

Recall Period in Consumer Expenditure Surveys Program

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We cannot answer the question about optimum recall periods without understanding the cognitive processes that respondents go through in answering questions that require reporting past behavior. So before turning to the discussion questions, I will briefly describe a basic cognitive model of the question/answering process with particular attention to behavioral recall within a specified time period.

A Cognitive Framework

Answering questions in a survey involves considerable cognitive work on the part of respondents. Much of what underlies recent advances in understanding survey response processes derives from the application of models of information processing to the question-answering process.

The mind is conceptualized as a large information processing system composed of a series of component systems. The physical sensations of sound and sight enter the system in the sensory register (For a more complete description of this conceptualization see Rumelhart, 1977 or Lindsay and Norman, 1977). The sensory register has capacity limitations so that only a portion of the information is transferred to short-term memory. Attention plays a large role in determining what is brought into short-term memory. Attention is a function of an executive monitor that enables and controls the information processing system much the way that programs enable what computers do. The executive system controls the entire system through goals and plans that are organized into priorities for action.

The storehouse of the system is the long-term memory system that has a very large capacity. Working memory refers to the system in which active thinking takes place. The activity here draws on short-term memory and retrievals from long-term memory. Short-term memory has limited capacity but rapid access, while long-term memory has large capacity but relatively slow access. Long-term memory appears to have two rather distinct subsystems, semantic memory and episodic memory (Tulving, 1983), although this distinction is not universally agreed upon. Semantic memory refers to memory associated with vocabulary, language structure, rules and abstract knowledge, while episodic memory refers to memory for events that took place in time and space.

Information is represented as a list of features or concepts that are linked together in networks. Information is stored in memory in structures that are hierarchically organized with more general concepts being higher in the structure than more discrete instances of the concept or distinct features. The term “schema” is sometimes used to refer to larger, more complex shared and/or

overlearned structures that organize our thoughts on familiar topics and may be retrieved as a whole rather than as individual parts (Bartlett, 1932).

Language is the medium through which information is primarily communicated and thus information, to be available for communication, must be associated with a linguistic code. The exact relationship between language and thought and whether or not all thoughts have verbal representation are still subjects of debate. It is clear, however, that meaning is encoded somehow in language and these codes play an important role in the acquisition, storage and retrieval of information. Emotion may also be part of the code, although its role is not well understood.

Knowledge structures facilitate and constrain patterns of activation in the mind. What comes to mind, that is, into consciousness, is limited and is the result of the activation of the networks. Activation is rapid but goes along pathways determined by the ways information is encoded. Encoding puts information into particular categories and structures the pathways by which the information will be retrieved. Cues are stimuli that are related to the codes and stimulate the activation of the networks. Activation is rapid but does take time. The amount of time it takes for someone to respond to a stimulus (reaction time) is often used in research as a clue to the way information is coded (Bradburn, 2004).

The Question-answering Process

There are number of models of the question-answering process (Cannell, Miller and Oksenberg, 1981; Strack and Martin, 1987; Tourangeau and Rasinski, 1988; Sudman, Bradburn and Schwarz, 1996) that, while differing in details, generally agree on a series of processes respondents go through in answering questions. The respondent must accomplish several tasks in responding to a survey question. The first task the respondent must undertake is to comprehend the question being asked. This entails both understanding in a literal sense what the consumer expenditure questions are asking, but may also be influenced by what the respondent thinks the interviewer wants to know. The context of the question can also influence the respondent's understanding of the question. The next stage involves recalling information and computing a judgment. CEQ respondents must search memory for instances of the type of expenditures asked about. The recency of the purchase, whether it is a routine or an infrequent purchase and other factors will play a role in what is recalled. In addition, for some expenditures, the respondents may need to judge whether their experience fits the category. The next stage of the survey response process is formatting an answer, which involves finding the appropriate response alternative. Here the response categories may influence the amount of reporting (Schwarz and Hippler, 1991). The final stage of the response process involves editing of the response. It is here where factors such as the social desirability of the respondent's answer, or perhaps the level of sensitivity of the expenditure, may influence the respondent's decision on how to respond.

To summarize: these processes are: 1) comprehending the meaning of the question; 2) retrieving relevant information; 3) formulating an answer; 4) formatting and editing the answer to meet the requirements of the interviewer and respondents self-presentation. While conceptually viewed as a linear sequence, it is recognized that in reality the processes occur in the flow of a conversation and that the different processes may go on in parallel or in rapid cycling back and forth. For purposes of

considering the question-answer process, it is useful to consider them as if they were separate and proceeded in an orderly sequence. (For a fuller explication of the framework see Sudman, Bradburn, & Schwarz, 1996, Chapter 3.)

Retrieving Relevant Information

The process that is most important for research on reference periods is that of information retrieval. Remembering is a process by which the memory storehouse is searched to retrieve a particular item that is being sought. If we think of memory as a big storehouse, it is clear that it must be organized in some way in order for us to be able to retrieve things from it. Just as we must label files when we put them in file drawers, so we must attach some kind of labels to information in the memory storehouse. The labeling process, often called “encoding,” refers to various aspects of the information or the experience, including emotional tone, attached to the item when we stored it in memory so that we can retrieve it. (For a more complete discussion of memory models see Tourangeau, Rips and Rasinski, 2000, Chapter 3).

Information, such as the wording of the question and any explanatory material available to respondents at the time they are asked to recall an event, acts as retrieval cues. Retrieval cues are any words, images, emotions, etc. that activate or direct the memory search process. If retrieval cues do not specify the event type, e.g., a purchase, then the event types must be inferred before the search can begin. This inference can come from the wording of the question or from the larger context in which the question is asked, including the preceding questions or the introductory material to the survey.

Retrieval is an active process that is facilitated by cues in the question. Cue lists are assumed to reduce survey measurement error in a number of ways (e.g., Tulving and Pearlstone, 1966; Hudson and Davis 1972; Bellezza and Hartwell, 1981). The presence of a cue list may aid the respondent at the comprehension stage in understanding the question and determining what should be included in the answer (Dashen & Fricker, 2001). Cues may also help respondents with retrieval and estimation, in which they recall the information needed to answer the question and decide whether the information is relevant to the question. Further, according to models of memory that describe memory as an associative network (e.g., Collins & Loftus, 1975), the mention of a particular example may activate memories of other, related events the respondent may have experienced.

The effect of cue lists on recall has been addressed extensively in the psychological realm (for a review of the literature on cue effects and possible explanations see Nickerson, 1984). The results of some of these studies are somewhat counterintuitive to the notion that cues may help respondents answering a survey question. Instead of a facilitative effect of cues, inhibitory effects of cues have often been found. In experiments of part-set cuing effects, respondents hear lists of words and are asked to recall those words by writing them down on paper, sometimes with cues printed on the top of the answer sheet. Experiments may vary the category relatedness of the items on the list and the relatedness of the cues to the list items. For example, the cues may be the categories to which some of the words belong, or they may be a subset of the actual words from the list. The explanation for the inhibitory effect of cues is related to interference—when some items are primed, other items not primed may be more difficult to access.

Another factor that may influence the effectiveness of cue lists on survey response is respondent characteristics. One characteristic that has been demonstrated to moderate data quality is the age of the respondent (e.g., Herzog & Rodgers, 1988). In a study demonstrating the inhibitory effects of providing a partial set of cues to recall in comparison to a free recall condition, the authors found that recall performance was impaired in the partial cue condition (Marsh et al., 2004). Older respondents showed even more impairment compared to younger respondents.

Because information, both in episodic and semantic memory, is encoded in many different ways, the cues in the question or in the context surrounding the question including previous questions, may facilitate or constrain the activation and produce better or less good retrieval. Tulving (1983) developed the idea of ‘encoding specificity’ in which all of the aspects of events at the time of their occurrence, including, importantly, emotional states, get encoded in the representation of the event in memory. Retrieval is more likely to be successful the degree to which cues activate specific aspects of the coding.

Retrieval takes time. One clear empirical finding is that giving respondents more time to answer questions produces more accurate reports, particularly for behavioral questions. But time is not all there is to it. Memories for events in one’s life appear to be organized in event sequences (Barsalou, 1988), for example, a shopping trip, which are hierarchically organized. Giving respondents cues to remind them about the sequence is more effective than trying to get them to retrieve information about a specific event. Examples are an important aid to recall, but they are not a panacea. Giving respondents of list of magazines that they might have read improves reports of reading; a list of organizational types helps respondents remember all the organizations they belong to. While examples may help reduce omissions, they have the effect also of being direct cues for memory and result in greater reports for the types of items on the list (Tucker, 1992; Smith, 1990). If an important type of activity or event is omitted from a list, the lack of a cue for that type of activity may result in underreporting.

The CEQ asks respondents to report on expenditures that have occurred within a reference period. The length of the reference period will have an effect on the completeness and accuracy of the reports. One of the well-established regularities in psychology is that memory for an event is a partial function of time. The longer ago the event, the more difficult it is to remember. This is not a simple relationship, however, depending on many factors other than time that are not fully understood. For many years the shape of “forgetting curves” was thought to be most like the Ebbinghaus ([1894] 1964) negatively accelerating curve. But more recent work indicates that forgetting curves vary by topic, may be nearly linear, may have quite shallow slopes, and may be on the scale of years rather than days (Bahrick, 1983; Wagenaar, 1986; Bradburn, Rips and Shevell, 1987; Sudman et al., 1996; Tourangeau et al., 2000). When people experience many similar incidents, such as repeated purchase of common goods, recalling each event is more difficult than for a one-time event, such as buying a car. Initially distinguishable events may become confused or blended with later similar events into a schematic memory (Linton, 1975).

Contextual Cues

Various contextual cues present in a survey can enhance recall accuracy by helping the respondent access information from memory. Contextual cues in a survey come from many sources. They come from the information a respondent may learn about the survey from advance materials such as letters or brochures, from the interviewer, and from the survey questionnaire itself. Of particular interest is the context that the survey introduction and question content provide. At the comprehension stage of the response process, a potential advantage of cues is to help respondents understand what the question is asking for (Schwarz & Hippler, 1991; Schuman & Presser, 1981). At the retrieval stage, prior questions provide a context that can make information more accessible for later questions (see for example, Tourangeau & Rasinski, 1988). This effect can be explained by priming models. In this type of model, memory may be viewed as a network of interconnected nodes. Activation of a node for one item, such as “coffee,” spreads to related nodes, such as for “tea” or “soda,” facilitating retrieval of the related item.

Providing context through the use of cues and attitude questions can improve recall performance not only by priming the information to be recalled, but by providing respondents with additional time for processing. Time on task is highly related to improved reporting (Sudman, Bradburn, and Schwarz., 1996). Indeed, simply asking longer questions can give people more time to recall events, producing better data (Cannell, Oksenberg, & Converse, 1977; Bradburn, Sudman, and Associates, 1979).

When thinking about retrieval, we mostly think about forgetting or failure to retrieve relevant information. Sometimes, however, incorrect information may be retrieved that results in overreporting behavior. The best-known example is the phenomenon observed by Neter and Waksberg (1964) called “telescoping”, that is, recalling events that took place at a time other than the time period asked about. Telescoping occurs in response to questions about behavior in defined time period such as: “How many times have you been to the doctor in the past 6 months?” Neter and Waksberg found in analyzing data from the Consumer Expenditure Survey that when respondents reported on purchases in different reference periods, there was a systematic overreporting of purchases that came from reporting purchases made in a previous period as if they had been purchased in the period being asked about.

Rubin and Baddeley (1989) proposed a model to account for telescoping based on the dating of autobiographical events in calendar time. Huttenlocher, Hedges & Bradburn (1990) proposed a model to account for telescoping based on the dating of autobiographical events in terms of elapsed time from the present. The two models share the same general approach but differ in details because of their focus on how the events are represented in temporal memory.

Both models assume there are no systematic errors in dating events (that is, dates associated with events are stored in memory correctly) but rather that observed errors in reporting are the result of errors in the recall process. The observed telescoping errors that result in overreporting are caused by the combination of three independent factors. The first is the normal forgetting process. The second is that, even when events are remembered, errors in dating occur randomly and increase linearly with time. The third is that intrusions often occur from events outside the reference period,

but cannot occur from events that have not yet happened. In other words, intrusion occurs in only one direction—from the past forward (Huttenlocher, Hedges, & Bradburn, 1990).

Telescoping can be reduced by “bounding,” that is reminding respondents of what they reported in the previous interview. The design of the CEQ, with its repeated interviews with the same household, reflects a concern for telescoping. With a longer reference period, the amount of telescoping will increase, because respondent uncertainty about when events happened becomes greater the further away from the present the event occurred (see Huttenlocher, Hedges, & Bradburn, 1990 for a full explanation of the phenomenon). Bounding may reduce the telescoping produced by the longer reference period but will not totally eliminate it. In an investigation of the effects of differing reference periods, one must be concerned both with forgetting and with telescoping. The optimum reference period is the point where the forgetting curve and the telescoping curves cross. (Sudman & Bradburn, 1974)

Key Aspects of the Recall Period

As noted above, forgetting increases with time, but the shape of the forgetting curve differs for different types of events. The shape of curve can be thought of as an omission parameter. In general the parameter is influenced by the salience of the event. All else being equal, more frequent events are more salient to the respondent, so that the omission rate is lower on frequently purchased goods than on infrequently purchased durable goods.

The questions in the CEQ concern not only expenditures but expenditures within a certain time period currently a three-month time period. As has been shown notably by Neter and Waksberg (1961, 1963, 1964) respondents may report events that lie outside the reference period. Although the shape of a telescoping curve has not been well studied for different types of events, it is likely that it will also vary with the type of event and the time period involved. Telescoping appears to behave in a reverse manner to omissions: the more frequent the event, the greater the likelihood of confusion about dates. Also, as Huttenlocher, Hedges, & Bradburn (1990) found, memory for many past events is not coded in calendar time but in elapsed time such a month ago, three-months ago, a year ago, etc. Further the size of the elapsed time interval to which an event is coded tends to increase with time. For more recent events it may be coded as the past week, 10 days ago, or two-weeks ago. For events are further back, the time may be coded as three-weeks, a month, a month-and-a-half, two-months, three-months, then 6-months, then a year. The changing size of the elapsed time categories affects the amount of telescoping. Thus one can think of a telescoping parameter which differs for different types of events.

The trick is find the optimum recall period at which the omission parameter and the telescoping parameters intersect and the underreporting due to omissions balance out the over reporting due to telescoping, that is the point where the net relative error is minimized. Sudman and Bradburn (1973, 1974) present one model for estimating the net relative error due to omissions and telescoping:

$$R.E. = r_o (1+r_t) - 1$$

Where r_o refers to the relative error due to omissions and r_t refers to the relative error due to telescoping.

A considerable amount of work on the relative errors for different types of consumer expenditures due to omission and telescoping was done by Sudman and Ferber in the 1960s (1970, 1971), but my impression is that there has been little empirical work done more recently that would enable us to estimate omission and telescoping parameters today. Such work would be necessary to determine the optimum recall periods for different types of consumer expenditures.

Balancing Low Item-incidence Levels and Sample Size Requirements with a Short Recall Period.

There are two approaches to this problem: 1) vary the recall period for at least certain types of expenditures where there is evidence that the relative error due to omissions is small related to time and a longer recall period can produce acceptable levels of accuracy, e.g. large consumer durables, or 2) vary the sample size for low incidence items. Varying the recall period for low incidence items would appear to be the easiest from an operational point of view. But the omission parameter may not be the same for all low-incidence items. Some items of low-incidence but also low salience, e.g. a wedding present for the child of a friend, might well have a very steep forgetting curve and be omitted from reports if the recall period were long. Thus varying the recall period would need to be informed by good data on omission parameters for different types of low-incidence expenditures.

Varying the sample size for different types of expenditures is operationally more difficult and expensive. One possible approach using a short recall period would be to start with a very large sample that is used for the low-incidence items, and then use subsets to estimate medium and frequent expenditures. This approach would treat the CEQ as a family of independent samples that would use different questionnaires that covered expenditures of differing frequencies. For some purposes, e.g. for low incidence, low salience events, all samples would be combined; for some purposes, e.g. medium frequency, moderate saliency events, several samples would be used; for frequent and very salient events, only one sample would be used. Obviously it would take considerable experimental work to be sure which sample size would be optimal for which type of expenditure.

Other Tradeoffs

Some of the solutions to improving the quality of CEQ may require a more complex design of the CEQ involving both complex sample designs and multiple versions of the questionnaire. One trade off is between what might be an optimal design from a theoretical point of view and operational and analytic difficulties. More complex designs require more interview training, more monitoring and extensive case management systems, and present more difficulties in constructing data files that can efficiently produce the tabulations needed for statistical reporting.

Some of the quality improvements brought about by a new design may be lost through errors introduced in the execution of the design.

Best Practices for Determining the Recall Period for the Various Expenditure Categories.

The goal would be to select the recall period that minimizes the net relative error from both omission and telescoping. As noted above the shape of the forgetting curve appears to vary for different types of events, although it is almost always a decreasing function of time. (For an exception see Mathiowetz and Duncan, 1988). There does not appear to be any generalized knowledge about what types of events have different shaped curves, so some more empirical work is needed to determine the optimum recall periods for different categories of expenditures. There is enough known that it is clear that no single recall period will be optimal for all events. Sudman and Bradburn (1973) found that a negative exponential function of the form ae^{-bt} where t is the time since the event and a and b are constants, fit fairly well a variety of expenditure data. The value of b varies with expenditure types and must be determined empirically.

Best Practices for Grouping Questions Using Varying Recall Periods within a Survey

The goal in grouping questions is to minimize the cognitive effort for respondents to recall the requested information. As noted above, people organize memory as event sequences that are hierarchical. Thus grouping questions that tap into the same type of event sequences would aid recall. For example, grouping items that would be purchased on a shopping trip to a grocery store, to a clothing store, a pharmacy, etc. would be likely to improve the recall of similar items purchased. If certain types of expenditures are typical in distinct settings, grouping items by those settings, or at least cueing the setting in the body of the questions may improve recall. For example, in questions about alcohol consumption, giving examples of the kinds of situations in which one might drink increased consumption reports (Bradburn, Sudman & Associates, 1979).

Although time is not a particularly good cue for recall, it is probably not a good idea to ask for expenditures in different recall periods for items that are grouped together in memory. If there are items that are similar in terms of the contexts in which they are purchased but have differing frequencies, it is better to separate questions about them into the appropriate recall period, and repeat the contextual cues within each recall period section of the questionnaire.

Next Steps to Explore and Research Grouping Questions for Possible Change in CEQ Methods.

The literature on autobiographical memory is extensive and needs to be combed for the most relevant findings related to the types of questions used in the CEQ. Much of the literature leads to generalized principles that are not always consistent with the requirements of a large survey like the CEQ because they may require asking essentially the same questions in different formats or using different cues. A general finding is that the more time you give respondents, the more events they can recall, but surveys like the CEQ have to keep the length of the questionnaire to a minimum.

Using knowledge from psychology about cognitive processes, however, can lead to questionnaire that minimizes the cognitive burden on respondents and improve the quality of the data.

Some next steps would be: 1) do an intensive literature search to extract the major findings about context effects and recall of different types of events, particularly those related directly to consumer expenditures; 2) explore possible question groupings using cognitive methods as described in Sudman, Bradburn and Schwarz (1992); 3) formulate a set of hypotheses about way to group questions for most accurate recall; 4) conduct a set of experiments both in the laboratory and in the field so test out the hypotheses; 5) try out the best groupings resulting from these experiments in sizeable field tests to ascertain their operational feasibility. These steps would be best carried out by forming a team of survey methodologists, cognitive psychologists, and survey statisticians to conduct the research.

A Proposed Survey Design

The survey would consist of a set of conceptually separate surveys whose content was designed to optimize the organization of questions and the most appropriate recall period so as to produce the minimum net relative error from omissions and telescoping. The sample sizes would be determined by the desired level of precision for the CPI. As an example I would start with one survey that used a one-month recall period and another that used a three-month recall period. (If it were found that a 6-month recall period was appropriate for some large, salient items, a third survey could be used). The content of each survey would be questions about expenditures that have been found through experimentation to be best reported within the specified recall period. The questions would be about expenditures in that reference period. Questions in the three-month recall survey that asked for disaggregating expenditures over each of the three months would be eliminated or asked about in the one-month survey period.

Questions about expenditures with low frequencies would be asked about in both surveys to increase sample size, and estimates for expenditures made by modeling the combination of data from the two sources.

The surveys would be panel surveys so that bounding information from previous surveys could be used to reduce telescoping. Interviews would be conducted with each member of the household. Proxy information would be collected, but for expenditures that are age-related, I would develop model based estimates using the data reported by the age-appropriate respondents to weight the proxy reports.

The questionnaires would be organized by shopping venues or other event sequences that would create contextual cues to improve recall. Within such sequences, specific questions about expenditure categories necessary for the CPI would be asked. The format would have to allow for updating of expenditure reports if purchases are reported within some other sequences. Thus the questionnaire is more like a giant matrix with sequences as cues in the columns and expenditure categories in the rows. The respondents then are encouraged to use free recall expenditures within a venue, but then queried about specific categories not mentioned later in the interview. Respondents would be encouraged to consult records wherever possible.

An Additional Issue

The CEQ is ultimately interested in expenditures for specific categories. In order to achieve this goal the respondents have to recall both that they bought something and how much they paid for it. The memory processes for these two different facts may not be the same. One may remember that one bought a toothbrush but not how much one paid for it. Memory for prices will vary from individual to individual and may be related to respondent characteristics such as income level, age, or personality characteristics.

For something to be recalled it has to be encoded in memory. If it is never encoded, it cannot be recalled. For example, Lee, et al (1999) found that one reason mothers were bad at reporting the immunization status of their children was that many mothers never encoded the name of the various immunizations that their children were receiving and, hence, could not report them. One particular issue that needs to be investigated further is the degree to which the expenditures for particular items are in fact encoded in memory.

This may be a growing problem as people pay for more things with credit cards. If one buys several things that belong to different categories, e.g. buys a miscellaneous basket of goods at the grocery store and pays for it with a credit card, one may not ever take in the separate prices for different things bought. This information would never be encoded in memory and could not be reported. If they did not even remember what all went into the basket of goods and there is no itemized record, there would not even be a way to impute prices or quantities.

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