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The author investigates whether using a decompositional question (which decomposes an event into subcategories and elicits frequencies at the subcategory level) is effective in increasing the accuracy of frequency judgments elicited in consumer surveys. Results of a study show that the decompositional question makes the process of eliciting frequencies less effortful and enhances the accuracy of the elicited frequencies for frequent, irregular behaviors (i.e., occurring at sporadic intervals), but not for frequent, regular behaviors. Mediation analyses confirm that these effects manifest because the decompositional question triggers an episodic recall strategy, which enhances the efficiency of the judgment formulation process for irregular behaviors but interferes with the normal process for regular behaviors.

Are the Parts Better than the Whole?
The Effects of Decompositional Questions on Judgments of Frequent Behaviors

Surveys often have questions that ask people for the frequencies with which they engage in different behaviors. For example, a national consumer omnibus survey asks its panel members the frequency with which they purchase specific brands of detergents and cooking oil. Such frequency judgments are used by marketers in making market-size and brand-share forecasts. This omnibus survey also elicits information, such as the frequency of the usage of a brand of cooking oil in different types of culinary preparations. Information like this is the foundation for usage and benefit-based market segmentation. Government surveys also rely heavily on frequency questions. For example, the National Health Interview Survey (NHIS) on Epidemiology asks people how often they eat various kinds of foods, such as broccoli, spinach, rice, beef, liver, and so on, to determine people's level of health consciousness, and the NHIS on Cancer Control asks women how often they examine their breasts for lumps, to determine the levels of preventive care undertaken. Therefore, the accuracy of these reports is of utmost importance.

Previous research indicates that there is a certain amount of inaccuracy associated with frequency judgments, especially for behaviors engaged in frequently (Burton and Blair 1991).

For example, Menon (1993) demonstrated that at the individual level the extent of relative error associated with a frequency report can vary from 7% for a behavior that is reported most accurately to 113% for less accurately reported behaviors. The magnitude of these errors is enormous, and the consequences can be expensive for the marketing manager who relies heavily on these estimates for new product introductions, brand-share forecasts, or segmentation analysis.

This article investigates the effectiveness of a "cuing" question in increasing the accuracy of the elicited frequency judgments. Its focus is on frequent behaviors engaged in about once a day. Results of a study indicate that providing contextual cues by using a decompositional question serves to enhance the accuracy of the reports, contingent on the following conditions: First, the effectiveness of this question is moderated by the regularity of the target behavior such that the accuracy of frequency judgments pertaining to regular behaviors (i.e., behaviors occurring at a fixed periodicity) are not enhanced, but those pertaining to irregular behaviors are. Second, the effectiveness of this question is mediated through the cognitive process used for the task, such that the use of the decompositional question enhances episodic recall. This works well for irregular behaviors (because episodes are not represented well in memory and decreases the associated perceived cognitive effort. However, this does not work for regular behaviors (presumably because memory-based information such as rates of occurrence are already

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1These are raw differences between reported and actual frequencies as percentages of actual. Note that aggregate errors are smaller than any of these relative raw errors.

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highly accessible in memory and can be used in generating a frequency judgment) and increases the associated perceived cognitive effort.

The following section describes the decompositional question and how it is predicted to work. Next, a theoretical account of how information about behaviors is stored in memory, how it is used to form a frequency report, and why any of these processes might be affected by a decompositional question is presented. A description of a study conducted to test the proposed theoretical framework, the results, and their implications for questionnaire design follow.

THEORETICAL FRAMEWORK

What Are Decompositional Questions?

When respondents are asked in a survey how frequently they engage in a particular behavior, they search their memories trying to use some or all of the accessible information to form a judgment (Bradburn, Rips, and Shevell 1987). One cognitive process that respondents could use is to try to retrieve events or occurrences of the target behavior from memory (i.e., episodic recall). The decompositional question, which involves providing cues, aims at making this process of recall easier.

Reiser, Black, and Abelson (1985) suggest that the first step in retrieving an event from memory is to access the encoding context for specific experienced events. For example, to retrieve information about an event such as "eating at restaurant X with Person A," a person first must access the encoding context "going to a restaurant." Then the person must specify features that discriminate this particular recalled event from other experiences indexed within that context (e.g., going to a restaurant with Person A versus Person B). Finally, the person elaborates the retrieved experience (e.g., eating at restaurant X with Person A) using the information contained in the general knowledge structure of the encoding context (e.g., being seated, looking at the menu, ordering) to recall additional features of a specific event (e.g., the exact conversation with Person A that day). Results of Reiser, Black, and Abelson's (1985) two experiments reveal that retrieval from memory is faster when respondents are given an activity cue within the encoding context (presumably because processing can get a "head start") than when they must generate these cues themselves as part of the recall process.

In the case of behavioral frequency judgments, the respondent must arrive at a reasonable estimate of the number of times a particular event occurred. Reiser, Black, and Abelson (1985) seem to suggest that when the knowledge structure pertaining to the general events is accessed, the cues provided that discriminate among different subcategories that compose the general event will help the respondent arrive at a faster response. In the example used previously regarding going to a restaurant, such subcategories include going to a restaurant with friends, with a date, and so on. Moreover, Menon (1993) demonstrated that response time in arriving at a frequency judgment is related closely to the accuracy of the estimate. Incorporating this speed-accuracy relationship into the previously discussed framework, providing such activity cues should also help increase the accuracy of the behavioral frequencies obtained. Such cueing of subcategories is referred to as the decompositional question (Means et al. 1994; Schwarz 1990; Sudman and Schwarz 1989) and is hypothesized to improve behavioral frequency judgments, especially for frequent behaviors.

Breaking up a behavior into various subcategories eases the process by which the respondent generates frequencies by recalling specific instances. For example, a decompositional question eliciting the frequency of eating at restaurants would provide an exhaustive list of various occasions or situations in which a person would visit a restaurant (e.g., with friends, for lunch, for a date) and determine the number of times the person went to the restaurant for each of these occasions or situations. This process makes recall within each subcategory easier. For the cues provided through the decompositional question to be effective, they should coincide with the natural categories used by respondents to classify events (Barsalou 1983; Hu, Toh, and Lee 1996). This is because people are sensitive to frequencies within such categories and can estimate the frequency of instances within a category fairly accurately under diverse task instructions (Alba et al. 1980).

The decompositional question is hypothesized to counteract the effects of recency, vividness, and salience, which make some episodes more easily accessible than others and lead to highly erroneous frequency judgments. This is because the cues provided draw the respondent's attention to various scenarios in which the behavior might have been engaged in, besides the ones that are salient in memory. However, the effectiveness of this cueing question form depends enormously on the quality of the cues developed, and there could remain instances that cannot be tapped through cues.

Here, the effects of decompositional questions to elicit frequencies on (1) the cognitive process by which frequency judgments are formulated, (2) the perceived cognitive effort, and (3) most important, the accuracy of the frequency judgments are examined. Next, a theoretical model that examines the relationship among these variables is proposed.

How Does the Decompositional Question Affect the Frequency Judgment Formulation Process?

The effects of the regularity of the behavior. When formulating frequency judgments, a respondent has the option of retrieving individual episodes of the behavior. In general, frequent behaviors are not easily accessible in episodic format (Linton 1982; Schwarz 1990). In fact, in reporting frequencies of behaviors engaged in often, respondents rarely recall each instance of the behavior, a strategy referred to as "episodic recall or counting" (Blair and Burton 1987). This is because multiple instances of highly similar behaviors blend into a generic representation that renders them difficult to isolate individually (for review, see Schwarz 1990). Alternatively, respondents can rely on estimation strategies, using "any information they have in order to generate a reasonable answer" (Bradburn, Rips, and Shevell 1987, p. 160). One such estimation strategy is to use a summary representation of frequency per unit of time, such as a rate of occurrence (Blair and Burton 1987; Burton and Blair 1991). Previously, Menon (1993) demonstrated that the process used to formulate a frequency report and the resulting accuracy are affected by the regularity of the target behavior.

Regularity can be defined as deterministic occurrences of an event (Wheat and Morrison 1990) or as the occurrence of a particular event with the same periodicity (Krishna 1991). The greater the regularity of the behavior, the greater the
predictability of when the event will occur next. The time period between two consecutive occurrences of a regular behavior is less variable than that for an irregular behavior. Hence, behaviors can differ in their regularity, though they occur with the same frequency. Research on judgments of behavioral frequencies suggests that a rate of occurrence sometimes can be stored in memory (Blair and Burton 1987; Burton and Blair 1991), and this is more likely for regular than for irregular behaviors (Menon 1993).

The effects of using a decompositional question. The decompositional question is predicted to enhance episodic recall through the operation of two mechanisms: (1) the capability of the cue to trigger the salient aspect of the behavior and/or (2) the reduced frequency associated with each cue domain. In some cases, it also can help clarify the meaning of the question. The important issue, then, is: Does the use of this question form have different effects on regular versus irregular behaviors? The decompositional question is likely to work better for behaviors that have a high dependence on episodic recall, and this is contingent on the regularity of the behavior.

Previously, Menon (1993) demonstrated that in estimating the frequency of a regular behavior, the respondent is more likely to access rate-of-occurrence information, which he or she then applies to the reference time frame when estimating frequency. However, the decompositional question form is likely to interfere with the normal process and induce respondents to report frequencies for each of the individual subcategories provided in the decompositional question. Menon, Raghubir, and Schwarz (1995) demonstrated that respondents can infer information from a question, but might not necessarily use this inferred information in a judgment if more diagnostic information were available in memory. In keeping with this reasoning, therefore, though the use of decompositional questions could force respondents to use the cues and report frequencies for each subcategory, they might not rely necessarily on the information evoked through the cues in arriving at a global frequency judgment. In other words, through using the decompositional question could increase the proportion of people resorting to an episodic recall strategy, it might not increase it in a disproportionate manner compared with irregular behaviors; there will continue to be a significant proportion of respondents using estimation strategies.

In the case of irregular behaviors, because occurrences are not periodic, respondents are less likely to store and use a single, general rate of occurrence. Instead, they are more likely to rely on episodic recall (if information pertaining to individual episodes is accessible) or estimation procedures, such as counting for a short period (if some episodes are more accessible because of their salience/vividness) and extrapolating for the time frame of interest. Providing the decompositional question is likely to assist the process of episodic recall.

How Does the Decompositional Question Affect the Perceived Cognitive Effort Involved in Generating a Frequency Judgment?

Given the previous discussion, an important issue that arises is whether the decompositional question makes the task of arriving at frequency judgments uniformly simpler. The decompositional question is predicted to have different effects on perceived cognitive effort as a function of the regularity of the behavior, because information is reported most efficiently when the question form matches the information accessible in memory. Therefore, when the question asked is similar to the manner in which information is accessible in memory, perceived cognitive effort associated with the task is at the lowest. However, if the question does not match accessible information, then the perceived cognitive effort associated with this task increases.

Because using estimation strategies for regular behaviors is associated with lower levels of cognitive effort, given the accessibility of a rate of occurrence in memory for regular behaviors, interfering with this process by providing cues to enhance the use of episodic recall only will make the frequency formulation process more difficult. Therefore, using a decompositional question should increase the associated perceived cognitive effort.

Conversely, for irregular behaviors, the decompositional question is likely to decrease the perceived cognitive effort associated with arriving at frequency judgments. This is because the subcategories provided in the cues break the overall frequency into smaller frequencies, which makes the episodic recall process more manageable (see Blair and Burton 1987) and cognitively less taxing.

Another important issue is how the decompositional question enhances the accuracy of frequency judgments. Because episodic recall tends to be difficult and effortful for frequent behaviors, the effectiveness of the decompositional question is contingent on respondents’ dependence on episodic recall in reporting frequency judgments in the absence of other usable heuristics in memory.

Respondents formulate the rate of occurrence of a behavior after extensive experience with that behavior; it has been shown to yield more accurate frequency judgments than episodic recall for frequent behaviors. For example, using the verbal protocol technique to ascertain the manner in which respondents formulated frequencies, Menon (1993) demonstrated that when respondents used rates of occurrence, reported frequency is closer to an independent measure of actual frequency recorded in a diary. She also demonstrated that rates of occurrence are more likely to be accessible for regular behaviors than for irregular behaviors. Therefore, in the absence of recall cues, respondents make more accurate estimates of the frequency of the regular event than of the irregular one, because the effort required is less in the former case than in the latter.

Given this information, in the case of regular behaviors, respondents are more likely to use a rate of occurrence to arrive at a fairly accurate frequency estimate. Providing cues to enhance episodic recall only would not be the “normal” strategy that respondents use to generate a frequency report could be detrimental to the accuracy of the estimate, because this process is not efficient or optimal to the estimation task. Therefore, the use of decompositional questions could decrease the accuracy of frequency reports, depending on the proportion of people that resort to using episodic recall.

[2] I thank two of the anonymous reviewers for pointing this out.
strategies; the higher this proportion, the greater the decrease in accuracy.3

Conversely, in the absence of such a heuristic in memory, as is the case of irregular behaviors, respondents are likely to resort to the recall-and-count strategy, which becomes difficult for frequent behaviors. Therefore, respondents depend greatly on episodic recall for irregular behaviors. As discussed previously, research in the area of autobiographical memory (e.g., Brewer 1988; Brown 1995; Linton 1982; Wagenaar 1986; White 1982) indicates that as the frequency of the event increases, individual episodes become less distinct and episodic recall becomes more difficult. In the case of frequent irregular behaviors, by providing contextual cues, the category is broken down into smaller subcategories, which makes it easier for the respondent to arrive at a count for the subcategory. This can serve to enhance the accuracy of frequency judgments associated with irregular behaviors.

What Is the Relationship Between the Different Variables in the Proposed Model?

So far it has been suggested that for regular behaviors, respondents have access to a rate of occurrence of the behavior in memory and will use this information. Providing contextual cues only will interfere with this process, thereby making the frequency formulation task much more effortful and complex. It also has been suggested that for irregular behaviors, however, it is probably in the researcher’s interest to provide cues through a decompositional question, as the ease associated with generating a frequency judgment could be less and the associated accuracy of the frequency report could be greater. In essence, then, a mediated-moderation model (cf. Baron and Kenny 1986) is proposed, which is shown by paths 1, 4, and 5 in Figure 1. This model predicts that using the decompositional question enhances the use of episodic recall (Path 1). Decompositional questions also increase the perceived cognitive effort associated with generating a frequency judgment for regular behaviors and decrease it for irregular behaviors (Path 2). Similar effects manifest for the accuracy of the frequency judgment, in which responses to questions about irregular behaviors are

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3One factor that potentially contributes to this is the match between the reference period length and the rate of occurrence accessible in memory.

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*Figure 1*

RELATIONSHIPS AMONG THE VARIABLES IN THE MODEL

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Research hypotheses:

- H1: Path 1
- H2: Path 2
- H3: Path 3
- H4: Paths 1 and 4
- H5: Paths 1 and 5

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Cognitive Effort

Accuracy

Cognitive Process

Path 1

Path 2

Path 3

Path 4

Path 5

Question Wording

Regularity
more accurate but less so for regular behaviors (Path 3). Implicit in this theory is that these effects on perceived cognitive effort and accuracy manifest because of the change in the cognitive process that the decompositional question triggers (i.e., Paths 1 and 4, and 1 and 5). Therefore, the effect of question wording on perceived cognitive effort and accuracy is predicted to be mediated through the cognitive process.4

Research Hypotheses

In summary, on the basis of the theoretical model explained here, the following are predicted:

H1 (Path 1): The question wording will affect the cognitive process used to arrive at frequency judgments such that (a) the use of the decompositional strategy (versus an open-ended question) will increase the use of episodic recall (versus estimation) strategies in arriving at frequency judgments for both regular and irregular behaviors and (b) estimation strategies will continue to predominate regular (versus irregular) behaviors, even with the use of the decompositional strategy.

H2 (Path 2): The question wording will moderate the effects of regularity on the perceived cognitive effort required to arrive at frequency judgments, such that the use of the decompositional strategy (versus an open-ended question) will (a) increase the cognitive effort for regular behaviors and (b) decrease the cognitive effort for irregular behaviors.

H3 (Path 3): The regularity of the behavior will moderate the effectiveness of the decompositional strategy such that the accuracy of frequency reports associated with irregular behaviors is enhanced, but the accuracy of regular behaviors is not.

H4 (Paths 1 and 4): The effects of question wording on the perceived cognitive effort involved in formulating the frequency judgment are mediated by the cognitive process of generating the frequency judgment.

H5 (Paths 1 and 5): The effects of question wording on the accuracy of the frequency judgment are mediated by the cognitive process of generating the frequency judgment.

A study that tests these hypotheses is now described.

STUDY DESCRIPTION

Independent Variables

The following $2 \times 3 \times 2 \times 2$ mixed factorial design was used:

1. Regularity of the behavior. Two levels of this variable, regular and irregular, were manipulated within subjects, so that subjects reported frequencies for both kinds of behaviors.

2. Behavior replicate. To ensure that the results were not specific to a particular behavior, but rather were attributable to the regularity of the behavior, three different behaviors for each level of regularity were used. Therefore, this variable was nested within regularity. Six behaviors were selected from the 12 that were reported by Menon (1993), varying on regularity and matched on frequency. "Washing your hair" was used as a regular behavior and "making unplanned stops to talk to friends (more than a "Hi") was used as an irregular behavior, because these were used in a previous study (Menon et al. 1995). In addition, "having dinner" and "attending class" were used as the two other regular behaviors and "snacking" and "drinking water from a public fountain" were used as the irregular behaviors. All of these behaviors were reported as matching on frequency (i.e., approximately once a day; Menon 1993).

3. Question form. This variable was manipulated between subjects at two levels:

a. Control condition. An open-ended question pertaining to behavioral frequency was asked, with no recall cues: "Overall, how many times did you < behavior > in the last one week?"

b. Decompositional question. The questions pertaining to behavioral frequencies were asked with several cues and arrived at after conducting two extensive pilots. In Pilot 1, 35 subjects listed occasions, situations, or contexts that came to mind when they thought about each of the six target behaviors. Their responses were content-analyzed and a set of cues were developed. In Pilot 2, 21 subjects reported their behavioral frequency judgments for each of the six target behaviors using the cues arrived at in Pilot 1. After they answered each question, they listed any other cues that were absent from the set of cues presented. These cues were content-analyzed and a set of cues that were mutually exclusive and as collectively exhaustive as possible (presented in Table 1) were used to elicit frequencies in the main study. To adjust for overlap of some categories, subjects in the main study provided an overall frequency estimate (identical in wording to the question used in the control condition).

<table>
<thead>
<tr>
<th>Table 1</th>
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<tbody>
<tr>
<td>CUES USED IN THE DECOMPOSATIONAL QUESTION CONDITION</td>
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<tr>
<td>---------</td>
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<tr>
<td><strong>Regular Behaviors</strong></td>
</tr>
<tr>
<td>Washing your hair:</td>
</tr>
<tr>
<td>In the morning before work/school</td>
</tr>
<tr>
<td>After exercising</td>
</tr>
<tr>
<td>After work/school</td>
</tr>
<tr>
<td>Before bed</td>
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<tr>
<td>Before a date</td>
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<tr>
<td>Before a party</td>
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<tr>
<td>Before other casual social events</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Having dinner:</th>
<th>Snacking:</th>
</tr>
</thead>
<tbody>
<tr>
<td>By yourself, at home</td>
<td>Between classes</td>
</tr>
<tr>
<td>By yourself, at a restaurant</td>
<td>After exercising</td>
</tr>
<tr>
<td>With friends, at your home</td>
<td>After work/school, before dinner</td>
</tr>
<tr>
<td>At a friend’s home</td>
<td>Before bed</td>
</tr>
<tr>
<td>At a restaurant, with friends</td>
<td>At the movies</td>
</tr>
<tr>
<td>At a bar</td>
<td>At a party/bar</td>
</tr>
<tr>
<td>On the way home/school</td>
<td>Watching TV</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Attending classes:</th>
<th>Making unplanned stops to talk to friends (more than a “Hi”) during the day:</th>
</tr>
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<tbody>
<tr>
<td>Monday</td>
<td></td>
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<tr>
<td>Tuesday</td>
<td></td>
</tr>
<tr>
<td>Wednesday</td>
<td>On the way to work/school</td>
</tr>
<tr>
<td>Thursday</td>
<td>On the way back home from work/school</td>
</tr>
<tr>
<td>Friday</td>
<td>In between work/school</td>
</tr>
<tr>
<td>In the evenings</td>
<td>In or near the computer lab</td>
</tr>
<tr>
<td>Weekend</td>
<td>In or near the library</td>
</tr>
<tr>
<td>At a bar/restaurant/movie</td>
<td>At a subway station</td>
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</tbody>
</table>

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4 I am indebted to one of the anonymous reviewers for this invaluable comment.
after they had decomposed the behavior into the various cued scenarios. More important, the number of cues used for each behavior was matched at 7 (excluding an "other" category), so that the differences in accuracy observed could be attributed purely to the variables manipulated rather than to the number of cues provided. Furthermore, the content of the cues were matched by using similar wording, scenarios, and contexts.

4. Diary maintenance. Because this study was designed to monitor accuracy, a day-by-day diary was used, in which all behaviors were listed within a day, as the objective measure of frequency (for a similar application, see Menon 1993). Each subject maintained a diary for a period of one week. To rule out the possibility that diary maintenance affects a person’s memory for the event such that normal, nonmemorable events become salient, the order in which the diary was maintained was manipulated: One half of the subjects maintained the diary before they were administered the questionnaire, and the other half maintained a diary after they were administered the questionnaire. Therefore, there were two between-subjects levels to this variable.

Subjects

Seventy-six undergraduate business students enrolled in marketing research at New York University participated in the study.

Dependent Measures and Procedure

Diaries eliciting actual behavioral frequencies. The diaries required subjects to maintain a record of 12 behaviors, 6 of which were those under investigation. A larger number of behaviors were used in the diary to prevent sensitizing subjects to the actual behaviors under study.

Subjects maintained the diary for a period of one week starting on a Tuesday, and incentives were provided in terms of class credit. They turned in the diaries during two separate days when the class met (i.e., the Thursday and Tuesday following the distribution of diaries in class). They filled in the diaries on a daily basis. If the subjects did not engage in a particular behavior on a particular day, they were instructed to enter “not applicable” in the space provided to ensure that they invested some effort even when they had not engaged in the behavior. Finally, a “normal” week was chosen by ensuring that there were no midterm exams or holidays.

Questionnaires eliciting reported behavioral frequencies. Subjects were assigned randomly to one of the two question wording conditions: control or decompositional question. First, subjects reported the frequency of the six behaviors in a self-administered questionnaire. The order in which the six behaviors were presented was counterbalanced to avoid any kind of position effects. All frequencies were elicited either using the open-ended question (i.e., control condition) or through cues provided in the question (i.e., the decompositional question). In the decompositional question condition, subjects provided an overall frequency estimate after they had decomposed the behavior into the various cued scenarios (to adjust for category overlap), so this overall frequency served as the dependent measure. At the end of each frequency question, they wrote down how they had come up with the frequency report (i.e., retrospective protocols). This was intended to tap into the cognitive process by which frequencies are generated. They then rated the effort required to respond to each frequency question on a seven-point semantic differential scale anchored at “no effort at all” and “a lot of effort.” This served as the measure of the perceived cognitive effort taken to arrive at the frequency judgments, which reflects the match between the manner in which the question is asked and the accessibility of information in memory. As a manipulation check, they rated the regularity of each behavior on a seven-point semantic differential scale anchored at “irregular” and “regular.” The questionnaires were self-administered in class and students were debriefed thoroughly.

Accuracy measures. A comparison of the actual frequencies (diary data) with the reported frequency judgments (questionnaire data) yields a measure of accuracy. A comparison of the accuracy in the control condition with the decompositional question condition yields an estimate of the effectiveness of this cuing question.

The relative raw error indices (i.e., the differences between the actual and reported frequencies divided by the actual frequencies for each subject for each behavior, taking into account the direction of the error) were used as the dependent measure, as this more closely reflects the measure used in marketing surveys. Therefore, an overall negative raw error index across the sample indicates the proportion of underreporting associated with the frequency estimate, whereas a positive index indicates the proportion of overreporting involved. In addition, relative absolute error indices (i.e., the absolute differences between the actual and reported frequencies divided by the actual frequencies for each subject for each behavior) also were examined. This reflects the proportion of absolute error, or the total error, associated with the frequency report, irrespective of the direction of the error. In the case of both error indices, a statistical difference from 0 indicates the presence of error, and the larger the number, the larger the error associated with the estimate.

RESULTS

Analysis Design

The order of diary maintenance and questionnaire completion was rotated to guard against the maintenance of diaries affecting salience of events in memory. Reassuringly, two analyses of variance using the full 2 × 3 × 2 × 2 mixed design and the two error indices as the dependent measures indicated that none of the terms involving the order of maintaining diaries were statistically significant (F's < 1.0). Therefore, the order factor was dropped in all subsequent analyses.

Manipulation Checks

Regularity ratings. A 2 (regularity) × 3 (behavior replicate) × 2 (question form) analysis of variance on the regularity ratings elicited from subjects on the seven-point scale indicates that the main effect of regularity was significant (F(1,75) = 481.00, p < .001), such that washing one’s hair (mean = 6.42), having dinner (mean = 6.27), and attending class (mean = 6.51) were all rated as being significantly more regular than were making unplanned stops to talk to friends (mean = 2.35), snacking (mean = 3.61), and drinking

5 None of the differences between the summed and the overall frequencies were significant.

6 Menon (1993) shows that this measure yields similar results to response times.
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water from a public fountain (mean = 3.48). Planned contrasts between each pair of regular and irregular behaviors indicate that the differences are statistically significant (p's < .01).7

Matching behaviors on frequencies. Although the behaviors varied on regularity, it was important to ensure that the frequencies of these behaviors were matched on actual frequencies. A 2 x 3 x 2 analysis of variance using the actual frequencies as obtained through the diaries as the dependent measure revealed that the main effect of regularity is not significant (F(1,76) = .50, p = .48; all planned contrasts were nonsignificant, p's > .30). The mean frequencies across the behaviors varied from 6.00 to 6.73 a week. None of the other effects were significant (F's < 1.0).

In summary, all six behaviors were matched on actual frequencies, and three behaviors varied from the other three in terms of their regularity.

H1: The Effects of the Decompositional Question on the Cognitive Process (Path 1)

The written retrospective protocols of subjects were used to examine the differences in the cognitive processes across question conditions. Using the decompositional question should enhance the use of episodic recall, though estimation strategies still would predominate regular behaviors. That is, using the cognitive process as the dependent measure, two main effects were predicted: one of question wording and another of regularity.

Because a self-administered measure was used, subjects varied with respect to the detail provided in the retrospective protocol: Whereas some subjects were effusive, others simply reported “I counted” or “I do it once a day.” Whatever information was elicited was coded as being primarily an episodic recall versus an estimation strategy (analogous to the procedure followed in Menon 1993 and Menon et al. 1995, using the codes from Bickart et al. 1990) by two coders blind to the hypothesis.8 They agreed on 92% of the codes (Ia, the reliability index = .875; see Perreault and Leigh 1989); the rest were resolved through discussion.

Following the procedure adopted in Menon, Raghubir, and Schwarz (1995), a loglinear analysis within each level of regularity was run to ensure that question wording did not affect the three behavior replicates differently. Cognitive process was used as the dependent measure and behavior replicate and question wording as the independent variables, together with an interaction term, and confirmed that the interaction was not significant (for regular: \( \chi^2(2) = .011, p = .994 \); for irregular: \( \chi^2(2) = .738, p = .695 \)). Having confirmed that the behaviors, nested within regularity, were not affected differently by the question wording, a hierarchical loglinear analysis was run across the two levels of regularity, treating the three specific behaviors within each level as equivalent. The results from this analysis confirmed the prediction of a significant main effect of question wording (\( \chi^2(1) = 30.633, p < .001 \)), which indicates that using the decompositional question induces a tendency for people to move to episodic recall. For example, for regular behaviors, whereas only 11% used episodic recall strategies in arriving at frequency judgments of washing their hair in the control condition, as was expected given the accessibility of a rate of occurrence, 33% did so using the decompositional question (see Table 2). The analogous percentages were 10% versus 34% for having dinner and 18% versus 46% for attending class (all p's associated with z-tests < .05). This is true for irregular behaviors, too, as can be seen from the increase from 45% to 73% for making unplanned stops, 49% to 73% for snacking, and 44% to 81% for drinking water from a fountain (all p's associated with z-tests < .05).

Furthermore, the main effect of regularity was significant (\( \chi^2(1) = 54.063, p < .001 \)), which indicates that estimation strategies still predominate irregular behaviors. The interaction between question wording and regularity was nonsignificant (\( \chi^2(1) = .032, p = .859 \)), which indicates that the decompositional question does not have different effects on regular and irregular behaviors.

H2: The Effects of the Decompositional Question on Perceived Cognitive Effort (Path 2)

H2 predicted that subjects would rate the effort involved in arriving at frequency estimates of regular behaviors as more effortful and irregular behaviors as less effortful in the decompositional question condition compared with the control condition.

As predicted, a 2 x 3 x 2 repeated-measures analysis of variance using effort ratings as the dependent measure indicated a significant interaction between the regularity of the behavior and question wording (F(1,74) = 11.74, p < .001; for means, see Table 2). The simple effects of question wording within each level of regularity indicated that subjects rated the effort involved in arriving at frequency estimates of regular behaviors as being less when judgments were elicited in the control condition versus when they were elicited in the decompositional question condition (F(1,74) = 7.79, p < .007). The perceived cognitive effort associated with regular behaviors increased when decompositional questions were used for all three regular behaviors (Means: hair = 2.51 versus 3.27; dinner = 2.69 versus 3.43; class = 2.41 versus 3.24; planned contrast p's < .05). For irregular behaviors, as expected, the decompositional question makes the process of formulating a frequency judgment less effortful than does the control condition (F(1,76) = 13.56, p < .001). This also is reflected in the planned contrasts between the means associated with a behavior in the control versus decompositional question conditions (Means: stops = 4.36 versus 2.89; snacking = 4.54 versus 3.70; water = 3.56 versus 2.89; all planned contrast p's < .05).9

H3: The Effects of the Decompositional Question on Accuracy of Frequency Judgments (Path 3)

H3 predicted that decompositional questions would be more useful in reducing the errors associated with irregular behaviors than those associated with regular behaviors. To

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7The main effect of the replicate factor (F(2,150) = 8.70, p < .001) and the interaction term (F(2,150) = 11.31, p < .001) also were significant, which reflects that making unplanned stops was less regular than the other two irregular behaviors (p < .01; all other contrasts were nonsignificant, p > .20). None of the terms including the question wording variable were significant (F's < 1.0).

8There are many estimation strategies that a respondent could use (see Bickart and Felcher 1996; Bronson 1995). My primary focus was on the use of episodic recall versus any estimation process.

9Furthermore, as predicted, neither the three-way interaction nor the other two-way interactions were significant (p's > .30). The main effects of regularity and the replicate factors were significant (p's < .05), and that of question wording was marginally significant (F(1,74) = 2.77, p = .10).
Table 2

effects of Decompositional Questions on Behavioral Frequency Judgments

<table>
<thead>
<tr>
<th>Regularity</th>
<th>Behaviors</th>
<th>Cognitive Process—Path 1 ($H_1$) (% using episodic recall strategies*)</th>
<th>Perceived Cognitive Effort—Path 2 ($H_2$) ($I = 1$ not at all, $7 = very$ effortful)</th>
<th>Accuracy (Relative Error Indices)—Path 3 ($H_3$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regular</td>
<td>Washing hair</td>
<td>Control: 10.8, Decompositional: 33.3'</td>
<td>Control: 2.51, Decompositional: 3.27'</td>
<td>Control: .16, Decompositional: .20, report: .01', .08'</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(2.11)</td>
<td>(1.12)</td>
<td>(.23), (.26), (.28)</td>
</tr>
<tr>
<td></td>
<td>Having dinner</td>
<td>Control: 10.5, Decompositional: 34.2'</td>
<td>Control: 2.69, Decompositional: 3.43'</td>
<td>Control: .13, Decompositional: .11, report: .04', .03'</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(1.79)</td>
<td>(1.95)</td>
<td>(.20), (.20), (.24), (.23)</td>
</tr>
<tr>
<td></td>
<td>Attending class</td>
<td>Control: 17.6, Decompositional: 46.4'</td>
<td>Control: 2.41, Decompositional: 3.24'</td>
<td>Control: .21, Decompositional: .26, report: .14', .23'</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(1.88)</td>
<td>(1.04)</td>
<td>(.38), (.25), (.41), (.27)</td>
</tr>
<tr>
<td>Irregular</td>
<td>Making unplanned stops</td>
<td>Control: 45.5, Decompositional: 73.3'</td>
<td>Control: 4.36, Decompositional: 2.89'</td>
<td>Control: .51, Decompositional: .26', report: .20, .11'</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(2.19)</td>
<td>(1.35)</td>
<td>(.50), (.32), (.70), (.33)</td>
</tr>
<tr>
<td></td>
<td>Snacking</td>
<td>Control: 48.6, Decompositional: 73.3'</td>
<td>Control: 4.54, Decompositional: 3.70'</td>
<td>Control: .64, Decompositional: .26', report: .37, .05'</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(1.76)</td>
<td>(1.73)</td>
<td>(.26), (.31), (.89), (.41)</td>
</tr>
<tr>
<td></td>
<td>Drinking water from a fountain</td>
<td>Control: 44.1, Decompositional: 81.2'</td>
<td>Control: 3.56, Decompositional: 2.89'</td>
<td>Control: .66, Decompositional: .50', report: .15, .03'</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(2.07)</td>
<td>(1.84)</td>
<td>(.58), (.48), (.87), (.70)</td>
</tr>
</tbody>
</table>

Notes: Each cell has 38 subjects. Figures in parentheses are standard deviations.
*% using episodic recall strategies = (100 – % using estimation).
*Pairs of means or percentages (i.e., control versus decompositional question within a behavior) are significantly different from each other, $p < .05$.
*Not significantly different from zero, $p < .05$. 
test this, a 2 (regularity) × 3 (behavior replicate) × 2 (question form) mixed factorial analysis of variance on the absolute and raw error indices was used, in which the regularity × question wording interaction was expected to be significant, such that the decompositional question has an effect on irregular but not regular behaviors.

Using relative raw error indices as the dependent measure, as predicted, the interaction between question wording and regularity of the behavior was significant (F(1.74) = 4.18, p < .022; for means, see Table 2), which indicates that the question wording has different effects at each level of regularity. None of the other interaction or main effect terms were significant (p > .20), except for the interaction between regularity and the behavior replicate factor (p < .05).

In light of the significant interaction between regularity and question wording, the simple effects of the question wording condition within each level of regularity were examined. As predicted, question wording had no effect on the raw error index for regular behaviors (F(1.74) = 1.63, p = .21) but had a significant effect for irregular behaviors (F(1.75) = 2.70, p < .05). Planned contrasts between the pairs of mean raw errors in the control versus decompositional question conditions indicate that the differences are significant for irregular behaviors (p's < .05; reduction in error: stops = 9%; snacking = 12%; water = 32%). Although using the decompositional question is effective in reducing the errors associated with irregular behaviors, doing so eliminates the errors associated with two out of three of them (i.e., snacking and drinking water). In the case of the third behavior, it is likely that its lower regularity (see under Manipulation Check) requires that the decompositional question be more detailed to eliminate completely the error associated with the frequency estimate. However, this question is not effective for regular behaviors (p's > .10; reduction in error: hair = 7%; dinner = 1%; class = -9%), and in fact increases the error associated with attending class.10

Therefore, the decompositional question serves to increase the accuracy of irregular behaviors more than regular ones. The data, therefore, support our predictions.

H4 and H5: A Mediated-Moderation Model of the Frequency Formulation Process (Paths 1 and 4 and Paths 1 and 5)

H4 and H5 predicted that the effects of question wording on perceived cognitive effort and accuracy were moderated by the regularity of the behavior, which, in turn, was mediated by the cognitive process involved in formulating a frequency judgment (see Figure 1). To test this model, the following results are needed (Baron and Kenny 1986): (1) a significant regularity × question wording interaction on perceived cognitive effort and accuracy (already reported under H3 and H4); (2) a significant effect of question wording on cognitive process (already reported under H1); and (3) a smaller or null effect of the regularity × question wording interaction on perceived cognitive effort and accuracy when cognitive process is included in the model. To test the third condition, two regression models were run using effort ratings and accuracy as the dependent measures and the following independent variables: (a) Model A: regularity, question wording, and the interaction and (b) Model B: regularity, question wording, cognitive process, and all the two-way and three-way interactions.11 The difference in beta-coefficients of the question wording × regularity interaction across the two models indicates the magnitude of mediation attributable to cognitive process (Baron and Kenny 1986).

H6: Effort ratings. Model A was significant (R² = .11, p < .01), as was the regularity × question wording interaction (B = -.43, t = -5.37, p < .01). Model B also was significant (R² = .32, p < .01), though the regularity × question wording interaction was not (B = .07, t = .84, p = .40). Furthermore, all the interaction terms associated with the cognitive process variable were significant (p < .05), which indicates its effects over and above the regularity × question wording interaction.

H7: Relative raw error indices. The same mediated results hold for raw error indices. Model A was significant (R² = .05, p < .02), as was the regularity × question wording interaction (B = .06, t = 2.39, p < .02). Model B also was significant (R² = .09, p < .01), though the regularity × question wording interaction was not (B = .04, t = 1.39, p = .17). Moreover, the three-way interaction and the cognitive process × question wording interaction were significant (p < .05), which indicates the predicted effect of cognitive process over and above the regularity × question wording interaction.12

In summary, there is strong evidence that the cognitive process perfectly mediates (cf. Baron and Kenny 1986) the effects of the interaction between regularity and question wording on (1) perceived cognitive effort and (2) accuracy, as the associated beta-coefficient goes from being significant in Model A to nonsignificant in Model B. Therefore, the data completely support the model.

**DISCUSSION**

Understanding the organization of autobiographical memory in the interest of designing better questionnaires that elicit more accurate information is extremely important and is now attracting more attention among researchers (for a review, see Sudman, Bradburn, and Schwarz 1996). Whereas some research focuses solely on the effects of accessibility of alternate sources of information in memory on frequency judgments (e.g., Blair and Burton 1987; Menon 1993), others examine the effects of contextual information on response accuracy (e.g., Burton and Blair 1991; Menon, Raghubir, and Schwarz 1995). The study described here builds on my memory framework (see Menon 1993) and uses the theoretical underpinnings of accuracy as a basis for demonstrating that contextual factors such as question wording can be used to increase response accuracy by creating a better match between accessible information in memory and contextual cues. It extends the work of Burton and Blair (1991) and makes a theoretical contribution by demonstrating that the effects of question wording on perceived cognitive effort and accuracy are mediated by the cognitive process employed by respondents. It makes an applied contribution over the previous work in this area by investigating specific methods that marketing researchers can use to increase the accuracy of behav-

10These results are replicated when relative absolute error indices are used as the dependent measure. For the aggregate mean error, these results hold for all but one irregular behavior.

11Because the three factors are dichotomous, each variable was contrast-coded 1 and −1. Furthermore, to account for the repeated measures design, 1 used dummy coding to reflect each subject.

12These results are mirrored when relative absolute error indices are used as the dependent measure.
ioral frequency judgments. Breaking up an overall frequency into parts decreases the cognitive load on respondents and increases the accuracy of frequency reports associated with irregular, but not regular, behaviors.

Implications

Meditational model. The effectiveness of a question in increasing the accuracy of frequency judgments is demonstrated here to be highly contingent on the cognitive process used. The use of the decompositional question enhances the use of episodic recall, which contributes toward making the frequency formulation task easier and the report more accurate for irregular behaviors, but not for regular ones. Therefore, this extends previous results (Menon 1993) by showing that the accuracy of frequency reports is highly contingent not only on the regularity of the behavior but also on the cognitive process used by the respondent.

Effects of the regularity of the behavior on accessibility of information in memory and biases in judgments. The results of the study reported here provide corroborative support for previous research that indicates that the regular behaviors are stored in memory with a rate (e.g., Menon 1993; Menon, Raghubir, and Schwarz 1995). The findings indicate that this summary representation is not only available but also easily accessible, as is borne out by the effort ratings. In addition, because they are formed over a period of a person's lifetime, they are fairly accurate and therefore result in better frequency estimates. Therefore, even eliciting a rate might suffice in the case of regular behaviors, because this yields accurate results and reduces the cognitive burden on the respondent.

This finding also ties in neatly with that in Menon, Raghubir, and Schwarz (1995) that regularity moderates biases of frequency estimates. In that study, the authors discover that when a behavior is regular, even the range of response alternatives provided does not bias responses, unlike the case of irregular behaviors. Results of the current study provide corroborative evidence that regularity is a robust phenomenon that moderates the effects of various biases in various contexts.

When do we need to enhance accuracy and how do we do this? The results of this study reveal that irregular behaviors tend to be reported much more inaccurately than do regular behaviors. The main contribution of this study is that, reassuringly, the accuracy of frequency judgments associated with irregular behaviors can be enhanced by providing contextual cues and using the decompositional question. This is a particularly important finding in the light of the conclusion by Sudman, Bradburn, and Schwarz (1996, p. 215) that "we are still far from able to improve estimation accuracy through task manipulation." Therefore, we can increase the accuracy of frequency judgments of frequent, irregular behaviors of the nature of those investigated here, with the added benefit of making the task simple for respondents by using a decompositional question.

Furthermore, the results demonstrate that respondents use some summary representation from memory (e.g., a rate) in arriving at a frequency report of a regular behavior, and they tend to be fairly accurate in their estimate. Conversely, given that the focus was on frequent behaviors engaged in about once a day on an average, the absence of this rate in memory (as is the case for irregular behaviors) makes it necessary to recall each instance episodically. This is a fairly tedious task (as is noted by the effort ratings in Table 2). It also results in less accurate frequency estimates. Furthermore, the results show that the relative raw errors associated with regular behaviors tend to be nonexistent. What does this mean? When researchers are dealing with aggregate data across a sample, they do not have reason to be concerned about the accuracy of frequency judgments of regular, frequent behaviors, because using a rate of occurrence from memory enhances accuracy. Using decompositional questions does little to enhance the accuracy of frequency judgments associated with such behaviors.

An important question in this regard is how to come up with the cues to use in the decompositional question. Although the decompositional question has been shown to increase the accuracy of irregular behaviors here, the process of arriving at the list of cues is critical to its success. In the current research, cues used were generated from the respondent population through pilot studies. It is important to provide the respondent with an exhaustive list of occasions or situations to avoid part-list cuing effects. In its simplest form, part-list cuing effect refers to a reliable finding that cues given at the time of recall result in poorer recall of items that were not cued as compared with a control group that did not receive these cues (Lynch and Srull 1982). This means that the provision of cues can introduce a bias in favor of the cued subcategories. Therefore, the list provided to the respondent must be exhaustive. Alba and Chattopadhyay (1985) discuss the conditions under which part-list cuing effects can occur: In the context of brand recall, they obtained results that indicated that the effects of part-list cuing can vary as a function of consumer knowledge and market structure. Moreover, it is critical also to determine that one subcategory does not predominate in terms of eliciting the frequency, because if it does, then the decompositional question will not work in a manner different from a normal open-ended question. Therefore, it is important to pretest the list of occasions and/or situations used in the decompositional question to avoid such effects. Furthermore, the development of decompositional questions is a complicated process that involves a significant amount of pretesting to determine whether a behavior is uniformly regular or irregular for the population under study. As such, the guidelines that can be provided to the practitioner might be clear from a theoretical standpoint, but they are less so from a practical standpoint.

Limitations and Areas for Further Research

One of the limitations of this study is the use of student subjects. The need to obtain objective data to compare reported frequencies, at the same time manipulating regularity and controlling frequency, makes it difficult to obtain high internal and external validity. Although the study reported here is experimentally controlled—and hence high in internal validity—the ability to extrapolate to other behaviors and the general consumer population is an avenue for further research. Another limitation is that diaries served as the objective measure of accuracy. Although there is general consensus that purchase diaries reflect "true" purchases of frequently purchased products (Sudman 1964a, b; 13Note that Hu and colleagues (1996) demonstrate that results obtained through laboratory experiments were replicated in a field setting, which thus provides support for the generalizability of the current findings.)
Wind and Lerner (1979), replicating the results of this study using another objective accuracy criterion is important in enhancing the ecological validity of the findings.

The measure of perceived cognitive effort reported here was a single-item measure used previously (Menon 1993). There are many other measures that could be used instead (e.g., response latency, multi-item effort measures), and replicating these results using stronger measures is desirable in further endeavors.

Given the unequal variances across regular and irregular behaviors and the skewed distribution of the error indices, some caution must be exercised in the interpretation of the ANOVA results. Further research could confirm the findings reported through other analytical procedures.

Moreover, the results indicate that regular behaviors can be associated with no relative raw error, but they still are associated with some relative absolute error at the individual level. In addition, though using compositional questions could reduce the relative absolute errors associated with frequency estimates of irregular behaviors in this study, doing so did not eliminate them (except in the case of raw errors at the individual level). These are other areas worth pursuing in the future.

The focus was on frequent everyday behaviors. The question arises regarding the accuracy of less frequent behaviors. It is possible that using the compositional question could inflate the frequency and lead to more errors, presumably because of issues such as telescoping. These effects could occur over and above other effects such as the regression to the mean (cf. Fiedler and Armbruster 1994) and is worth exploring. Conversely, it also is possible that for such less frequent behaviors, cuing in depth could increase cognitive effort, but also accuracy. This question could be addressed in further research.

Finally, in a previous study, Menon (1993) examined the effects of the similarity of occurrences as a variable in determining the cognitive processes that respondents use. In the current context, using an episodic recall strategy (facilitated through compositional questions) could induce telescoping or omission errors, but this could be contingent on the similarity of the behavior. Dissimilar behaviors might be more prone to telescoping errors, and similar ones to omission errors. Further research could be directed at examining the impact of this factor on the effectiveness of the decompositional question.

REFERENCES


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