks and works should be compatible with user conventions and expectations." For example, using the Page Up, Page Down, and arrow keys for movement may make more sense than using function keys. The layout of dates, telephone numbers, etc. in the CAI system should match users' expectations or common conventions for the presentation of such information.

4.7. Tolerance

The system should be tolerant of human capacity to make errors. Galitz (1993: 26) writes: "The fear of making a mistake and not being able to recover from it is a primary contributor to a fear of dealing with computers." System design should recognize that errors will be made, and should include appropriate error prevention, detection and correction facilities (see Reason, 1990). Efforts should be made to prevent serious errors while facilitating easy recovery from more common errors. The more potentially disastrous an action, the more difficult it should be to perform. Thus, backing up to change a previous answer in CAI should be easier to do than suspending an interview in midstream. Actions should be easily reversible.

4.8. Efficiency

The system should be designed to minimize effort and maximize

efficiency on the part of the user. System response time is only one aspect of efficiency. As Mayhew (1992: 508) notes, overall task time is a function of both system and user response time. In other words, task time = system response time + system display rate + user scan/read time + user think time + user response time + time making errors + time recovering from errors. By improving the speed of the system (without attending to interface issues to reduce user time or errors), only the system side of efficiency (response time and display rate) will be addressed, without affecting other components of overall task time. All aspects of good interface design should facilitate the overall efficiency of operation. For example, user response time can be optimized by avoiding complex sequences of actions for common operations. User scan/read time can be reduced through effective screen design. Galitz (1993: 48) notes that system responsiveness should match the speed and flow of human thought processes, and offers some specific guidelines for various types of operations (see also Shneiderman, 1992: 284-297).

4.9. Supportiveness

This is closely related to the principles of explicitness and comprehensibility. Tolerance of errors and facilities for easy recovery from errors is another characteristic of a supportive system. The limited cognitive capacities of users should be recognized and accommodated. This can be done by reducing the amount of memorization of commands, codes, syntax and rules required by users (Brown, 1988: 97). Reliance on recognition rather than recall will help reduce cognitive burden for the user. Norman (1991: 6) writes, "It is typically the case that for systems with 40 plus commands, only about 7 commands show any frequency of use". Complex sets of commands and those that are rarely used are less likely to be remembered. Supportive systems provide online help and make it readily accessible to the user. If one needs to consult a manual to find out how to get online help, something is gravely wrong with the system.

4.10. Optimal Complexity

The early dictums on design (on both screen and paper) called for keeping things simple and maximizing the use of blank space. This view has given way to a recognition from a growing body of research (see Tullis, 1983; Coll and Wingertsman, 1990; Staggers, 1993) that users' preference for complexity exhibits an inverted U shape. Users both prefer and perform better with a moderate amount of complexity, rather than too simple or too complex. Galitz (1993: 35) notes that complexity should be commensurate with the capabilities of the system users. Complexity refers not only to the amount or density of information of the screen, but to all aspects of screen design. Hix and Hartson (1993: 49) recommend organizing the screen to manage complexity.

5. Lessons to be Learned from HCI

These general design guidelines for CAI systems should be seen as a set of goals for improving CAI design, rather than principles set in stone. There may be other characteristics of effective systems not mentioned here. There is also a recognition that compromises among these qualities or guidelines may be necessary to achieve optimal usability of CAI systems. Nonetheless, I have found examples of violations of each of the guidelines in various production instruments used by a number of different organizations. The CAI systems we use are clearly not perfect, and there is much room for improvement. These guidelines may help us on the road to quality improvement in instrument design to facilitate the work of our interviewers.

Many of these guidelines are not new to CAI. A number of these principles have already been articulated with regard to CAI. Nicholls and House (1987), for example, note that one of the general objectives of CAI systems is that they should meet interviewer needs. They explicate further: " displays must be quickly comprehensible [Principle 6], interviewers should have access to all needed information [Principle 9], opportunities for interviewer error should be minimized [Principle 7], and interviewer movement through the questionnaire, either forward or backward, should be expedited [Principle 8]" (Nicholls and House, 1987: 96). Despite these and other efforts to articulate design guidelines for CAI systems, it appears that little progress has been made.

If the only contribution made by human-computer interaction research to CAI was in the development of a set of general design principles (such as those outlined above), we would not have gained much. There are two additional keys to the applicability of HCI research to CAI. The first is a theoretically-grounded understanding of the interaction between human and computer and how the interface impacts the user and his/her task. Human factors research traces much of its theoretical roots to cognitive psychology (see for example Carroll, 1991), and it is this body of literature that will be most helpful to CAI design. The second critical lesson to be learned from HCI is the application of research methods to measure and understand the usability aspects of CAI systems (and user interfaces in general). The utility of HCI research lies not only in <u>what</u> was found, but also <u>how</u> it was found. A variety of methods are used in HCI research that can be readily adapted for use in CAI. These include usability testing in laboratory settings, experimental studies, observation and so on (see Shneiderman, 1992). Both theory and measurement are important to the partnership between HCI and CAI.

With regard to theory it is important to note that not all the findings of HCI research are equally applicable to computer-assisted interviewing. The nature of the interviewing task may be

very different from that studied in HCI (use of programming languages, word processors, spreadsheets, etc.). The partnership with HCI does not mean uncritically applying all findings in that field to CAI. Rather, by focusing on similarities and differences between CAI and other tasks involving human-computer interaction, we can distinguish between what is useful and what requires further exploration.

As far as measurement is concerned, many of the techniques already used in survey research can be applied to study interaction aspects of the task. These include:

(a) Cognitive laboratory investigations of interviewer-computer interaction using observation, protocol analysis, think alouds, etc.
(b) Laboratory-based experiments testing alternative designs or focusing on particular issues and actions interviewers face in CAI.
(c) Scripted mock interviews which may include tests of particular types of actions.
(d) Observation of production interviewing using computers.
(e) Experiments embedded in production data collection.
(f) Measurement of interviewer production and process (e.g. keystroke files, time stamps, monitoring, behavior coding).

Many of these methods parallel those used to study human-computer interaction, and can be productively applied to CAI.

6. Conclusion

So where do we go from here? In this discussion I have tried not to be too prescriptive in terms of ways to design user interfaces for CAI. Rather, I am advocating more of a design philosophy that (a) explicitly takes the users into account; (b) involves measurement of progress toward usability goals (e.g reducing learning, minimizing errors, maximizing user satisfaction, etc.); and (c) attempts to extract empirically-derived principles and guidelines that have general applicability beyond the particular system or interface on which they were tested or developed. These tasks can be greatly facilitated by learning from the field of HCI research.

In terms of action steps, I believe the field of computer-assisted interviewing can make great strides by doing the following:

(a) Apply what is already known about human-computer interaction and usability to CAI.
(b) Adapt HCI research methods to understand and explore usability issues in CAI. Conduct both qualitative and quantitative research on the interface between interviewer and computer in CAI.
(c) Explicitly incorporate usability testing as an integral part of the instrument development process.

(d) Identify gaps in our knowledge in the human-computer interface in CAI, and undertake research to close these gaps.
(e) Think ahead to new technologies and what we require of them, rather than being constrained by the limitations of existing CAI systems.

In this discussion, I have tried to turn our attention to the future rather than the immediate past. I see these issues both as challenges and as great opportunities for survey research. Let us not just embrace the machine, let us understand it and thereby unleash its full potential.

In doing so, we can learn a great deal from HCI research. In the same way that the field of questionnaire design has reaped great benefits from the partnership with cognitive psychology, so too can CAI benefit from interaction and collaboration with human-computer interaction or human factors researchers. Indeed, the benefit may well be mutual.

REFERENCES

Baker, R.P. (1992), "New technology in survey research: Computer-assisted personal interviewing (CAPI)." Social Science Computer Review, 10 (2): 145-157.

Balestrino, R., Fortunato, E. and Montagna, S. (1992), "A survey questionnaire design methodology." Pp. 489-501 in Westlake, A., Banks, R., Payne, C. and Orchard, T., Survey and Statistical Computing. New York: North-Holland.

Bayerl, J.P., Millen, D.R. and Lewis, S.H. (1988), "Consistent layout of function keys and screen labels speeds user responses." Proceedings of the Human Factors Society 32nd Annual Meeting, pp. 344-346.

Brown, C.M. (1988), Human-Computer Interface Design Guidelines. Norwood, NJ: Ablex.

Carroll, J.M. (ed.) (1991), Designing Interaction: Psychology at the Human-Computer Interface. New York: Cambridge University Press.

Coll, R. and Wingertsman, J.C. (1992), "The effect of screen complexity on user preference and performance." International Journal of Human-Computer Interaction, 2 (3): 255-265.

Connett, W.E., Mockovak, W.P. and Uglow, D.A. (1994), "Future CAI needs from a user perspective." Paper presented at the Census Bureau's 1994 Annual Research Conference and CASIC Technologies Interchange.

Couper, M.P., Groves, R.M. and Kosary, C. (1991), "Methodological issues in CAPI." Proceedings of the American Statistical Association, Survey Research Methods Section.

Davis, S. and Bostrom, R. (1992), "An experimental investigation of the roles of the computer interface and individual characteristics in the learning of computer systems." International Journal of Human-Computer Interaction, 4 (2): 143-172.

Dibbs, R. and Hale, A. (1993), "Questionnaire design in a paperless society." Proceedings of the Bureau of the Census 1993 Annual Research Conference. Washington: Bureau of the Census.

Falzon, P. (ed.) (1990), Cognitive Ergonomics: Understanding, Learning and Designing Human-Computer Interaction. San Diego: Academic Press.

Galitz, W.O. (1993), User-Interface Screen Design. Boston: QED.

Gould, J.D. (1988), "Designing for usability: The next iteration is to reduce organizational barriers." Proceedings of the Human Factors Society 32nd Annual Meeting, pp. 1-9.

Gould, J.D. and Lewis, C. (1983), "Designing for usability -- key principles and what designers think." Proceedings of CHI '83: Human Factors in Computing Systems. New York: ACM, pp. 50-53.

Grabinger, R.S. (1989), "Screen layout design: Research into the overall appearance of the screen." Computers in Human Behavior, 5: 175-183.

Groves, R.M. and Nicholls, W.L. (1986), "The status of computer-assisted telephone interviewing: Part II -- Data quality issues." Journal of Official Statistics, 2 (2): 117-134.

Grudin, J. (1989), "The case against user interface consistency." Communications of the ACM, 32 (10): 1164-1173.

Hix, D. and Hartson, H.R. (1993), Developing User Interfaces: Ensuring Usability Through Product and Process. New York: Wiley.

Hunter, P. (1993), "Introducing CAI standards within OPCS." Paper presented at the Second International Blaise Users Conference.

Kreighton, K., Matchett, S. and Landman, C. (1994), "Building integrated systems of CASIC technologies at the U.SA. Bureau of the Census." Paper presented at the Census Bureau's 1994 Annual Research Conference and CASIC Technologies Interchange.

Marchionini, G. and Sibert, J. (1991), "An agenda for human-computer interaction: Science and engineering serving human needs; Report of an invitational workshop sponsored by the National

Science Foundation." SIGCHI Bulletin, 23 (4): 17-32.

Mayhew, D.J. (1992), Principles and Guidelines in Software User Interface Design. Englewood Cliffs, NJ: Prentice-Hall.

Mumford, L. (1934), Technics and Civilization. New York: Harcourt, Brace and Company.

Nicholls II, W.L. and House, C.C. (1987), "Designing questionnaires for computer-assisted interviewing: A focus on program correctness." Proceedings of the Bureau of the Census Annual Research Conference. Washington, DC: Bureau of the Census.

Nicholls II, W.L. and Kindel, K.K. (1993), "Case management and communications for computer assisted personal interviewing." Journal of Official Statistics, 9 (3): 623-640.

Nielsen, J. and Levy, J. (1994), "Measuring usability: Preference vs. performance." Communications of the ACM, 37 (4): 66-75.

Norman, D.A. (1983), "Design principles for human-computer interfaces." Proceedings of CHI '83: Human Factors in Computing Systems. New York: ACM, pp. 1-10.

Norman, D.A. (1988), The Design of Everyday Things. New York: Doubleday.

Norman, D.A. (1993), Things that Make Us Smart: Defending Human Attributes in the Age of the Machine. Reading, MA: Addison-Wesley.

Norman, K.L. (1991), The Psychology of Menu Selection: Designing Cognitive Control of the Human/Computer Interface. Norwood, NJ: Ablex.

Pierzchala, M. (1993), "Computer generation of mega-version instruments for data collection and interactive editing of survey data." Proceedings of the Bureau of the Census Annual Research Conference. Washington, DC: Bureau of the Census.

Powell, J.E. (1990), Designing User Interfaces. San Marcos, CA: Microtrends Books.

Ravden, S. and Johnson, G. (1989), Evaluating Usability of Human-Computer Interfaces. Chichester: Ellis Horwood.

Reason, J. (1990), Human Error. Cambridge: Cambridge University Press.

Shneiderman, B. (1992), Designing the User Interface: Strategies for Effective Human-Computer Interaction. (2nd. ed.) Reading, MA: Addison-Wesley.

Staggers, N. (1993), "Impact of screen density on clinical nurses' computer task performance and subjective screen satisfaction." International Journal of Man-Machine Studies, 39 (5): 775-792.

Tullis, T.S. (1983), "The formatting of alphanumeric displays: A review and analysis." Human Factors, 25 (6): 657-682.

Weeks, M.F. (1992), "Computer-assisted survey information collection: a review of CASIC methods and their implications for survey operations." Journal of Official Statistics, 8 (4): 445-465.

DISCUSSION OF TWO PAPERS ABOUT CASIC

Sandra Sperry
Westat, Inc.

This is such an interesting time in survey research. After many years in which there was very little change in the approaches used to collect data and prepare it for analysis, the past ten years have produced enormous change. First there was the growth of centralized telephone interviewing using computer-assisted data collection methods. Then in the late 80's, government agencies began to experiment with using laptop computers to collect data for in-person interviews. Now it seems to be completely accepted that an agency will, at the very least, consider computer-assisted survey information collection (CASIC) techniques for all its surveys.

The impact of these two papers about CASIC comes in part from the fact that the Census Bureau and the Bureau of Labor Statistics do things on such a grand scale. How often do survey researchers get to casually mention that their pretest of a CATI system included 10,000 cases? This is what Jeanette Mon tells us about the CATI test done in 1982 to prepare for the 1992 Census of Agriculture. And Cathy Dippo tells us that the Parallel Survey, which was carried out for 18 months to assess the overall effects of redesigning the Current Population Survey (CPS), was "relatively small," that is, only 12,000 households per month.

The scale of these two projects, along with their emergence at a time when so many organizations are considering how best to implement CASIC, makes these two papers especially valuable. The papers are, among other things, historical records that document aspects of the development and application of CASIC at a time when CASIC is moving from being unusual and experimental to being the data collection mode of choice.

Both papers tell us a lot about process, although each paper focuses on different aspects of the process of applying CASIC methods. Cathy Dippo's paper tells us about the methodological processes used to redesign the CPS questionnaire for computer-assisted data collection. Jeanette Mon's paper focuses more on the processes used to manage all aspects of developing and using CASIC methods. Both include much helpful information for the researcher embarking on a project that will use CASIC. I would like to mention a few of the points that I found most relevant.

I will start with Cathy Dippo's paper. She notes that preliminary work on designing a new CPS questionnaire included laboratory work on how interviewers and respondents understand labor force terminology. This work led to developing questionnaires that were also tested with laboratory techniques. Then special respondent debriefing techniques were used with 2,300 CPS telephone respondents. The results of this debriefing verified the laboratory findings. These results are reassuring about the value of using laboratory techniques for questionnaire design. Most researchers do not have the resources to carry out a respondent debriefing of this scope and, therefore, are not able to evaluate the results of their laboratory work with this precision.

I was also very interested in how the CPS staff used CASIC techniques to help them with questionnaire design. The use of behavior coding while monitoring CATI interviews is an excellent way to maximize the benefits of a CATI or CAPI pretest. Programming follow-up probes to debrief respondents about specific answers that they gave during the main interview seems like another inspired idea for getting the most out of a pretest.

The design features of a CASIC questionnaire that have been incorporated into the new CPS instruments, that is, complex skips, wording that is specially tailored to the respondent's situation, built-in consistency checks, and dependent interviewing in longitudinal data collections, are aspects of CASIC that I think have been incorporated into a number of CATI and CAPI surveys. It was interesting to read about some of the ways in which the CPS instrument has changed to make use of CASIC, but the concepts presented in this part of the paper were not as new to me as some of the approaches used for instrument development. To learn even more about the instrument development process, I think many researchers would be interested in reading some of the technical reports written by the CPS Overlap Analysis Team. The technical reports present more detail about work that was done on this project, a project that included much more developmental research than most projects can afford.

I would like to turn now to Jeanette Mon's paper. As I mentioned earlier, this paper addresses more of the issues encountered in managing a large CASIC design and data collection. I was particularly struck by the number of different Census divisions (five) that needed to cooperate and communicate with one another in order to carry out the 1992 Census of Agriculture's CATI follow-up. Because different divisions had different responsibilities with regard to the same data, it was very important for them to meet regularly and to document carefully everything that they did. It is often easy for researchers working on smaller studies or in organizations with a less structured approach to dividing up responsibilities to assume that they do not need the level of formal communication and documentation that was required for the Census of Agriculture follow-up. I would hypothesize, however, that all survey research projects would be better off if they included more preparation of the formal specifications that Ms. Mon mentions in her paper.

Ms. Mon also mentions that to develop the basic system specifications that are required by the CASIC programming staff, the subject matter experts needed to go through a learning period. She notes that in some instances, the requisite specs were so complicated that it took a considerable amount of time to learn how to prepare them. I think this is a problem that many of us have encountered in developing CASIC instrumentation. The process requires much collaborative work among staff involved in all different aspects of a CASIC project, and we must occasionally spend time just learning how to communicate with one another.

The description of how different states were scheduled to be called in each of two telephone centers presents another lesson in managing a large scale CATI operation. It was very important that the scheduling of states be kept flexible so that when one or the other of the phone centers began to run low on work at particular times (as happened on two different occasions), new states could be installed to provide the level of work needed to keep interviewers working efficiently.

The paper about the Census of Agriculture's CATI follow-up included one more section that I found particularly enticing. The CATI software created a file with a complete history of all actions made with regard to a case. Staff used these files "to produce tables and graphs for management analysis." Some of the tables and graphs are included as attachments to the paper. I found these tables and graphs very intriguing and would like to know more about how the management staff used them during the field operations phase of the project.

In conclusion, I will not suggest the usual call for more research. Rather, I will end with a call for more papers from the research on which these two papers are based. There is a great wealth of material here to be explored, and I think there is much for all of us to learn from it.