

A Hybrid Response Process Model for Business Surveys

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Based on findings from unstructured interviews with business data reporters at 30 large multi-unit companies, we formulate a hybrid response process model for establishment surveys. The proposed model expands upon Tourangeau's (1984) cognitive response model – comprehension, retrieval, judgment and communication – to explicitly include influences that are organizational in nature. The additional steps frame the cognitive response process, set its context, and may potentially contribute to measurement error. Originally developed in 1998–99, the model appears to have influenced establishment survey pretesting and measurement error research both within the U.S. and abroad. The current article presents the original research, along with reinterpretation of available literature, providing additional conceptual and empirical justification for the organizational steps in the hybrid model.

Key words: Cognitive response model; establishments; record-keeping; measurement error; response burden.

1. Introduction

The cognitive response model for survey response, usually attributed to Tourangeau (1984), generated an entire field of research to study and reduce measurement error by evaluating and improving survey questions. Cognitive research methods, such as cognitive interviewing (see Willis 2005, for a detailed description), use the model as a framework for questionnaire evaluation and pretesting, to identify potential sources of response error and suggest repairs that reduce these errors. While the bulk of this research has been undertaken and reported relative to household and general population surveys, the cognitive response model and its associated research methods have also taken hold in establishment surveys. However, characteristics of establishments as respondents have challenged the direct applicability of the model, resulting in some modifications (Edwards and Cantor 1991).

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This article formally presents a “hybrid” establishment survey response process model suggested by research originally presented at the Second International Conference on Establishment Surveys (Sudman et al. 2000), and later extended by Willimack and Nichols (2001). It combines the Sudman et al. examination of the survey response process in large multi-unit companies with reinterpretation of the literature presented by Willimack and Nichols, which together lend additional support to the hybrid model.

This article begins with a review of various enhancements to the basic cognitive model and places them in the context of establishment surveys. We then provide a brief description of the research methodology that led us to develop our proposed hybrid response model for establishment surveys. Addressing each step in our model, we present selected findings and offer supporting arguments from the literature, where available. We suggest general implications of our findings for data collectors and data users. Finally, we illustrate how the model can be used as a framework for researching the potential for response errors in establishment surveys, and we provide suggestions for future research.

2. Reviewing the Development of Cognitive Response Process Models

Tourangeau’s (1984) original cognitive response model consists of the following four steps:

1. *Comprehension*: Understanding the meaning of the question.
2. *Retrieval*: Gathering relevant information, usually from memory.
3. *Judgment*: Assessing the adequacy of retrieved information relative to the meaning of the question.
4. *Communication*: Reporting the response to the question, e.g., selecting the response category, and editing the response for desirability.

Eisenhower et al. (1991, p. 128) precede the basic four steps with the encoding process, referring to the “knowledge to answer survey questions.” They claim that the potential for measurement error begins with encoding, that is, how knowledge and memories are stored and utilized. They suggest that encoding contributes to measurement error in surveys in two ways:

- *Memory formation*: The manner in which memories are formed affects their retrieval.
- *Proxy response*: Memories concerning others are likely stored differently from memories concerning oneself.

3. Adapting the Cognitive Model to the Establishment Survey Setting

Edwards and Cantor (1991) adopt this five-step model (Tourangeau’s four core steps plus encoding) for establishment surveys, making a few enhancements. Their modifications appear in *bold italics*:

1. Encoding in memory/*Record formation*
2. Comprehension
3. *Source decision: memory or records*
4. Retrieval/*Record look-up*

5. Judgment
6. Communication

As the establishment analogue to “encoding in memory,” record formation is explicitly added to the first step of the response model. With two potential sources for answering survey questions – respondent’s memory and establishment records – Edwards and Cantor add the source decision step to their model and modify the cognitive retrieval step to include record look-up.

The following hybrid response process model for establishment surveys was initially proposed by Sudman et al. (2000) based on exploratory research described in this article and modified slightly by Willimack and Nichols (2001):

1. Encoding in memory/record formation.
2. ***Selection and identification of the respondent or respondents.***
3. ***Assessment of priorities.***
4. Comprehension of the data request.
5. Retrieval of relevant information ***from memory and/or existing company records.***
6. Judgment of the adequacy of the response.
7. Communication of the response.
8. ***Release of the data.***

The critical difference between the Sudman, Willimack, and Nichols model and its predecessors is that it explicitly recognizes organizational behavioral steps that affect the survey response process – hence making it a hybrid of both organizational and cognitive factors. Record formation, respondent selection, defining priorities, retrieving information from records and releasing the data are all driven by organizational goals and by decisions that support those goals.

The core cognitive steps – comprehension, retrieval, judgment, and communication – remain intact, although we suggest some modification to the dimensions of the retrieval step. Our primary assertion is that the three steps added to the model preceding the core cognitive steps – encoding/record formation, respondent selection/identification, and assessment of priorities – set a context for the cognitive process, and themselves potentially contribute to measurement error. The final step added to the model – releasing the data – may also have consequences for measurement error.

4. Methodology

The development of this model grew out of results of qualitative research originally conducted by the authors in 1998–1999. The methodology for this research was based loosely on techniques used in cognitive research. Traditional application of cognitive research methodology in survey research calls for in-depth interviews with respondents to identify difficulties at various stages of the cognitive response process affecting the accuracy of the response. These methods have typically been used to identify potential measurement error properties of specific questions or series of questions, and to suggest possible repairs for reducing those errors. In this research, we modified the traditional cognitive approach, conducting unstructured interviews on a broad range of topics to

discover the statistical reporting processes used by our sample companies and to uncover possible sources of error.

The focus of this initial exploratory research was on large multi-unit companies, because they account for a very large portion of census statistics and survey estimates. We also suspected these large companies face complex statistical reporting issues. Additionally, because of their size and influence, they are selected for multiple surveys and censuses.

Unstructured interviews were conducted during group meetings with company staff responsible for government reporting during site visits to 30 large multi-unit companies. We attempted to arrange meetings with 37 companies, but seven did not participate for a variety of reasons. These companies were selected from the largest 1,100 companies in the U.S., based on employment, at the time this research was initiated in 1998. It must be noted that this was a judgment sample useful for exploratory purposes, and that statistical analyses and inferences are not appropriate.

The selected companies represented a variety of industry types, with many companies diversified into multiple industries. Both public and privately owned companies were selected, as well as companies with varying degrees of foreign involvement. The selected companies also exhibited differing cooperation rates on various U.S. Census Bureau surveys and censuses. Special effort was made to include some companies from rapidly developing sectors that represented growing significance in U.S. Census Bureau estimates.

The U.S. Census Bureau's business register containing company contact names was used to arrange the meetings. Typically the company was represented by 2–6 members of the headquarter's financial reporting staff responsible for completing government surveys. Occasionally participants also included controllers, information specialists, human resources staff, tax accounting staff, and legal department staff. U.S. Census Bureau participants included a project researcher, one or two subject area specialists, and the project sponsor, a U.S. Census Bureau senior executive.

Meetings typically lasted at least three hours and were audio-recorded with permission from the company. Participants from only four companies refused audio-recording, while still permitting interviews. Using a protocol tailored for each company based on background research, a variety of topics were discussed, including company organization and information system structure, availability of data, respondent selection and response strategies, and perceptions of confidentiality and burden. We did not focus on a single U.S. Census Bureau census or survey report form; instead we typically reviewed one or two of the 1997 Economic Census forms the company received, and two of the current survey forms completed at corporate headquarters. In all cases, company participants were very responsive and candid regarding our discussion topics.

5. Findings and Interpretation

In this section, we present findings that were particularly pervasive across many of the companies we interviewed, organized around each step in our proposed hybrid model. We also integrate support from relevant literature and offer interpretation in light of our results.

5.1. Step 1: Encoding in Memory/Record Formation

5.1.1. Encoding

The existence of data in records is not, by itself, a sufficient condition for the availability of data. Edwards and Cantor (1991) suggest that information to answer survey questions is either in the respondent's memory or in business records. Thus, the respondent must choose between memory and records regarding the source of information used to answer a given survey question – hence, the addition of Step 3 in their model presented earlier.

The source decision varies with the type of question – whether the question requests figures (e.g., dollars, quantities), offers response categories, or uses an attitude scale to codify opinions. For example, the U.S. Census Bureau asks some questions that do not require numerical answers, instead requesting Yes/No or categorical answers, such as the type of jurisdiction within which the establishment is located (e.g., city, town, township, etc.), kind of business, class of customer, or method of selling.

While it may be true that the respondent has encoded in memory basic figures that also appear in records, such as employment, payroll and revenues, it is even more pertinent that an establishment respondent's "knowledge to answer survey questions" also includes knowledge of various sources of information within the business, such as records, information systems or co-workers, as well as familiarity with company structure. Particularly in large companies, divisions of labor and decentralized data sources distribute knowledge across company units, requiring data to be assembled from multiple sources to satisfy survey requests (Groves et al. 1997; Tomaskovic-Devey et al. 1994). Thus, knowledge of multiple data sources and locations, including responsible co-workers, must also be encoded in the respondent's memory. To the extent that the respondent does not possess this knowledge, or that the respondent's knowledge is flawed or incomplete, there is potential for measurement error.

In summary, there are two types of knowledge encoded in memory important to the response process in business surveys:

- Personal knowledge from which a question may be answered directly.
- Knowledge of sources, such as records or other company personnel, from which the answer to a question can be obtained.

Thus, regardless of whether a particular question can be answered from business records, what and how is such knowledge and how it is encoded in the respondent's memory is of utmost importance to the potential for measurement error.

5.1.2. Record Formation

The end products of record formation are recorded data, which are typically considered the subject of many establishment survey questions, particularly those collected by national statistics institutes. What data appear in business records? Our research results, along with those of previous record-keeping studies (U.S. Bureau of the Census 1990), found that data recorded in company records are primarily driven by three things:

- *Management*: Data are kept to manage the business, to ensure the goals of the business – e.g., to make a profit – are met. Items tracked vary depending on data

needed to monitor activities for particular units or levels of the company. For example, many companies in our research indicated that more detailed data were tracked by individual business units, levels or locations, while the corporate financial office was responsible for tracking and reporting aggregate or consolidated figures.

- *Regulations*: Data are kept to meet regulatory requirements, such as those in the U.S. imposed by the Internal Revenue Service (IRS), the Securities Exchange Commission (SEC), the Federal Trade Commission (FTC), workers' compensation, or unemployment insurance, among others.
- *Standards*: Recording of figures is guided by Generally Accepted Accounting Principles (GAAP).

Our company visits revealed that these large companies utilized multiple information systems containing data to meet various reporting and management needs. For example, one system handled payroll information, while another monitored inventories. Most systems, if not all, were automated, and may or may not have been linked. Different information systems were sometimes located and maintained in different departments of the company, keeping track of different data items. On the other hand, in some instances, the same data items were tracked separately within each business unit or subsidiary.

Which data are actually recorded in business records clearly affects the availability of data to meet a survey request. Besides our large company research, a number of research papers discuss data availability, often discerning whether data requested in surveys exist in company records. Some examples are Carlson et al. (1993), Eisenberg and McDonald (1988), Mulrow et al. (2007), Ponikowski and Meily (1989), Rutchik and Freedman (2002), Sykes (1997), U.S. Bureau of the Census (1990), and Utter and Rosen (1983).

In our study of large companies, it was clear that some data did not exist at all in company records. For example, many respondents said their records did not contain the county in which the establishment is located, which was requested on the 1997 Economic Census. Some data were not kept at the levels requested on surveys. For example, industries that operated in a network, such as communications, finance, and transportation, did not attribute revenue data to individual establishments because these geographic units were not meaningful for management decision-making. In addition, business records frequently were not organized to match statistical reporting units. For example, the U.S. Census Bureau requires reporting units to be identified by Employer Identification Numbers (EINs), permitting associated administrative data to be used to evaluate coverage and to support editing and imputation. However, most companies reported that EINs did not map to particular business units, nor did they play a major role in how information systems were organized.

If data collectors could affect record formation – that is, if we could influence businesses to record the data that we will ultimately be collecting for statistical purposes – then retrieval of the data would be eased. There are a few rare instances of this – e.g., influencing payroll software developers to incorporate data requested by the Covered Employment and Wages (ES-202) program conducted by the U.S. Bureau of Labor Statistics (Searson 2001).

5.2. Step 2: Respondent Selection/Identification

The identity of the respondent has implications for the efficacy of the core cognitive steps and, thus, also for measurement error. Different respondents for the same company may:

- have differing knowledge of available data sources encoded in memory;
- comprehend questions differently;
- have varying degrees of access to different data sources, as well as varying abilities to retrieve data from them;
- make different judgments regarding the adequacy of the information retrieved; and
- communicate the response in different manners.

Edwards and Cantor (1991) suggest that measurement error due to the respondent may be minimized by selecting as the respondent the person most knowledgeable about the requested data. Thus, the desired respondent would be the person closest to the record formation process, having both knowledge of contents of the records and understanding of the concepts being measured by recorded data. Tomaskovic-Devey et al. (1994) call this the “technical core.” Selecting such a person for the respondent should reduce variation in the cognitive steps.

However, due to distributed knowledge, especially in large companies, a single respondent may not be the most knowledgeable about all the requested data items for surveys that consist of multiple different information requests. Multiple “most knowledgeable respondents” may be needed. Because of organizational hierarchies, a single respondent may be knowledgeable about the existence of these data (Tomaskovic-Devey et al. 1994), but not have intimate knowledge of the figures themselves, nor have the ability to directly retrieve these figures. As a result, the single most knowledgeable respondent may be redefined as the person who has broader knowledge of the existence of a variety of types of requested data and their sources, including both records and other knowledgeable people.

Evidence from our study of large companies supports this assertion. We found that most company level reporting for the U.S. Census Bureau was centralized in a Financial Reporting Group at each company. Occasionally, this function was located in a more specific Government or External Reporting Group. These staffs were almost entirely made up of accountants who perform other reporting tasks such as required filings for the Securities Exchange Commission (SEC), annual reports, and other management requests. These people were generally well-trained (most were Certified Public Accountants) and motivated to do a good job.

We found that the staffs responsible for government reporting changed frequently as people were promoted or reassigned, or as the company merged, divested or reorganized. Many of the company reporters we interviewed were relatively “new” in their current positions, having occupied them one or two years or less. It was rare to find the same reporter for consecutive economic censuses, which occur every five years.

Government reporting was usually coordinated by one person, but involved multiple staffs or personnel to produce various reports. Only occasionally did one single person handle all or most of the reporting to the U.S. Census Bureau. In fact, companies with a manager coordinating government reporting appeared to identify data providers more easily than those without, and they delegated the survey response task to others.

A number of different approaches were used within companies to select the respondent. If there was a person listed on the mailing label, that person received the form initially, but may not necessarily have been the one to complete the form. Often the person with experience was selected to complete the survey; other times the task was assigned to a new staff person for training purposes. Competing job responsibilities and access to the data were always factors considered when assigning the respondent.

A second round of respondent selection occurred if the original corporate respondent did not have access to the necessary data. Detailed data were often available at levels, departments, or business units other than the corporate level. Often the respondent already knew individuals or, at minimum, the office where the detailed data resided, since corporate staff accessed these data for their other job duties.

Our research findings show that the designated respondent typically had the ability to gather the requested data from multiple sources in the technical core. This ability is often associated with a certain level of authority within the company. Indeed, authority is a second attribute of the desired respondent identified by Edwards and Cantor (1991). They note that the desired respondent must not only have knowledge of the requested data, but also the authority to release it. They also note, however, that authority and knowledge may not reside in the same person.

Findings from our large company research suggest that authority is manifested in three decisions:

- the survey participation decision (see Willimack et al. 2001, for a discussion of this);
- delegation of the response task, that is, selection of the respondent;
- assessment of the priority of the response task relative to the respondent's other duties.

The latter two decisions have implications for the response model and affect the potential for measurement error. First, respondent selection is under the control of the business, not the survey organization. Our research on the response process in large companies found that survey response was often delegated or assigned to someone other than an authority figure. In addition, limited empirical research has shown that, even when survey organizations make the effort to identify staff believed to be most knowledgeable about the requested data – that is, the desired respondent according to Edwards and Cantor (1991) – it is not uncommon for the actual respondent to be someone else (Ramirez 1996).

Second, the person with authority needs to have a certain level of knowledge of company records and data sources in order to select an appropriate respondent that will minimize measurement error. That “certain level of knowledge” may vary with the type of survey and the breadth of data requested. Third, priorities set by the authority person affect the respondent's motivation, or attentiveness to the response task, subsequently affecting data quality.

5.3. Step 3: Assessment of Priorities

As a result, we believe that assessment of priorities is an explicit step in the response model. Since it influences the respondent's motivation, it too affects the potential for measurement error. The greater the respondent's motivation to do a good job responding

to the survey, the more attentive the respondent will be to the four core cognitive steps, reducing measurement error. The higher the priority of the response task, the greater will be the motivation.

Our research with large U.S. companies found the following priorities assigned to various tasks and activities among financial reporting staffs:

1. Requests from management, as well as those from investors for public companies.
2. Preparation of Annual Reports, SEC and IRS filings.
3. Other periodic financial statements (quarterly or monthly).
4. Other government or nongovernment regulatory requirements (e.g., Hart-Scott-Rodino filings, Department of Energy or Department of Transportation regulatory filings).
5. Other government data requests (such as those from the U.S. Census Bureau and other statistical agencies).
6. Nongovernment data requests.

Priority is given to activities required to keep the business open and growing. Respondents noted that government reporting is not a revenue-producing activity – it bears a cost without an associated revenue or penalty. Thus, while reporting on U.S. Census Bureau surveys is taken seriously, it is not a company's highest priority task.

The timing of survey requests is a factor related to response, and survey due dates are considered when scheduling the work relative to other priorities. The U.S. Census Bureau attempts to schedule data requests to coincide with the expected availability of the requested data. However, these periods tend to be when reporters are busy with other priorities. For example, the first quarter of the fiscal year, which is a calendar year in most companies, is especially stressful for company reporters because of multiple reporting requirements. Surveys with due dates falling within this period are problematic and may be deferred. Respondents indicated they would like to receive advance notice of surveys, so they could plan for upcoming work relative to other tasks.

Respondents also noted a preference for due dates explicitly identified as month, day and year. They expressed concern that some U.S. Census Bureau report forms say "Due date: within X days of receipt," which is less useful for scheduling the response task, because the form may "float" around before reaching the appropriate respondent.

Companies distinguished between mandatory and voluntary surveys, giving higher priority to those that are mandatory. Some companies refused to participate in voluntary surveys. This decision was attributed to management decisions about resource use. If data requested on voluntary surveys are not readily available, management may choose not to expend the resources to compile requested voluntary information. In addition, some respondents commented that follow-up phone calls from U.S. Census Bureau analysts questioning reported data added burden.

Additionally, the respondent's personal motivations affect the priority given to completing a survey. A respondent's motivation is related to job performance and evaluation criteria, since respondents complete a survey within the context of their jobs (Nichols et al. 1999). Motivation is also associated with pride in one's work and professional standards. Social psychological factors that influence the survey participation decision may also affect a respondent's attentiveness to the response task itself. In addition to those described by Groves et al. (1992), such as scarcity, consistency, and social proof,

a respondent's efforts to do well may be personally motivated by altruism, a sense of civic duty, or interest in the survey topic.

5.4. Step 4: Comprehension of the Data Request

During our company visits, we rarely had the opportunity to learn respondents' interpretations of specific questions. Nevertheless, we did learn about their interpretations of selected questionnaire elements and terminology.

Nearly all respondents reported using information printed on the mailing label to define the reporting unit. That is, they interpreted the name and address information to determine the part of the company for which to report data, regardless of whether the U.S. Census Bureau intended the reporting unit to be the entire company, business units involved in particular industries, or an individual establishment. Respondents' varying interpretations of the desired reporting units are pertinent because these large companies have multiple subsidiaries and are frequently involved in new acquisitions, mergers and joint ventures. For example, when two companies merged and the mailing label identified only one of the original companies, only data for that part of the company was reported on the form. Also, corporate divestitures may not be readily identified by the U.S. Census Bureau when data collection procedures tailored to individual subsidiaries by-pass what had been corporate headquarters.

Respondents had various interpretations of the term "establishment," which is essentially a business presence at a physical location. In industries, such as retail, where management decisions are made and profit/loss is monitored for individual locations, then respondents' interpretation was correct. However, in some companies, "establishment" was equated with "business unit" or divisions operating in particular business activities, which typically accumulate multiple establishments. For networked industries, geographic units are not meaningful management units, and thus "establishment" was not a meaningful term. Interpretation of the term "establishment" in these industries is unclear, and likely inconsistent.

As corporate accountants, the company reporters for these large companies practice GAAP. To the extent that requested data items follow GAAP, accountants had no trouble understanding them and retrieving data. In fact, reporters tended to interpret questions in the context of GAAP. This is true even when there was uncertainty about what the questions were asking for – reporters assume the item has the same definition as required by GAAP. This is an appropriate assumption, since most of the information requested in U.S. Census Bureau surveys follows accounting standards. There are, however, some exceptions. Some economic concepts of interest to data users deviate from accounting standards, and measurement errors are more likely to occur in these instances.

5.5. Step 5: Retrieval of Relevant Information from Memory and/or Existing Company Records

As we noted earlier, our reconsideration of the literature suggests that much of this previous research addressed the retrieval step by focusing on data availability in terms of the results of record formation. However, record formation is only one dimension of data availability. Others are the respondent's access to data sources and the respondent's ability

to retrieve data from these sources, either records or co-workers with firsthand knowledge of them. Thus, availability may be conceived to be a function of record formation, the respondent's access to records, and retrieval.

Retrieval incorporates three components:

- The cognitive act of retrieving from memory knowledge of data sources, company records, information systems, company structure, or appropriate personnel;
- Access to appropriate records or knowledgeable personnel; and
- The physical act of retrieving data from records and/or information systems, which includes:
 - Extracting information from computer and paper files,
 - Consulting multiple sources, both people and records, because of distributed knowledge, and
 - Compiling information.

As a result, the function defining data availability suggests particular inferences and conclusions. For example, if data exist in records and the respondent knows this but does not have access, then the data are not available. If data exist in records and the respondent does not know this, then access is irrelevant, and the data are not available. Thus, data availability requires both the respondent's knowledge of and access to records, data sources, and/or knowledgeable personnel. Moreover, access is a necessary but not a sufficient condition for retrieval, and thus data availability.

Because knowledge and access vary with the respondent, data availability varies with the respondent. This adds another dimension of the retrieval step that is subject to respondent variation, resulting in potential measurement error. Previous research has rarely delineated data availability in attributes of the respondent's (a) source knowledge, (b) records access, and (c) retrieval activities.

In our original research with large companies, we too considered retrieval primarily in terms of availability. Response burden is much more dependent on the availability of data and the ease with which data can be retrieved than on the length of the survey form. Our company visits revealed that the availability of data lies along a continuum. Some data were directly available from company information systems; some data were compiled or calculated based on data that can be directly retrieved. Data that could be directly accessed by company reporters were the easiest to supply on surveys. In addition, since financial records are based on GAAP, U.S. Census Bureau data that align with GAAP tend to be more easily retrieved and of better quality.

Other data required some degree of effort to retrieve, involving multiple data sources and/or providers. It was common for corporate Financial Reporting Unit staff to obtain data by request from "local" information systems that were not directly accessible to the central unit. Reporters also obtained and summarized data from alternate sources within the company, such as from information systems supporting other units. Retrieving data from alternate sources sometimes required use of computer programming resources.

Company reporters' greatest problem was responding to U.S. Census Bureau requests for data that either were not kept or were kept in ways that made it very difficult to supply information. Some examples of requested data not kept in company records were described earlier. Other data, such as employment during "the pay period including March 12" and

EINs, were kept in other departments and were not directly accessible to the staff in the corporate Financial Reporting Unit. Data that were difficult to obtain in the manner requested by the U.S. Census Bureau include receipts categorized by detailed merchandise or product lines, or data for non-revenue-producing establishments (auxiliaries).

We were able to identify several information retrieval strategies used by the large companies in our study. Nearly all reporters kept documentation related to government reporting, along with supporting “work papers” or accounting schedules documenting calculations of items and/or indicating data sources. Notes indicated pertinent instructions relative to data available from the company’s records.

Business respondents are quite adept at using spreadsheets and their functionality. Instruments designed to look and work like spreadsheets or integrate easily with spreadsheets facilitate retrieval and reporting. Many of our study respondents explained that they actually translated our report forms into spreadsheets, which automated data retrieval and calculations, at least to some extent.

For repeated periodic surveys, all respondents used documentation of previous period reporting as a guide for completing subsequent forms. This strategy has the advantage that changes from one period to another reflect real changes in the business and not changes in question interpretation. There are disadvantages, however. Any previous errors are perpetuated. Also, if there are changes in the survey, respondents may overlook these changes and simply fill out the form as they did the previous time. In addition, new surveys may be viewed as more burdensome than ongoing requests, since there are no work papers to support such new requests.

In addition, we discovered two common completion strategies related to the role of the respondent. Sometimes the respondent *coordinated* the survey response, by distributing the report form(s) to local data providers, that is, to staff at other levels or units in the technical core of the company. In some cases, these local data providers completed and mailed the form directly back to the U.S. Census Bureau, with little intervention from the coordinator; in other cases completed reports were returned to the coordinator for corporate-level review. Processes with little oversight or validation may be more open to measurement error due to missing data and possible duplication of data, especially if there is overlap among the entities.

In an alternative strategy, the respondent *compiled* the necessary data for the request, gathering data from multiple sources and/or requesting data from local data providers. Copies of the form and instructions may have been sent to the local providers. More likely, though, data needs were interpreted by the compiler and communicated via telephone or e-mail to staff with access to the data. The compiler then completed the form(s) with data obtained from the local data providers. In either of these retrieval strategies – coordinating response or compiling data – the involvement of local data providers results in a second, and perhaps embedded, round of cognitive response processes, with consequences for measurement error.

5.6. Step 6: Judgment of the Adequacy of the Response

Judging the adequacy of a response is aided by questionnaire instructions. Respondents in all our company visits said attention was paid to instructions that accompany U.S. Census

Bureau forms, but to varying degrees. While new respondents tended to review the instructions more closely, other respondents simply looked for changes from the previous reporting cycle. Overall reaction to the instructions by large company reporters was positive. When instructions were not clear, respondents called the U.S. Census Bureau for additional clarification, and they were generally satisfied with the assistance they received.

For data that were difficult or impossible to retrieve directly from records, company reporters resorted to estimation strategies rather than leaving items unreported (i.e., blank). Moreover, they only used estimation schemes when company data did not include the type of detail requested on the report. (In other words, they did not estimate for data that were available from records.) Often estimation strategies were based on algorithms agreed upon by consultation within the company. One example was to allocate revenue among locations on the basis of payroll when revenue data were not compiled in this manner. This may have been done with or without the knowledge of the U.S. Census Bureau.

Another estimation procedure used by company reporters was to update figures reported in previous time periods. This strategy reduces trend variability due to measurement artifacts. Very often the estimation algorithms were documented in work papers, so new respondents would know how estimates were derived.

When survey reference dates differed from reporting periods associated with company records, companies tended to choose a convenient reference date relative to their records. This may mean that different periods were actually used for different surveys. In some cases, a different set of records was used to report for the annual survey than was used for the monthly survey (e.g., tax records or fiscal year-end close for annual reporting vs. general ledger for monthly reporting).

5.7. Step 7: Communication of the Response

Many economic census forms request that percentage break-downs of revenue by merchandise line be reported in whole numbers only. More than one company questioned whether we were aware of the effect of only reporting percentages in rounded whole numbers. Revenues for this company were so large that a revenue figures less than 0.5 percent (which they reported as "0" per our instructions) was a substantial amount of money. Another company ignored the instruction to report percentages in whole numbers and reported them to one decimal place. Respondents, in general, failed to understand that rounding error is relatively inconsequential to our statistical summaries. Instead they were more concerned that reported data accurately represented their companies.

All respondents were enthusiastic about electronic reporting. Not only were these personnel computer savvy, using computers and electronic spreadsheets daily, but the data necessary to complete most requests were stored in computer systems. Some companies had translated our paper questionnaires into in-house electronic versions, especially those that acquired data from several sources across the company.

5.8. Step 8: Release of the Data

Finally we add the release of the data as an explicit step in the response process. In our research on large companies, we found that, while the assigned respondent may be responsible for reporting individual data items on the survey questionnaire, it was not

uncommon for someone with authority to re-enter the response process prior to releasing the data to statistical agencies. These authorities reviewed and verified survey forms for completeness and consistency, essentially performing their own company-level quality assurance procedure. Responses were compared to aggregated corporate figures generated by their own internal reporting processes. Effort was made to reconcile reported data against figures presented publicly, such as in SEC filings or Annual Reports, to ensure that a consistent picture of the company was presented to the outside world, of which statistical agencies are a part.

In addition, authorities considered the confidentiality and security of the data release relative to the sensitivity of the data being requested. Company reporters generally trusted that the U.S. Census Bureau keeps data confidential. Concerns for confidentiality were not given as a reason for not reporting. Companies noted that most requested data are public from SEC filings. Some detailed information at local levels or for shorter time periods (weekly, monthly vs quarterly or annual) was considered more sensitive. Most companies indicated that data would not be released to the U.S. Census Bureau until it had been released to stockholders or reviewed by upper management.

With the advent of electronic reporting, companies were asked about their willingness to report data via the Internet. While, in general, companies expected security of data would be assured, a few companies had confidentiality concerns about using the Web to file data.

6. Implications for Data Users and Data Collectors

Users of economic data expect that the data are highly reliable with little or no measurement error. Likewise, data collectors recognize that, although measurement error is inherent in the survey process, it is their goal to reduce measurement error to the extent possible. Thus it is necessary to identify sources of error and evaluate their implications for improved data collection procedures, as well as for analytical interpretation of the data. Our findings have measurement error implications pertinent to both data users and data collectors.

6.1. Data Users

First we focus on some implications for data users. Generally, company reporters are conscientious, well trained, and make every effort to supply reliable information if it is available. They reconcile figures with past reports and with public information creating consistent data from cycle to cycle. As we noted previously, data are likely of good quality to the extent they match standard accounting concepts, are retrievable from accessible information systems, and can be reconciled with public information. This is true even when calculations must be performed on existing data to meet U.S. Census Bureau definitions. We advise data users to evaluate their variables of interest relative to these criteria.

Users must be aware, however, that some variables will not be available from all companies. This is especially the case with revenue information by location. Such data are typically available for retail chains and manufacturers, but are not likely to be available for networked service industries, such as finance and banking, consulting, communication,

and transportation. In these industries, monitoring revenue by location does not have management meaning for evaluating performance of the business; thus it is not part of their information systems.

Where this information is not available, the standard U.S. Census Bureau procedure has been to allocate revenues to locations based on payroll data. This allocation can be defended as reasonable in the absence of better data, but data users must be aware when revenues are being allocated on the basis of a model. In such cases, high correlations between payroll and revenue are a function of the model, and are not indicative of real economic behavior. In addition, other estimation procedures that take place at companies are unknown to the U.S. Census Bureau. These too may have ramifications depending upon what relationships the data users draw against these variables.

Additionally, data users must be cautioned in an evolving economy. The frequency of organizational changes appears to affect accurate reporting, although not deliberately. Duplicate reporting and missing units are possible consequences of these changes.

Data users must be cautious in their use of the establishment as a unit of analysis. The definition of establishment tends to be driven by geography, EIN, and industry or function. Thus it is somewhat artificial and arbitrary, especially in the growing service sector. Many service firms have difficulty defining establishments. There may be multiple establishments at a single location, because of EIN assignments. Alternately, many firms assign multiple locations to a single EIN. In any case, how establishments are delineated tends to be at the discretion of the respondent, based on their interpretation of U.S. Census Bureau forms, instructions and questions. Thus, even the definition of the reporting unit – and the unit of analysis – is subject to respondent variation.

6.2. Data Collectors

The implications of measurement error for the data user should be addressed by the data collector. Our hybrid model can be used to aid this endeavor, by providing a framework for investigating the survey response process in businesses, identifying potential response problems, and suggesting ways they might be addressed by survey organizations through modifications and improvements to data collection instruments and processes.

The findings from our research showed that, fortunately, the respondent to economic survey requests was typically the person with access to the appropriate data or who was able to gather data to either report directly or create an estimation scheme. The use of automated databases by organizations has made data accessible; however, it often requires multiple reporters. Only a few companies reported instances where the requested due date was prior to management review of the information. Company reporters, however, cannot always complete their U.S. Census Bureau reporting tasks in a timely manner because these tasks often coincide with other higher priority duties.

The challenge for data collectors is to develop and use data collection methods that facilitate the response process and avoid procedures that hinder it, in order to reduce respondent burden. Our research results provide some suggestions. Many of our companies requested an advance listing of all upcoming data requests for the year, so they could plan and incorporate the response task into ongoing processes. Suggestions for items included in such an advance notice follow:

- A summary of requested data and notice of new surveys or changes in ongoing surveys, particularly major definitional or conceptual changes affecting data requirements, so these might be incorporated into data capture or retrieval;
- Names and phone numbers of the previous respondent, to aid respondent identification and, in the face of staff turnover, to reassign the response task;
- Survey due dates to help them schedule all the different requests relative to competing priorities for the year;
- U.S. Census Bureau contact information, so assistance may easily be sought when there are difficulties interpreting the data request or judging the adequacy of answers.

In addition, survey designers should consider business priorities when scheduling critical data collections or, at least, granting deadline extensions. Explicitly identifying due dates in terms of month, day and year will also facilitate scheduling the work relative to other business priorities.

Our findings also suggest additional procedures to facilitate respondent identification. Placing the name and title of the last data provider on the mailing label would help companies eliminate many of the “floating” survey forms. In large companies where a government reporting coordinator/manager delegates the reporting task, the manager’s name should be placed on the mailing label. Maintaining the identity of the appropriate respondent in ongoing periodic surveys could be accomplished by adding a question at the end of the form asking to whom the survey should be mailed the following cycle.

Our findings raise a dilemma regarding redesigning business survey questionnaires to reduce errors of interpretation, navigation or process. Since company reporters routinely refer to the survey report forms completed for previous periods, along with associated documentation, simply changing the forms may increase measurement error because it disrupts the reporter’s routine response process, at least in the short run. The trade-offs in various types of measurement errors must be evaluated. At a minimum, any changes in the form and instructions should be highlighted, so that respondents are aware that changes have occurred. Careful attention should also be given to mailing labels to make it clear what parts of the business are to be included or excluded.

Difficulty with the retrieval step seems, by and large, to be the main source of respondent burden, because multiple data sources and providers are often needed for survey response. Further, some requested data do not match recorded data, or are not recorded at all, potentially resulting in item nonresponse or estimation by respondents. Recognizing that data users will inevitably request information not directly kept in records or that cannot be easily retrieved, data collectors are challenged with building a bridge from available data to needed data. This may entail seeking creative solutions for the redesigning of data collection instruments and the adoption of strategies that recognize the spectrum of data availability, as well as taking an active role negotiating data needs relative to data availability.

Using electronic forms that work with businesses’ databases, particularly if they are designed around spreadsheet applications, will aid data retrieval and response communication. As we move from paper to electronic forms, building features into applications to facilitate practices such as distributing data requests to local providers,

maintaining supporting work papers, and verifying data should help improve data quality and ease reporting burden.

7. The Hybrid Model as a Research Framework

The traditional cognitive response model provides a framework for investigating the potential for measurement error in surveys. Research methods based on the cognitive model are used to identify survey questions that may be prone to response error, diagnose the reason(s) for errors, and revise the questions so as to reduce or eliminate these errors. Thus, the goal of such research is to aid survey organizations in improving their data collection instruments and processes.

While the cognitive response model remains pertinent for evaluating potential measurement error in establishment surveys, it does not address many other issues common to the response process for businesses. Our hybrid model, which was built inductively based on results from the research reported here, explicitly incorporates these organizational influences. Its purpose, like that of Tourangeau's cognitive model, is to provide a framework for investigating potential measurement error so that survey design may be altered to reduce or eliminate such error. Section 6.2, which described implications of our research for data collectors, demonstrated how such research findings can motivate solutions to mitigate problems that could contribute to error.

Additionally, Willimack (2008) describes how protocols for pretesting business surveys at the U.S. Census Bureau are guided by the hybrid survey response process model presented in this article. Probes that investigate organizational steps tend to form a preamble and a postlude to the question-by-question probes examining cognitive steps. First, general questions obtain background information about the organizational structure, respondent selection, and the respondent's role in the company. Next come cognitive probes about specific survey items, often with emphasis placed on the types and location of available records that respondents would likely draw upon. The interview ends with probes about what happens after a form is completed, constituting its release to the U.S. Census Bureau.

After researchers conduct exploratory or cognitive interviews with a small purposive sample of business respondents, they prepare a report summarizing findings across all interviews. They develop recommendations for alleviating any potential measurement errors suggested by those results. The researchers collaborate with survey sponsors and subject area specialists to determine modifications to the survey design or collection process that may reduce or eliminate those errors.

Our hybrid response model was also integral in guiding modifications needed to include establishment surveys in Q-Bank, an online database of survey questions, mainly from U.S. government statistical agencies, that have been pretested or otherwise evaluated (<http://wwwn.cdc.gov/QBANK/Home.aspx>). Q-Bank, the product of an interagency endeavor in the U.S., was created to ensure retention and sharing of pretesting results (Miller 2005). The database, searchable by a number of coded question characteristics and types of response error, is a doorway to associated complete research reports. Originally developed to contain interviewer-administered surveys of households and individuals, the coding scheme was enhanced to include self-administered and establishment survey

questions (Hunter et al. 2005). Development of the classification scheme for response errors in establishment surveys was informed by the hybrid response process model presented here. (Establishment survey question response error codes and their definitions can be found in the Q-Bank User's Manual for Self-Administered Population and Establishment Questionnaires 2008.) Research utilizing the contents of Q-Bank aids our understanding of relationships between question characteristics and response errors, helping survey organizations to improve instrument design and reduce the potential for measurement errors.

8. Future Research Needs

Research conducted since the initial presentation of the hybrid response model (Sudman et al. 2000), much of which it motivated, has substantially aided our understanding of the business survey response process. (See, for example, work by Anderson and Morrison 2005; Bavdaz 2006, 2007; Dale and Haraldsen 2007; Giesen 2007; Haraldsen 2004; Haraldsen and Jones 2007; Hedlin et al. 2005; Hedlin et al. 2006; Jones 2005; Jones et al. 2005; Jones et al. 2006; Lorenc 2007; Marske and Marcus III 2000; Marske and Stempowski 2009; Morrison and Anderson 2005; Snijkers 2008; Tuttle 2009; Willimack 2007.) Nevertheless, many research questions remain, to improve or validate our model, or to understand and document its limitations.

Our model is based on results of exploratory research on the response process in large companies, and primarily referring to survey requests for numerical data. Does the model describe the response process in small- and medium-sized businesses, which are typically less complex than large multi-unit companies? Is the model appropriate for non-numeric information requests? What modifications or caveats are needed so that it applies more generally?

We suggest a more clear distinction between record formation and information retrieval than currently found in the literature, while data availability encompasses both. We suggest that cognitive research into the retrieval step more explicitly will consider (1) the respondent's knowledge of records sources and how that knowledge is retrieved from memory; (2) the respondent's access to relevant records; and (3) the strategies and activities involved in physically retrieving data from records.

Comparison of statistical requests with data maintained to meet various regulatory requirements may help ascertain where efficiencies could be gained in data retrieval. Record-keeping studies will identify sources of various types and levels of data. Estimation strategies used by respondents should also be studied to gain insights into model development. Common estimation strategies employed for particular variables could be shifted from the data provider to the data collector. This would ease respondent burden, as well as reduce variability due to respondents.

It is important to recognize that an organization such as a business or an establishment cannot respond for itself. It relies on a person within the organization to provide information on its behalf, that is, to act as a proxy or an "informant" for the organization. This person is subject to issues of knowledge formation and memory retrieval raised by Eisenhower et al. (1991). In particular, how do respondents for businesses obtain and retain knowledge about records, information systems and data sources? How does the

context of the job affect the encoding step and retrieval from memory? Does memory related to one's job differ from memories associated with oneself? How does this vary across different possible respondents/informants who may be involved in responding to a survey? What does this suggest about selecting a respondent so that measurement error is reduced?

We have discussed the implications that respondent selection has for the four core cognitive steps embedded within our proposed response process model. We have shown that respondent selection is under the control of the business. Thus, it is possible for survey response to be delegated to different types of respondents/informants within or across firms. Who are these different respondent candidates and what are the criteria by which they are selected? How do these criteria vary by survey? What alternative cognitive processes may be used by different candidates and how is the quality of the reported data affected?

Additionally, multiple respondents/informants may be required to complete a single survey request, causing successive cognitive processes as survey questions and instructions are communicated from one informant to another. How are forms routed to other reporters, and how might this process be aided by the survey designer? In addition, traditional cognitive interviewing is needed to learn how company reporters interpret questions and instructions, and these interviews should follow the trail of multiple reporters throughout the company. How does the successive cognitive processing of multiple respondents affect measurement error?

We have suggested that priorities and other aspects of motivation affect a business respondent's cognitive processes. What can survey designers do to relieve the potential measurement error related to reduced attention to the response task?

The advent of electronic data collection challenges us to ensure that electronic instruments ease data retrieval and communication, but not at the expense of other steps in the survey response process. Research needs to include usability testing to discover and alleviate cognitive difficulties with graphical interfaces of electronic instruments. Lastly, the final step in our response process model, releasing the data, may also have consequences for measurement error.

Our research demonstrates that unstructured interviews are useful for exploring problems and issues related to the survey response process in businesses. Results from such research lay the groundwork and suggest hypotheses for more in-depth statistical research. Improved understanding of the response process in business surveys will lead toward improved data collection methods to reduce measurement error and respondent burden.

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