

# ENCOURAGING RESPONDENTS TO USE VISUAL IMAGERY TO IMPROVE ACCURACY OF REPORTING IN THE AMERICAN HOUSING SURVEY

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## Overview

A variety of research suggests that American Housing Survey (AHS) respondents sometimes experience difficulties in reporting the rooms in their homes. We hypothesize that the current format of the response task, which requires respondents to report rooms in response to categorical cues, does not facilitate accuracy because it fails to conform to typical cognitive structures about one's home. In a small-scale field test, an alternative approach, which encourages visual memory for rooms and a floor-by-floor recall order, shows promise for reducing reporting errors.

## Background

Over the past several years, Census Bureau staff have carried out a variety of research studies to evaluate and revise various sections of the AHS questionnaire. During one of these efforts, which was focused on the survey's heating equipment questions (Von Thurn and Moore, 1995), we stumbled rather inadvertently on another problem area for AHS -- the number and type of rooms in the housing unit.

The rooms questions are important to the survey sponsor, the Department of Housing and Urban Development (HUD), which uses them as the basis for their "Overcrowding Ratio," a major indicator of housing quality. Errors in reporting the number and type of rooms in the housing unit can easily bias the Overcrowding Ratio.

The research we employed to evaluate the heating equipment questions involved cognitive interviews in the homes of respondents, who often gave "tours" of their home to provide researchers with a first-hand look at their actual heating equipment. An unintended byproduct of such tours was that we could compare the respondents' answers to the rooms questions to our own observations.

To our surprise we found that discrepancies between the questionnaire reports and our direct observation were quite common. Of the 28 respondents, 13 neglected to mention all of their rooms. Several others over-reported at least one room.

Our first response was to confirm that these errors were not simply a function of the think-aloud cognitive interview method. Think-aloud interviews are often very disruptive of the natural flow of standard field interviews, and could certainly lead to reporting errors in otherwise easily-reportable information. In addition, the non-

representativeness of the "sample" may have introduced some bias in our perception of the prevalence of reporting problems. Thus, we looked for confirmation of the existence of a rooms reporting problem with quantitative, representative data.

As with most of its surveys, the Census Bureau routinely conducts reinterviews among a sub-sample of AHS respondents to estimate response variance. Although the most recent rooms reinterview data are more than 10 years old, those data (Pennie, 1988) do show high levels of inconsistency for rooms reports. This finding lent credence to our suspicion that the problems we observed were not an artifact of our research methods, but instead represented respondents' real difficulties in reporting their rooms.

## Possible Causes of Inaccurate Rooms Reports

In our search for an explanation for the observed reporting difficulties, we quickly discounted a few of the "usual suspects." Given the subject matter, problems due to lack of information, memory decay, and sensitivity all seemed highly unlikely. Instead, we focused on the current wording of the AHS "rooms" question series (see Figure 1).

Figure 1 -- The Current, "Categorical" AHS Question

- 26a. How many of each of the following rooms does this (house/apartment) have?
- (1) Bedrooms?
  - (2) How many full bathrooms with hot and cold piped water, AND a sink, AND a flush toilet, AND a bathtub or shower?
  - (3) How many half bathrooms?
  - (4) Kitchens?
  - (5) Living rooms?
  - (6) Separate dining rooms?
- 26b. Are there any other rooms?

The current wording employs a straightforward categorical approach, asking for the number of rooms in each of several categories. There are several possible reasons why respondents may occasionally experience problems with this format. First, the question's category labels may not match the respondent's own names or labels. For instance, the respondent may prefer the label "family room" to "living room." Or he or she may wish to label a dining room/family room combination a "great" room. Label mismatches such as these may cause confusion and result in

reporting errors.

A related problem is rooms to which multiple labels might apply. How is a TV room/guest bedroom to be reported? How about a room which in the home's original design was a bedroom, but which now functions as a den or an office? Such ambiguities are not at all unusual, and the questionnaire itself does not offer any guidance to a confused respondent.

Furthermore, what exactly is a room? Does the space need to be fully enclosed by floor-to-ceiling walls and/or doorways to be a "room," or can some other configuration suffice? A number of ambiguous situations emerged during the cognitive interviews. Again, the questionnaire does not offer any guidance.

Another fundamental problem with the current approach is the "partial list cuing" phenomenon, first identified by Belson and Duncan (1962). A non-exhaustive list of retrieval cues does tend to reduce under reporting of specifically-mentioned items, but at the same time renders the "other" catch-all category quite ineffective as a recall cue for any remaining non-listed items. The exact memory mechanism responsible for this is not certain. Roediger and Neely (1982) posit a general tendency for memory retrieval to follow recently activated retrieval paths. Retrieval efforts that lead repeatedly to already-recalled information are a signal that the memory store is exhausted and that memory search should be terminated. Another factor may be respondents' assumptions about the exhaustiveness of the cues; after being asked about a wide range of room types, it may be that respondents assume that all rooms are already accounted for.

A fifth important shortcoming of the current approach is that it fails to follow a spatially logical sequence. By asking for rooms category by category, the respondent is forced to retrieve the information in a fashion which may make it difficult for him or her to keep track of what has and has not been reported. This would also lead to difficulties in retrieving and reporting on "other" rooms, and may lead as well to double-counting of rooms with ambiguous labels. A more orderly approach would make it easier for the respondent to report all rooms once and only once.

Finally, the categorical approach fails to exploit the fact that memory for rooms appears to be essentially visual, not semantic. Even though there are individual differences in the vividness of mental imagery (Reisberg, et al, 1986), psychological research indicates that visual memory is much more accessible than semantic memory (Anderson, 1995). The comments of our cognitive interview respondents made it very clear that many of them engaged in spontaneous visualization as they attempted to report their rooms. For example, when asked about "other rooms," one respondent replied: "I'm trying to think now, when you walk in, there is a foyer way and if you walk straight across the foyer that leads you into the family room, if you take a left up the stairs that takes you to the second floor." Without any prompting

from us, respondents were answering the question by forming mental images of their home. This finding is supported by research in the area of linguistics (Linde and Labov, 1975) that strongly confirms both that dwelling knowledge is readily accessible in people's heads, and that it emerges in a mostly "tour"-based form, following quite systematic rules, in response to only gentle and general probing.

We began to look for a question wording approach that would take advantage of respondents' visual memory, reduce problems related to the ambiguous labeling of rooms, and that would proceed through the reporting task in a more orderly fashion, consistent with the actual spatial organization of the respondents' homes. Basically, we were looking for an approach that would follow one of the more primary principles of questionnaire design -- pose the response task in a way that makes the most sense for the respondent (Croyle and Loftus, 1992). If we did adopt such an approach, we thought we might improve the quality of important AHS data and at the same time reduce burden on the survey's respondents.

#### Research Design

Based on our assessment of the likely problems with the current question design, we revised the rooms question series to be more consistent with respondents' presumed cognitive structures, as shown in Figure 2:

Figure 2: The Revised Question

26. *Starting with the top floor, tell me all the rooms on that level. It may help if you try to picture yourself walking from room to room.*

We developed a three-part research program to test our hypothesis that a floor-by-floor recall sequence that encouraged respondents to use their visual memories would improve AHS rooms reports. First, in the fall of 1995, we conducted a handful of exploratory interviews designed to confirm that a visual-memory-based approach was really worth further pursuit. The results were unambiguous: with no guidance from us, all of these initial respondents spontaneously used what appeared to be visual imagery in response to a general request to report the rooms in their home.

Next, we carried out a cognitive interview evaluation of the revised question wording. In January 1996, we conducted ten cognitive interviews. We found that respondents had no apparent difficulty understanding or complying with this task, took readily to the visual imagery suggestion, and were able to easily report their rooms using a floor-by-floor sequence.

Our third research step was to try to assess the impact of the new question wording on the actual quality of AHS

rooms reports. We contracted with Westat, Inc. to conduct a small, split-ballot field experiment. We conducted personal visit interviews, using a modified AHS paper and pencil questionnaire, in households randomly assigned to receive either the current (“categorical”) rooms question series or the revised (“floor-by-floor”) approach. We restricted our study population to people living in large homes (defined as having 3 or more bedrooms), because we suspected that the quality of rooms data might be relatively unaffected by question form for people living in small, simple homes -- in other words, we wanted to test the new approach under circumstances where we thought it would have the most beneficial effects.

The study used a convenience sample of volunteer respondents, who were paid for their participation, with no attempt to convert reluctant respondents. All interviews were audio-taped, with the permission of the respondent. Westat pre-identified a number of neighborhoods consisting of single family, detached, large homes in the Baltimore/Washington area. We instructed interviewers to contact every house on assigned blocks, switching the questionnaire version after each completed interview.

At the end of each interview, the interviewer and respondent toured the home to permit the interviewer to diagram a floor plan of the house. Comparing the floor plan to the survey answers permits an assessment of the accuracy of the rooms reports, and thus the relative quality of the data under the two questioning approaches.

### Findings

A total of 162 interviews were completed, 79 with the current “categorical” question format and 83 with our revised “floor-by-floor” wording. However, as we reviewed the questionnaires and associated floor plans, we discovered a number of cases that did not meet the test specifications. We ultimately deleted from consideration 21 cases which had been conducted in small homes (defined as having fewer than 10 rooms); 4 cases in which the interviewer had administered the wrong treatment; and 15 cases with incomplete floor plan data. Thus, our analyses are limited to the remaining 122 interviews.

60 of the 122 interviews were conducted using the floor-by-floor version and the remaining 62 were conducted with the categorical approach. Eight interviewers collected the data, evenly dividing their work load between the two versions.

Table 1 summarizes the comparison of the two versions of the rooms question series to the floor plans drawn by our field test interviewers. The comparison is largely based on application of pre-set, objective rules for making decisions about what constitutes a discrepancy and what constitutes a non-discrepancy, although it also includes some judgment-based decisions (e.g., we disregarded all discrepancies which resulted from interviewers’ failure to record in the questionnaire a room clearly reported by the respondent, or

from floor plans which were obviously incomplete)<sup>2</sup>. According to a chi-square test, the proportion of interview cases conducted under the revised, floor-by-floor approach which produced a room under report or over report (37%) is significantly less than the comparable proportion (55%) obtained under the current categorical approach (chi-square=4.83, p<.05).

Table 1: Discrepancy Outcomes at the Case Level

	Revised Floor-by-Floor		Current Categorical	
	n	%	n	%
Total Cases	60	100%	62	100%
No Discrepancy	17	28%	10	16%
Label Discrepancy Only	21	35%	18	29%
Room Under or Over Report Error	22	37%	34	55%
Under Report Only	15	25%	26	42%
Over Report Only	4	7%	3	5%
Under and Over Report	3	5%	5	8%

The 122 analyzed interviews yielded 81 under reported rooms and 17 over reported rooms. Table 2 displays this information by questionnaire version and by whether or not the under/over reported room was a “major” room or not. (Table 4, found at the end of this paper, displays the same results in greater detail, and shows our definitions of “major” and “other” rooms.)

Table 2: Total Number of Under- and Over-Reported Rooms

	Revised Floor-by-Floor (60 interviews)		Current Categorical (62 interviews)	
	n	Avg Number	n	Avg Number
Total Number Rooms Under Reported	25	.42	56	.90
Major Rooms	11	.18	16	.26
Other Rooms	14	.23	40	.65
Total Number Rooms Over Reported	7	.12	10	.16
Major Rooms	4	.07	8	.13
Other Rooms	3	.05	2	.03

As a rough indicator of statistical significance, we calculated a simple t-statistic on the comparison of the average number of under reported rooms per case by treatment -- .42 for the floor-by-floor treatment, .90 for the

categorical. By this test, the difference between the means is highly significant ( $t=3.72$ , 120 df,  $p<.001$ ). Certainly the small number of cases in the field experiment and especially its non-statistical design render any formal assessment of these results somewhat suspect. Nevertheless, the observed trends certainly support the notion that the revised approach reduces respondent difficulties in reporting rooms accurately.

Finally, contrary to some expectations, the floor-by-floor approach was only trivially longer to administer than the categorical approach, as shown in Table 3. (Table 3 excludes 4 cases for which we were unable to calculate time estimates.) The estimates in Table 3 are calculated from interviewers' recording of interview start and end times.

Table 3: Average Time to Administer Interview

	Revised Floor-by-floor (n=57)	Current Categorical (n=61)
Average length of interview (in minutes)	16.7	15.9

Summary and Discussion

Despite the limitations of our research methods, we find these results encouraging. It appears that important data quality improvements are possible with a revised approach to asking about rooms that is more in conformance with respondents' memory structures and cognitive processes than the current approach.

Among our next tasks are the resolution of several remaining operational issues, including: (a) ensuring that the new approach can be adapted for single-story homes without causing respondents any new difficulties (review of the interviews mistakenly conducted in small homes for the field test suggests that this will not pose a problem); (b) exploring whether we can engineer additional improvements in the reporting of rooms with ambiguous labels and with ambiguous functions (the new approach clearly does not solve these problems, but it does bring them to light where they potentially can be solved); and (c) refining the methods used to record respondents' rather free-wheeling replies to make sure that all reported rooms are captured and no information is lost (our paper-and-pencil test, using interviewers who may not have had assignments of sufficient size to become truly familiar with the procedures, may not be predictive of what is likely to occur in an automated (CATI/CAPI) interview).

One final note of interest: in a post-study debriefing, interviewers voiced some dissatisfaction with the floor-by-floor format as compared to the current categorical approach -- they described the revised format as "clunky," and predicted better results with the categorical approach. Although their prediction about data quality differences

appears to have been off the mark, their concerns in the area of ease of administration are undoubtedly valid. The floor-by-floor approach IS more difficult for interviewers to administer, perhaps primarily because getting better data on rooms seems to require a "script" that is somewhat unpredictable, and that allows respondents some control of the interaction. The key for us will be -- as it should be in all questionnaire design endeavors -- to design an AHS instrument that maximizes respondents' ability to respond accurately and at the same time maximizes interviewers' ease in collecting high quality data.

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Notes

1. The views expressed in this paper are the authors', and do not necessarily represent official views or positions of the U.S. Census Bureau.
2. An initial comparison adhering to a strict set of pre-established, objective rules for determining when a report was discrepant from a floor plan shows a pattern of differences very similar to the results in Table 1, although with an increased overall level of apparent error. We include the results of our more subjective assessment here because we believe it provides a more accurate picture of true error frequencies, while still revealing differences between treatments in the field experiment.

Table 4: Total Number of Under- and Over-Reported Rooms by Questionnaire Version and Room Type

	Revised Floor-by-Floor (60 interviews)		Current Categorical (62 interviews)	
	Under Report	Over Report	Under Report	Over Report
Bedroom	4		2	2
Full Bathroom	3		1	
Half Bathroom	2			
Kitchen				2
Living Room			1	
Family Room / Great Room		1	1	1
Recreation Room			1	
Den / Library / TV Room			3	
Office / Business Room	1	1		1
Other Finished Room	1 Foyer / Rec Room	2 Study Dressing Room	7 Sitting Room (2) Attic Basement (4)	2 Dinette Sitting Room
<b>Major Rooms Sub-Total</b>	<b>11</b>	<b>4</b>	<b>16</b>	<b>8</b>
Laundry / Utility / Storage/ Pantry	10	2	20	1
Other Unfinished Room	3	1	15	1
Other	1 Enclosed Porch		5 Hobby Room Workshop Work Room Furnace Room Storage	
<b>Other Rooms Sub-Total</b>	<b>14</b>	<b>3</b>	<b>40</b>	<b>2</b>
<b>TOTAL</b>	<b>25</b>	<b>7</b>	<b>56</b>	<b>10</b>