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Someone remarked at last year's ASA meeting that the Census Bureau and other survey organizations are doing a lot of methodological research that isn't being reported. The Census Bureau does report on and/or list much of its research output in the annual Census Bureau Methodological Research List, the technical and working papers series, the technical notes series, census procedural histories, and articles published in professional journals. Nevertheless, there was some justification for the remark. We have done many things that are not readily accessible even within our own organization. Some results are not reported at all, others are widely scattered, and most people designing surveys don't have time to make a comprehensive review of the literature.

This paper constitutes an effort to make results of our experience more readily available. In preparation for it we identified, reviewed, and summarized all split-panel tests of questionnaires conducted by the Census Bureau. We identified 15 such tests. To learn how these tests were conducted and what their results were, we assembled available documentation and spoke to the principal investigators. We then prepared a summary description of each test in a standard format. This proved to be so rewarding, both in terms of giving us a clearer picture of what was learned from the tests and in suggesting ways of improving the design of future experiments, that we plan to present the full results in a Census Bureau technical paper, to be issued within a few months.

To define more precisely what is included in this review, we mean by a split-panel test a controlled experiment in which the treatments to be compared and analyzed consist of versions of a questionnaire which differ in one or more respects but have the same data objectives. The variations to be tested may involve the wording of individual questions, the answer format (checkboxes for categories vs. open end), the order of questions, the general format, including color of paper and printing, size, arrangement of questions on the page, and other features of the questionnaire.

Split-panel tests need not be restricted to questionnaires -- they may cover any aspect of survey methodology, including collection procedure --mail vs. telephone vs. personal interview; number and spacing of mail followups; use of information from prior rounds in a panel survey; length of reference period; and respondent rules in interview surveys. We have, in fact, conducted split-panel experiments concerned with many aspects of the data collection process; here, however, we limited the review to tests involving multiple versions of questionnaires.

Exhibit I is a summary of the 15 tests we identified and reviewed. The earliest test was

made in 1957; the latest and possibly the most sophisticated from the point of view of questionnaire design (Number 4: 1969 Questionnaire Variation Study) is still in progress. At least two additional tests, now in the planning stage, have not been included on this list. We have also excluded at least two tests for which the necessary experimental controls were obviously inadequate.

Most of the tests are characterized either as "built-in" tests or pretests. The built-in test is conducted as an integral part of a census or survey. The built-in tests have obvious advantages -- they are carried out under realistic conditions, their costs are marginal since most of the data are going to be collected and processed anyway, and sample sizes can be large enough to minimize the contribution of sampling error and permit clear emergence of treatment differences.

In a pretest, on the other hand, while costs are higher, radical innovations can be tested without fear of upsetting an on-going system. Furthermore, pretests provide the only opportunity to experiment with census materials and procedures while the census is not going on.

"Methodological test" covers everything that does not qualify as a built-in test or pretest, e.g., Number 7, the Current Population Survey Methods Tests, where alternatives to standard procedures in the regular monthly survey are tested in a separate group of sample areas, specifically set aside for experimental purposes.

Ten of the 15 tests used mail as the principal collection method; this reflects the Census Bureau's increasing reliance on self-enumeration.

Seven of the tests were nationwide. Thus, potential bias attributable to regional differences could be eliminated. When personal interviews were required, however, it was not always possible to conduct nationwide tests and it became necessary to exercise judgments about general applicability of results observed in a geographically limited study population.

The built-in tests usually provided larger samples than the pretests and methodological tests. The sample size requirements depend on the kinds of comparisons to be made and the sensitivity needed in measuring treatment differences. Sample sizes of from 1,000 to 5,000 cases for each version have been adequate for nearly all purposes, although when dealing with low frequency items, such as unemployment, or with aggregates, larger samples may be needed.

Validity checks are needed unless the only concern is to learn which of two questionnaires will produce a higher mail return rate, or lower item nonresponse. In most cases, however, we also want to know which alternative leads to less response error. The principal methods used to obtain direct measures of validity are reinterviews and record checks. Test Number 15 illustrates a direct way of checking validity. Retrospective data on occupation and industry five years ago were compared with current data collected for the same persons five years earlier.

External sources of information about income, morbidity data, and some other subjects indicate that standard survey techniques produce underestimates of known aggregates. Such information is the basis for indirect validity checks; i.e., we have been willing to conclude that an experimental version which produces a higher figure is better.

Exhibit II consists of standard descriptions of 3 of the 15 tests, and shows the relevant parts of the questionnaires. The last topic in the standard description, "Possible Generalizations," goes beyond the results of the particular test described. It contains one or more principles for questionnaire design <u>suggested</u> by the results of the test. Some of these are summarized below. Although they are not startling or novel, a step forward has been taken when ideas about questionnaire design are supported by experimental evidence.

1. Probing questions can improve accuracy of response. A version of the Current Population Survey questionnaire which included probes about hours worked and about self-employment provided improved statistics for these subjects. Marginal improvement in reports about size of farm were also achieved through probing questions. There are, of course, limits to effectiveness of probing. Additional probing about labor force status in test Number 7 produced no significant changes.

2. It is usually better to break complex classifications into simple elements and ask questions about each element than to ask interviewers to make the classifications. A test for the 1960 census which required classification of living places as dwelling units or quasidwelling units indicated that it could be done better if the enumerators recorded information about the criteria they used in making their classification than if they did not.

3. When a rough estimate or guess of an amount is needed, the checkbox alongside of a class interval obtains a higher response rate on a self-enumerative questionnaire than a question requiring a write-in amount. This was observed in an agriculture census pretest for a question about value of land and buildings.

4. In self-enumerative questionnaires, when one choice is made easier than another, responses may be biased toward the easier choice. Two tests indicate such bias. One showed that respondents, when asked to recall their occupation five years ago, were more likely to report it inaccurately as "same" if a checkbox was provided for such a response than if there were no such precoded category. A second test showed fewer reports of mixed ethnic origins when checkboxes could be marked for single ethnic but write-in entries were required for mixed origins than when write-in entries were required for <u>all</u> reports of ethnic origins.

5. In a voluntary survey, an explicit statement that cooperation in the survey was voluntary reduced returns by a small percentage but did not affect completeness of response (even to a detailed income question) by those who returned questionnaires.

We cannot, of course, guarantee that the ideas just presented will be useful in all situations. The particular study population, the collection procedures, the various kinds of subjects covered in the survey, the sponsorship of the survey, the time at which the survey is taken -- all these and many other factors may interact with the features we have discussed to produce results differing from those observed.

Papers like this traditionally end with a plea for more research -- in this case we think it appropriate to follow tradition and, further, to urge that experimenters take pains to report their findings in at least as much detail as we have provided for these 15 tests. All such efforts will contribute to the development of a much-needed set of tested principles for questionnaire design.

	Name of test	Parent program	Type of test	Primary collection procedure	Study population	Number of question- naire versions	Approximate sample size per version	Validity checks
1.	1961 Experimental Farm Survey	1964 Census of Agriculture	FARM ( Methodolog- ical test	CENSUSES ANI Mail	D SURVEYS Farms in selected counties	4	400 farms	Intensive interview for a subsample
2.	1963 Farm Panel Pretest- Round 2	Panel Evaluation Survey, 1964 Census of Agriculture	Pretest	Mail	Farms in selected counties	2	230 farms	None
3.	1968 Agriculture Census Pretest	1969 Census of Agriculture	Pretest	Mail	Farms in two States	4	4,500 farms	None
4.	1969 Questionnaire Variation Study*	1969 Census of Agriculture	Built-in	Mail	Farms receiving standard census questionnaire, excluding very large ones	9	2,000 in- scope farms	Resurvey with alter- nate version of ques- tionnaire and reconcil- iation of reported differences
			DE	MOGRAPHIC SI	URVEYS			
5.	1967 Health Interview Survey Study	Health Interview Survey	Built-in	Interview	Civilian non- institutional population	2	17,500 persons	None, but higher rates of illnesses reported assumed to be better
6.	1969 CPS Income Experiments	Current Population Survey (March Income Supplement)	Built-in	Interview (some by telephone)	Households	2	13,000 households	None, but larger amount of income reported assumed to be better
7.	1963 CPS Methods Test, First Series*	Current Population Survey	Methodolog- ical test	Interview (some by telephone)	Civilian non- institutional pop- ulation in select- ed counties	3	5,500 households	Intensive reinterview for subsample; employ- er record checks
8.	1969 Test of Explicit Statement on Voluntary Reporting	Survey of New Beneficiaries	Built-in	Mail	Persons recently awarded Social Security or Medi- care benefits	2	3,400 persons	None

Exhibit I SPLIT-PANEL TESTS OF QUESTIONNAIRES CONDUCTED BY THE U.S. BUREAU OF THE CENSUS

\* See ExhibitII for further description of study design and results.

6

Name of test		Parent program	Type of test	Primary collection procedure	Study population	Number of question- naire versions	Approximate sample size per version	Validity checks
9.	1957 Employment Pretest	1960 Census of Pop- ulation and Housing	POPULATI Pretest	ON AND HOUS	ING CENSUSES Civilian non- institutional pop- ulation 14-years - eld and over in	3	800 households	Intensive reinterview
10.	1958 Housing Pretest	1960 Census of Pop- ulation and Housing	Pretest	Interview	Philadelphia SMSA Housing units in selected areas of Washington, D.C.	3	700 housing units	Independent reinter- view and reconcilia- tion of differences
11.	1966 (First) Content Pretest	1970 Census of Pop- ulation and Housing	Pretest	Mail	Households in St. Louis Park, Minn. and Yonkers, N.Y.	2	2,350 households	Independent reinter- view and reconcilia- tion of differences
12.	1967 (Second) Content	1970 Census of Pop- ulation and Housing	Pretest	Mail	Households in Gretna, La.	2	2,100 households	None
13.	1966 (First) Question- naire Format Test	1970 Census of Pop- ulation and Housing	Pretest	Mail	Households	2	1,150 households	None
14.	1967 (Second) Question- naire Format Test	1970 Census of Pop- ulation and Housing	Pretest	Mail	Households	4	1,120 households	None
15.	1968 Subject Response Study*	1970 Census of Pop- ulation and Housing	Pretest	Mail	Civilian non- institutional population 14- years-old or older	2	1,400 households	Comparison of current responses on occupa- tion 5 years ago with information given 5 years ago.

#### Exhibit I -- Continued

SPLIT-PANEL TESTS OF QUESTIONNAIRES CONDUCTED BY THE U.S. BUREAU OF THE CENSUS

\* See Exhibit II for further description of study design and results.

7

## Test No. 4

## 1969 QUESTIONNAIRE VARIATION STUDY

- 1. Parent Program: 1969 Census of Agriculture.
- 2. Type of Test: Built-in.
- 3. Date: January 1970 and January 1971.
- 4. <u>Study Population</u>: In general, the study population consists of farms with total value of products from \$2,500 to \$500,000, as indicated in the administrative records from which the initial census mailing list was formed. Due to changes as well as errors in the records, the actual population includes some out-ofscope cases (to be excluded from analysis) and some farms with total value of products outside the indicated range.
- 5. Questionnaire Versions Tested: There were nine versions, differing in wording and format of questions and in use of shading. The nine questionnaire versions combined seven alternative formats in a way that permits measurement of individual format effects and of interaction effects. The alternative formats were:
  - (a) An alternative version of questions about acres-in-place and tenure.
  - (b) The inclusion among the land-use questions of a space for transcription of acreage reported in a preceding series of questions.
  - (c) The addition of checkboxes marked "None" to the answer spaces of questions about numbers of various kinds of machinery on the farm.
  - (d) The use of two answer columns for questions on cost of chemicals used; one for the cost of chemicals only and the other for the cost of application. The standard format had one answer column, asking for cost of chemicals, excluding cost of application.
  - (e) The use of two answer columns for questions on income and expenditures; one for the farm operator's share of income or expense and the other for landlords' or contractors' shares. (Standard format had one column asking for these shares combined in one figure.)
  - (f) The deletion of many explanatory notes from the questions on income and expenditures.

- (g) The omission of shading. The standard census questionnaire was lightly shaded everywhere except the answer spaces.
- 6. <u>Design of Study</u>: A national systematic sample of cases was selected from the census mailing list and randomly divided into nine subsamples, one to receive each of the nine questionnaire versions. The sample size was selected to yield about 2,000 in-scope farms in each subsample.
- 7. <u>Collection Procedure</u>: Mail, with a reminder card and four mail followups.
- 8. <u>Validity Check</u>: Plans call for a January 1971 mailing to a subsample of respondents. They will receive the alternative version of the acreage and tenure questions from the one mailed to them in January 1970. The two forms will be matched and when differences are observed, reinterviews will be conducted to determine whether changes in acreage or tenure occurred or, if not, which version obtained the more valid information.
- 9. <u>Principal Items Analyzed by Version</u>: Return rates, acceptability of entries, item nonresponse, and selected agricultural characteristics.
- <u>Limitations</u>: Very small and very large farms are not included; newly established farms are not included.
- 11. <u>Principal Findings</u>: No difference in return rates between versions. Other results not yet available.
- 12. Consequences: None to date.
- 13. Possible Generalizations: None to date.

<u>Sources of material</u>: Outline prepared by John Forsythe, using the following sources:

- (a) Memorandum A-69-A-15 of June 30,1969,
   "Plans for Questionnaire Variation Study, 1969 Census of Agriculture"
- (b) U.S. Bureau of the Census Advance Report: "Data-Collection Forms and Procedures for 1969 Census of Agriculture, Irrigation, and Agricultural Services"

# ILLUSTRATION. Standard Census Format

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etc for crops		I _	·		1		
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section 34.)	b. Ingredients purchased - such as soybean meal, cotton-	634	i	635	1	<i>\////////////////////////////////////</i>	
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others - your landlord, contrac-	a. Commercially mixed formula feeds	634	10	635	\$	\$	
tors, buyers, etc enter your best	b. Ingredients (Do not include whole grains.)		- 10		\$	\$	
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and yours in the first column.	-	638		639	••••••••••••••••••••••••••••••••••••••	939	<u> </u>
(See Leaflet. section 34.)	d. Hay, green chop, silage, etc		10	6.40	\$	\$	
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	4. Commercial fertilizer				2	941 \$	
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	b. Diesel fuel	••••			\$	\$	1
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G. Motor oil, grease, piped gas, kerosene, and fuel oil			647	▼	947		
	<b>9.</b> Hired farm labor	••••		648	\$	<b>\$</b> 948	
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# ILLUSTRATION – Continued. Variations as described in 5E and F combined

#### Test No. 7

1963 CURRENT POPULATION SURVEY METHODS TEST, FIRST SERIES

1. Parent Program: Current Population Survey.

- 2. Type of Test: Methodological.
- 3. Date: April 1963 to December 1964.
- 4. <u>Study Population</u>: Households in Boston, Mass.; Charolotte, N. C.; and Marion County, Ohio.
- 5. <u>Questionnaire Versions Tested</u>: Three versions and one supplementary form as follows:

CPS-1: Standard form used for survey.

<u>CPS-X2</u>: Questionnaire with more detailed inquiries about labor force participation, and, for employed persons, hours worked and class of worker.

<u>CPS-X3A & X3B</u>: Advance form covering key items to be filled by respondent; followup form for interviewer's use.

<u>CPS-X45</u>: Supplementary form summarizing information given in previous interview to be checked against and reconciled with current month's data.

6. Design of Study: About 1,300 interviews were conducted every month during the experiment. Six interviewers in each of the three areas each conducted about 24 household interviews a week for three weeks of each month. Each interviewer used a different one of the following procedures in each of the three survey weeks of the month:

<u>Procedure 1</u>: Standard questionnaire (CPS-1) used and independent interviews conducted each month.

<u>Procedure 2</u>: Detailed questionnaire (CPS-X2) used and independent interviews conducted each month.

<u>Procedure 3</u>: Advance form (CPS-X3A) mailed with request that it be filled and held for interviewer. Interviewer transcribed data to the CPS-X3B. The procedure was later changed to request mail return of the completed form by a specified date.

<u>Procedure 4</u>: Detailed questionnaire (CPS-X2) used for the first step in the interview. The previous month's information shown on the CPS-X45 was consulted after the first step. Reconciliation performed as needed.

<u>Procedure 5</u>: Same as Procedure 4, except standard questionnaire (CPS-1) was used for the first step.

Assignments were randomized over an entire city or county by interviewers and week of the month. Households were initially interviewed for four consecutive months. The rotation cycle, however, was later reduced to three months.

- 7. <u>Collection Procedure</u>: For Procedure 3, there was an advance mail form followed by personal or telephone interview; for the other four procedures, information was collected by personal interview.
- 8. Validity Check:

(1) Comparisons were made with reinterview results for a subsample of cases.

(2) Checks were made against independent lists of corporations and establishment payroll reports to validate the classification of persons as self-employed or as employees.

- 9. Principal Items Analyzed by Version: Comparisons were made among experimental procedures for total population in labor force, employed and unemployed persons by sex, gross changes in employment, employed persons by hours worked and class of worker, part-time workers by reason for part-time employment.
- 10. Limitations: Results apply only to the selected study areas.
- 11. Principal Findings: "Perhaps the most interesting finding of this experiment is that, in spite of the sharp differences in approach, there do not appear to be any major differences among the procedures in the distributions of the sample by employment status ... While findings have been inconclusive with regard to the basic employment status classifications, some clearcut improvements have been evident in the detailed questionnaire ... Most striking of these is the case of the information on hours worked."\*
- 12. <u>Consequences</u>: After further testing in a national experimental sample, changes were made in the standard questionnaire for CPS based on the results of the test. These changes were in the detailed questions about hours worked, duration of employment, class of workers, etc.
- 13. Possible Generalizations: Probing questions can improve accuracy of response for some items. However, adding questions to an already fairly comprehensive inquiry may have very little effect.

Source of material: Prepared by N. D. Rothwell in consultation with Daniel Levine and Joseph Waksberg. The only written source is cited in the footnote below.

<sup>\*</sup> Quotation from "New Methodological Research on Labor Force Measurement," Joseph Waksberg and Robert B. Pearl, September 1965.

## ILLUSTRATIONS HOURS WORKED



## Test No. 15

## <u>1968 SUBJECT RESPONSE STUDY:</u> OCCUPATION FIVE YEARS AGO

- 1. Parent Program: 1970 Census of Population.
- 2. Type of Test: Pretest.
- 3. <u>Date</u>: August 1968.
- 4. <u>Study Population</u>: Civilian noninstitutional population 14-years-old and over as of July 1963.
- 5. <u>Questionnaire Versions Tested</u>: There were two versions, SR-15 and SR-16, of questions about occupation five years ago. Question wording was identical but response categories differed as follows:
  - (a) SR-15 permitted respondents to mark a circle if their business or industry and kind of work five years ago were the same as reported in an earlier question about current employment.
  - (b) SR-16 required a write-in entry of all respondents employed five years ago to show kind of business or industry and kind of work.
- 6. <u>Design of Study</u>: The sample for the study was selected from a list of households in which interviews had been conducted in the July 1963 Current Population Survey five years before the test.

Approximately 2,800 households were selected and questionnaires were mailed to all household members who had been 14-years-old and over as of July 1963 in the selected households. The 2,800 households initially selected were sorted into two groups on an alternating household basis. 6,401 questionnaires were mailed.

- 7. <u>Collection Procedure</u>: Mail; reminder cards sent a week later; personal followup.
- 8. Validity Check:
  - The use of the 1963 survey panel as the sample provided persons whose occupation five years before the test had been reported five years earlier as their current occupation.

- (2) The level of occupational mobility is measured in the Current Population Survey. This served as a standard for the pretest results.
- 9. Principal Items Analyzed by Version:
  - (a) Return rates.
  - (b) Item nonresponse rates.
  - (c) Differences between employment status, occupation and industry as reported on a current basis in 1963 and retrospectively in 1968.
- 10. <u>Limitations</u>: Analysis of differences was made only for those who responded by mail.
- 11. <u>Principal Findings</u>: There were no significant differences between versions in mail return rates and item nonresponse rates.

For persons who reported being employed on both occasions, but reported different occupations, a higher proportion of those reporting on SR-15 said (incorrectly) in 1968 that their previous occupation was the same as their current one (27.8 percent vs. 22.6 percent).

- 12. <u>Consequences</u>: Because of the high difference rates observed for both versions, quiries about specific occupation or industry five years ago were included only on the 5-percent sample version of the 1970 census questionnaire.
- 13. <u>Possible Generalizations</u>: In self-enumerative questionnaires, when one choice is made easier than another, responses may be biased toward the easier choice.

<u>Sources of material</u>: Outline prepared by N.D. Rothwell, using following sources:

Memoranda from Thomas G. Walsh: (1) E15 No.2 -- "Data Results from the 1968 Subject Response Study"

(2) E15 No.3 -- "Accuracy of Retrospectively Reporting Work Status and Occupation Five Years Ago"

Memorandum from Thomas G. Walsh and Paula J. Buckholdt:

(3) Results Memo No.1 -- "Mail Return Results of the Subject Response Study"