The Influence of Prior Beliefs, Frequency Cues, and Magnitude Cues on Consumers’ Perceptions of Comparative Price Data

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A widespread practice in grocery store advertising is to compare the advertised store’s prices to a competitor’s prices on multiple items. An important, but largely unexplored, issue is how this information is processed and used in conjunction with prior beliefs to influence price perceptions. In our initial studies we manipulated prior beliefs and two data-based cues—frequency of price advantage and magnitude of price advantage—to determine their relative influence on consumer price perceptions. Results indicate that prior beliefs affected price perceptions, but that the frequency cue exerted a dominating influence. Several follow-up studies demonstrate the robustness of this phenomenon across a variety of presentational and instructional conditions.

Classic economic approaches to pricing increasingly are being supplemented by behavioral research concerned with how individuals react emotionally and psychologically to prices and price-related cues (Monroe 1990; Monroe and Petroshius 1981; Thaler 1985; Winer 1988). Although prices are concrete relative to other product attributes (such as quality), price perceptions are malleable. Judgments about price are often based on a comparison to a reference point. Thus, such judgments are susceptible to manipulation of the reference point and to rhetorical devices that influence the perceived deviation from this point (e.g., Dickson and Sawyer 1990; Herr 1989; Inman, McAlister, and Hoyer 1990; Lichtenstein, Burton, and Karson 1991; Liefield and Heslop 1985; Urbany, Bearden, and Weilbaker 1988).

Prices as Data

The tactics used to influence price perceptions are likely to be most effective when consumers are unmotivated or unable to make precise and comprehensive price comparisons. Price is a search attribute, and, regardless of how it is framed, consumers have the opportunity to discern or estimate the price differentials among brands within a store or within brands across stores. Obviously, more effort is required to compare across stores, but the amount of effort will vary as a function of the decision context. In the case of durable goods, the effort required to make the comparison is smaller because durables are typically purchased in iso-
lation from other goods and therefore the task is restricted to a single product category. Thus, it is relatively easy to compute the magnitude of the savings to be obtained by shopping at the least expensive store.

In contrast, consider the case of grocery items, which are purchased together on a regular basis but whose prices may vary significantly within and across stores and over time because of promotional activity by both the retailer and manufacturer. Rarely, if ever, does one store dominate another on all items, and it is difficult to identify any particular category of goods that may serve as an accurate predictor of overall prices on a consistent basis. Indeed, because of the value orientation of what is believed to be a large segment of shoppers, many grocery stores claim to offer the best values and often provide evidence by singling out particular items for which they offer a price advantage. Given this retail strategy and the enormous number of stockkeeping units that can be implemented, consumers who compare stores across a small number of items may draw erroneous conclusions about the value offered by competing stores.

**Prices as Complex Data.** It is implausible to expect consumers to conduct a controlled experiment across their typical shopping basket, given the number of products, brands, sizes, and formulations in their consideration sets and the apparently low level of effort they may exert even in the purchase of relatively expensive goods (Marmorstein, Grewal, and Rishe 1992). It is more likely that consumers will attempt to simplify the task. Some consumers may make comparisons on only a few items and (over) generalize to the remainder. Other consumers may sample more widely but adopt a heuristic that makes the task more manageable. One heuristic that may be especially attractive in this context involves tallying the number of items on which each store enjoys a price advantage over its competitors (the frequency heuristic). Effort is reduced substantially because the heuristic requires neither the computation of the individual price differences on each item across stores nor the aggregation of differences across items. Although such details are lost, the heuristic does allow the consumer to incorporate a relatively large number of items into the judgment process (see Alba and Marmorstein 1987).

The potential influence of frequency information is indicated by three basic phenomena. First, although it is unlikely that consumers would make a conscious attempt to obtain formal counts, a substantial body of evidence indicates that frequency knowledge may be obtained unintentionally by virtue of the ease with which it is encoded (cf. Hasher and Zacks 1984). Thus, accurate perception of the frequency with which one store dominates another may develop incidentally after exposure to comparative price data from a variety of sources, including promotional messages and in-store observations (cf. Krishna 1991). Second, the pricing literature suggests that consumers may take little notice of or may not long remember the magnitude of a price differential. For example, Dickson and Sawyer (1990) found that when shoppers are simultaneously provided the regular and discount prices of a good in a supermarket they often fail to compute the difference. Thus, simple awareness that a price has been reduced (or even a false signal of a price cut) may be more influential than the size of the reduction (see Buyukkurt 1986; Inman et al. 1990; Kalwani and Yim 1992; Lattin and Bucklin 1989), depending on the size of the reduction (Della Bitta, Monroe, and McGinnis 1981). Third, the marketplace fosters the use of frequency information. Whereas discussions about retail pricing tactics often refer to “loss leaders,” many retail advertisements, particularly the ubiquitous comparative advertisements placed by supermarkets, attempt to convey value by describing the wide array of items on which the advertised store has a price advantage over its competitors.

**Prices as Ambiguous Data.** In many instances, frequency heuristics may enable consumers to make reasonably accurate decisions at a relatively low cost (Russo and Dosher 1983). However, the same heuristic also can result in very poor decisions when the magnitude of the attribute differences outweighs the frequency with which one alternative surpasses the other. For example, if one store is less expensive than a competitor on a majority of items but the magnitude of its advantage on each item is small, its overall value may be inferior if the competitor steeply discounts the few items on which the competitor enjoys an advantage. If the frequency cue is offset by such magnitude differences, the data may be said to be ambiguous. That is, frequency of advantage and magnitude of advantage are negatively correlated, and a dominating alternative is difficult to identify (see Ha and Hoch 1989). The issue of how consumers react to ambiguous product information is central to understanding many consumers’ decisions regarding product and store choice. The relatively small amount of research devoted to this question has focused on how the interpretation of ambiguous information is affected by consumers’ prior beliefs or expectations (Deighton 1984; Hoch and Ha 1986).

**Beliefs versus Data.** It would be naive from a marketing perspective to expect prices per se to be the sole determinant (or even the primary determinant) of price perceptions (Brown 1969). Advertising and in-store atmospherics may create beliefs about prices independent of the prices themselves. It is important to note that, once a belief is formed, regardless of its basis, it may be very difficult to change (Hoch and Deighton 1989). The outcome may have serious implications for consumer welfare because (i) beliefs may be based on nonprice information that is inconsistent with the actual prices and (ii) marketplace dynamics may cause previously accurate
price-based beliefs to become outdated. Both scenarios are common. Some retailers lay claim to lower prices even though the facts may belie such assertions; other retailers actually respond to aggressive competitors by altering their pricing policies but find that perceptions lag far behind. In both cases, actual prices and consumer beliefs may conflict. The central issue addressed by our initial experiments concerns how actual prices (the data) and price expectations (prior beliefs) interact to influence consumer price perceptions.

A plausible guiding hypothesis is that prior beliefs will dominate the data. A robust finding in a variety of domains is that prior beliefs are a source of a myriad of biases, all of which can lead to distorted perceptions of the data and suboptimal decisions (Crocker 1981; Hoch and Deighton 1989). These distortions typically serve to maintain prior beliefs in the face of contradictory evidence (e.g., Alloy and Tabachnik 1984; Gilovich 1983). In some instances, nonsupportive data may even strengthen one's prior beliefs (e.g., Lord, Ross, and Lepper 1979).

If prior beliefs can drive perception and judgment when in conflict with the data, it follows that prior beliefs should exert a dominating influence when the data are ambiguous. Indeed, consumer research has shown that preexisting or experimentally induced dispositions exert a strong influence on product decisions made in ambiguous information environments (Deighton 1984; Ha and Hoch 1989; Hoch and Ha 1986; Yi 1990).

In light of these findings, consider the information environment described earlier. One store deeply discounts a small number of items; the other store slightly discounts a broad array of items. Aggregated across all items, however, both stores charge an identical amount for a given basket of goods. How will consumers perceive the relative value to be obtained at each store as a function of prior beliefs? Much evidence suggests that the question will be resolved in favor of prior beliefs. Thus, the store that slightly discounts a broad array of items should be perceived as less expensive when prior beliefs identify it as offering better value. The opposite should occur when prior beliefs favor the store that discounts a smaller number of items but by a larger amount.

However, two other outcomes are possible. First, insofar as some aspect of the data conflicts with prior beliefs, consumers may engage in deeper processing, which in turn should moderate prior beliefs and produce an accurate perception of the data. Some recent studies have suggested that such an outcome is possible (Hilton, Klein, and von Hippel 1991; Maheswaran and Chaiken 1991; see also Sniezek 1986; Wright and Murphy 1984). Second, one of the data-based cues may dominate prior beliefs. If consumers sample very narrowly and attend to the magnitude of the price differences, price perceptions should be driven by the magnitude differences among the specific items sampled. Alternatively, the aforementioned research on frequency learning and consumer price knowledge suggests that the frequency information in the data will compete favorably against prior beliefs as a determinant of retail store price perceptions. Formally, these competing outcomes may be expressed in the following series of hypotheses:

**H1a:** Prior beliefs will dominate data-based cues. Thus, regardless of the actual price cues (i.e., frequency vs. magnitude) favoring each store, the store that is believed to be less expensive a priori will be perceived as offering better value.

**H1b:** Conflict between the data-based cues or between prior beliefs and a data-based cue will prompt deeper processing, resulting in an accurate perception of the value offered by each store.

**H1c:** The magnitude cue will dominate all other inputs by virtue of the salience of large price advantages. Thus, the store with such advantages will be judged less expensive irrespective of prior beliefs and its frequency of advantage.

**H1d:** The frequency cue will dominate all other inputs by virtue of its ease of encoding. Thus, the store that is less expensive on a greater number of items will be perceived as less expensive overall, irrespective of prior beliefs and magnitude differences.

**Overview of Experiments**

A series of experiments was conducted to explore the relative persuasiveness of these factors in the context of the basic scenario described above. In the first set of experiments (i.e., experiments 1, 1A, 1B, and 1C), prior beliefs were pitted individually against the frequency and magnitude with which one store underpriced the other. For generalizability, prior beliefs were established by either capitalizing on subjects' prior price beliefs about two existing stores (experiments 1, 1A, and 1C) or by manipulating beliefs about two hypothetical stores (experiment 1B). The amount of time allotted for processing the price data was held constant at four minutes (experiments 1B and 1C), varied at two and four minutes (experiment 1), or varied at 1.5 or five minutes (experiment 1A).

The emergence of a robust frequency effect in these experiments prompted stronger tests of the frequency cue in two additional experiments. In experiment 2, subjects were allowed to control the amount of information they viewed and were provided with a monetary incentive to produce an accurate judgment of which store was lower priced. In experiment 3, the amount of time allotted for studying the information was doubled (on a per-item basis), and the salience of the magnitude
cue was manipulated through the use of frequently purchased items (so-called screamers).

The final three experiments explored the processes underlying the use of the frequency heuristic by exploring subjects' sensitivity to frequency and magnitude information. Experiment 4 employed memory measures to assess subjects' understanding of the structure of the price list. Experiments 5 and 6 attempted to establish boundary conditions on the influence of the frequency cue. In experiment 5, subjects were sensitized to the structure of the price list prior to viewing it; in experiment 6, the direction and magnitude of the price differential between stores was explicitly provided on an item-by-item basis.

**EXPERIMENT 1**

In this and several of the following experiments, subjects were presented with a price list for the same 60 items at two competing supermarkets. The total price of these items was identical at each store, but one store had a two-to-one frequency advantage over the other store (i.e., it was less expensive than the other on 40 of the items). The other store therefore possessed a magnitude advantage (i.e., it was proportionally less expensive by twice the amount on the 20 items for which it had lower prices). This initial experiment was exploratory in nature, examining prior beliefs at three levels (no prior beliefs, prior beliefs consistent with the frequency advantage, and prior beliefs consistent with the magnitude advantage) and the amount of time allowed for inspecting the price information at two levels (two vs. four minutes).

**Method**

**Subjects and Design.** Subjects were undergraduate and M.B.A. students who participated as part of a class exercise. Each subject was assigned randomly to one of the six cells of the 3 (prior beliefs) × 2 (processing time) between-subjects design. A total of 215 subjects participated, with the number in each cell ranging from 33 to 38.

**Prior Beliefs.** The prior beliefs variable was operationalized in terms of two real-world stores possessing very different price images. The low end of the scale was represented by Bi-Lo, a familiar store in the local market known for its low price orientation. Kroger, also well known in the local market for its quality/service orientation, was chosen to represent the other end of the scale. Selection of Bi-Lo and Kroger was based on a pretest that solicited opinions from 63 subjects regarding the relative expensiveness of the stores. Results showed that 81 percent of the respondents believed that Bi-Lo's prices were lower than Kroger's prices. In the no-priors condition, two neutral and fictitious names, Clark's and Taylor's, were used as store names.

**Materials.** All experimental materials were contained in booklets distributed to each subject. The first page of the booklet described the experiment in general terms. It noted that the study concerned supermarket prices and that participants would be exposed to prices at two competing stores. To enhance credibility, the cover page noted that the prices were based on an annual survey conducted by the Retail Grocers Association for the purpose of determining how grocery chains fare in terms of prices for a representative sample of grocery items. The Retail Grocers Association was said to analyze the data from the surveys and provide a report for all members of the association. The names of the two stores were then listed, and subjects were asked to examine the information carefully in preparation for follow-up questions.

The next two pages of the booklet contained the prices. For all subjects the products and prices on the 60-item price list were identical. Only their order and correspondence to retail store were varied. An attempt was made to sample items from every department in a typical grocery store. Each item was described in terms of product class, brand name (where applicable), and size (e.g., 2.7-ounce Crest toothpaste). Next to each item was the price at each of the two stores. Space constraints required that the 60 items be presented on two pages, 30 to a page. Within a page, 15 items were listed on each side. Within each side, the products were listed in the leftmost column, and the prices at the stores were listed in two adjacent columns. The store names appeared at the top of the price columns. One page of an illustrative price list appears in the Appendix.

To counterbalance potential order effects, a single random ordering of the 60 items was partitioned to the midpoint and assigned to separate pages. Across booklets, the ordering of the pages was systematically varied. Within a page the ordering of the items was identical for all subjects but the columns of prices were systematically switched so that the price at each store had an equal opportunity to appear immediately next to the product description.

The price frequency advantage also was distributed equally across the list. Within each set of 15 items on each side of each page, 10 randomly chosen items favored one store over the other. However, the total price

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1This finding was later corroborated by a manipulation check conducted at the end of this experiment on subjects in the no-priors condition. These subjects, who had been exposed to prices for Clark's and Taylor's and therefore were uncontaminated by the stimuli, were provided with the names Bi-Lo and Kroger and were asked to identify the store they believed to have lower prices overall. Of the 70 subjects in this condition, 79 percent believed Bi-Lo to have lower prices, 14 percent believed Kroger to have lower prices, and 7 percent were uncertain.
for each set of 15 items was identical at the two stores. Thus, the average price difference on the 10 items at the more frequently cheaper store was half the size of the average price difference on the five items that favored the less frequently cheaper store. Specifically, on the 40 items that favored one store, the average price difference was approximately \$0.77; on the remaining 20 items that favored the other store the average difference was approximately \$1.14. The distribution of the price differences overlapped to a small extent.

Finally, the 40 items that favored one store had an average price of \$1.91; the 20 items favoring the alternative store had a mean price of \$1.89. The range of prices within each set was greater than \$2.00 and nearly equal. The structure of the prices lists was crossed with the three levels of prior beliefs to manipulate one of the independent variables. In the frequency-consistent condition, Bi-Lo was always given the frequency advantage. In the magnitude-consistent condition the labels were reversed (i.e., Bi-Lo was less expensive on 20 of the 60 items but by twice the average amount). Thus, prior beliefs favored the store with the frequency advantage. In the magnitude-consistent condition the store names were Clark’s and Taylor’s. (Subjects were told in this condition that the data were real.

The final page of the booklet contained the dependent measure, which assessed subjects’ understanding of the relative prices at the two stores. Specifically, subjects were asked to estimate the total basket price at each store separately. To constrain the potential variance in the responses, the instructions noted that the total price at each store ranged between \$100 and \$130. (The correct answer for each was \$117.13.)

Procedure. Subjects were randomly assigned to conditions and paced through the task by the experimenter, who was blind to the hypotheses. After reading and understanding the cover page, subjects were informed of the amount of time to be allotted for inspection of the information and were urged to focus their attention on the prices. To ensure some consistency in allocation of attention across conditions, subjects were told that the experimenter would make an announcement when half of the allotted time had transpired. Subjects then freely examined the data. Immediately following the inspection phase, subjects turned to the final page of the booklet and provided total price estimates for each store.

Results and Discussion

The dependent variable was computed by subtracting the price estimate given to the store that was less expensive on 20 items from the estimate given to the store that was less expensive on 40 items, regardless of prior beliefs. A negative score, therefore, indicates that the store with the frequency advantage was perceived to have lower prices.

The mean difference scores as a function of processing time and prior beliefs are presented in Table 1. It is apparent from the uniformly negative values that the store possessing the greater number of price advantages was perceived to offer the best value in all conditions. ANOVA revealed a significant effect of prior beliefs (F2,209 = 3.71, p < .03), but no effect of processing time and no processing time x prior beliefs interaction (both F’s < 1). As suggested by the means, follow-up contrasts showed that the magnitude-consistent condition differed from both the no-priors and frequency-consistent conditions (p’s < .04), but that the latter two groups did not differ from each other (t < 1).

The main effect of prior beliefs provides the strongest evidence that subjects viewed the stores differently, a priori. As predicted by previous research, the frequency heuristic exerted a weaker effect on price perceptions when it conflicted with prior beliefs. However, the mean difference score was negative regardless of prior beliefs, and, compared to a null hypothesis of equivalent price estimates, the mean difference in each condition was significantly different from zero (p’s < .001). Thus, when prior beliefs (and magnitude information) conflicted with the frequency of price advantage, neither was the conflict resolved in favor of prior beliefs nor did it result in accurate perception of the overall price difference.

These results are corroborated by a categorical analysis of which store was perceived to offer the lowest

<table>
<thead>
<tr>
<th></th>
<th>No-priors</th>
<th>Frequency-consistent</th>
<th>Magnitude-consistent</th>
<th>Combined mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two minutes</td>
<td>-7.37 (7.63)*</td>
<td>-9.08 (6.08)</td>
<td>-6.12 (5.83)</td>
<td>-7.58 (6.62)</td>
</tr>
<tr>
<td>Four minutes</td>
<td>-9.20 (1.15)</td>
<td>-8.34 (5.57)</td>
<td>-5.22 (7.86)</td>
<td>-7.56 (8.01)</td>
</tr>
<tr>
<td>Combined mean</td>
<td>-8.29 (7.40)</td>
<td>-8.71 (7.40)</td>
<td>-5.64 (6.95)</td>
<td>-7.57 (7.35)</td>
</tr>
</tbody>
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*Standard deviations are in parentheses.
prices across all 60 items. Subjects were classified according to whether they assigned a lower price to the more frequently inexpensive store (i.e., the store with the two-to-one frequency advantage), the less frequently expensive store, or neither store. The proportions for each condition were .89, .07, and .04, respectively, in the no-priors condition; .91, .04, and .05, respectively, in the frequency-consistent condition; and .76, .14, and .10, respectively, in the magnitude-consistent condition. Thus, it is not the case that the mean difference scores were distorted by a small number of extreme responses. In each condition, the large majority of subjects favored the store possessing a higher frequency of price advantage (all \( z' > 4.3, p < .001 \)).

To our knowledge, these results provide one of the few instances in which the interpretation of ambiguous data does not conform to prior beliefs. In this case, however, the aspect of the data that dominated prior beliefs was not the actual price difference but rather the frequency of price advantage. Thus, prior beliefs were dominated by a misleading aspect of the data. The results support claims regarding the seductiveness of the frequency heuristic—a heuristic that has received relatively little attention in decision research but that appears to serve as the motivation for product appeals in the marketplace (Alba and Marmorstein 1987).

As noted, this study was conceived as an exploration into the types of trade-offs consumers make among multiple conflicting cues. Using the results as a starting point, the remaining experiments assess their replicability and generalizability.

**EXPERIMENT 1A**

In the previous experiment the four-minute study interval was selected on the basis of an informal pretest, which showed it to be sufficient for an unhurried reading of the entire stimulus. Casual observation of subjects' behavior in this condition revealed that most participants were able to complete initial processing of the information in as little as 2.5 minutes. On the basis of this observation and our desire to stretch the boundaries of experiment 1, experiment 1A examined a portion of the previous design using processing times of 1.5 and five minutes. In experiment 1, the most interesting finding was the size and direction of the absolute price differential in the magnitude-consistent condition (i.e., the condition that pitted prior beliefs against the frequency cue). Thus, for purposes of efficiency, this condition was made the sole focus of experiment 1A. It is interesting to speculate about how changes in processing time, in either direction, should affect this condition. Regardless of whether consumers have more or less opportunity to learn the price information, price judgments should move in the same direction and away from the outcome of a frequency heuristic. As processing time decreases, the average amount of attention paid to each price must decline. In the limit, no price receives attention and price estimates should be driven exclusively by prior beliefs. As processing time increases, greater opportunity to compute and aggregate the individual price differences should result in more accurate judgments. In the limit, precise knowledge of the overall price differential between the stores should obtain.

**Method**

The stimuli and procedure were virtually identical to those described in experiment 1. The only differences involved restricting the design to the magnitude-consistent condition and altering the length of the study phase. In the shorter condition, processing time was lowered to 1.5 minutes; in the longer condition, the time was raised to five minutes. In both conditions, subjects were again notified at the midpoint of the interval. In addition, to increase the intensity of processing in the five-minute condition, the experimenter urged subjects at the midpoint of the interval to devote their full attention to the data for the entire duration of the interval. A total of 147 subjects participated, 76 of whom were in the 1.5-minute condition.

**Results and Discussion**

Because the experiment was confined to the magnitude-consistent condition, all subjects viewed data that portrayed Kroger as less expensive on 40 items and Bi-Lo as less expensive on 20 items. To maintain consistency with experiment 1, the dependent measure was computed by subtracting subjects' estimates of the total price of the 60 items at Bi-Lo from the corresponding price estimate at Kroger; therefore, negative numbers indicate a dominance of the frequency heuristic over prior beliefs and the magnitude cue. Results showed a mean difference of $-3.07 in the 1.5-minute condition and $-4.51 in the five-minute condition. These means do not differ significantly from each other (\( F < 1 \)), but each is significantly less than zero (1.5 minutes: \( t_{75} = -3.24, p < .01 \); 5 minutes: \( t_{70} = -4.03, p < .01 \)). Thus, in both conditions the frequency cue dominated prior beliefs that Bi-Lo was the less expensive store. As in experiment 1, these results are corroborated by a categorical description of subjects' responses. Specifically, subjects were classified according to whether they assigned a lower price to the store with the frequency advantage (Kroger), the magnitude advantage (Bi-Lo), or neither. The proportions for the 1.5-minute condition were .62, .25, and .13, respectively; the corresponding proportions in the five-minute condition were .72, .20, and .08.

As expected, the mean differences were lower than in the previous experiment. However, the more important result is that the judgments continued to favor the frequency cue over prior beliefs and magnitude information. The difference in the five-minute condition
is especially revealing. It closely approximates the values obtained in the comparable prior beliefs conditions of experiment 1 despite a longer study time and the experimenter's exhortation to attend to the prices over the entire period. We surmise that five minutes exceeds the amount of time most consumers are likely to devote to a comparable advertisement for a grocery store. We do not suggest that the five-minute condition offers the most stringent test possible. There is no theoretical constraint on the amount of time that can be allotted to the task. However, our goal was not to determine the amount of time required to achieve a high level of accuracy, but rather to assess the relative influence of prior beliefs and aspects of the data under reasonable conditions.

**EXPERIMENT 1B**

To examine prior beliefs in the preceding experiment, we employed familiar stores and measured subjects' expectations about their prices. To create a strong test of prior beliefs, only stores that possessed different price images were selected. Nonetheless, we recognize that there is a loss of experimental control attendant with the use of any measured independent variable. To compensate, the present experiment manipulates rather than measures prior beliefs.

**Method**

**Subjects and Design.** Each of 88 business undergraduates was randomly assigned to either a magnitude-consistent condition, a no-priors condition, or a no-data condition. The latter condition served as a check of the prior beliefs manipulation.

**Materials and Procedure.** The price stimuli and instructions for the no-priors condition were identical to those used in the corresponding condition of experiment 1. Thus, the 40:20 price frequency advantage favored Clark's over Taylor's. In the magnitude-consistent condition, an addition was made to the instructions to create different price expectations at the two stores. Specifically, a paragraph was inserted that described the stores as follows:

**Clark's:** This grocery store is family owned and operated. It is the only store the family owns and is one of the smaller food retailers in town. The store's personnel are always there when you need them. Services like bagging, check cashing, and carry-out service are provided. Most shoppers consider the store tidy and neat.

**Taylor's:** This store is part of a chain organization that owns a large number of grocery stores. It is one of the largest stores in town. Price specials are advertised weekly. There is nothing fancy about the interior decoration or lighting. Taylor's advertising theme is "Taylor's tames grocery prices."

These descriptions were adapted from Buyukkurt (1986), who successfully used them to create the desired differences in price perceptions.

In the no-data condition, subjects were given these store descriptions but were not exposed to any price information. They viewed only the product information (i.e., product, brand, size).

**Dependent Variables.** The magnitude-consistent and no-priors groups first performed the price estimation task used previously in experiments 1 and 1A. That is, the store names were presented and subjects were asked to estimate, within the $100–$130 range, the total price of the 60 items at each store separately. The no-data control group was given the correct $117 total for Taylor's and was asked to estimate the price for the same items at Clark's.

A previously unused measure designed to test whether beliefs about the price list extended to other items in the store was then administered to all subjects. The question was worded as follows:

How much do you think the Smiths would pay for that exact same basket of groceries if they did all their shopping at Clark's in the coming month? $_______

In all other respects, the procedure used in the four-minute condition of experiment 1 was followed.

**Results and Discussion**

The focal comparison involves the magnitude-consistent (n = 36) and no-priors (n = 35) conditions on the 60-item price estimation task. As before, the estimate for Taylor's (which was less expensive on 20 items) was subtracted from the estimate for Clark's (which was less expensive on 40 items). The mean differences were −$3.92 and −$6.31 in the magnitude-consistent and no-priors conditions, respectively. These means did not differ from each other (p > .3) but each differed from zero (p's < .01), which indicates a dominance of the frequency cue over prior beliefs and magnitude differences. Categorical analysis is again supportive. The proportion of subjects in the magnitude condition who assigned a lower price to Clark's, Taylor's, or neither was .70, .19, and .11, respectively. The corresponding proportions in the no-priors condition were predictably stronger in favor of Clarks (the high-frequency store) and were .89, .09, and .02.

The no-data control condition (n = 17) required only a single judgment about Clark's in the context of the $117 reference point at Taylor's. Subjects estimated the total for Clark's to be $19.59 higher than the total for Taylor's. Thus, it seems that the prior beliefs manipulation was successful.

The second dependent measure produced similar results. Given a $500 expenditure at Taylor's, subjects
estimated expenditures for the same items at Clark's to be $480.62, $476.29, and $556.47 in the magnitude-consistent, no-priors, and no-data conditions, respectively. The first two groups did not differ from each other (p > .5), but each differed from the no-data condition (p's < .001). The results again reflect the considerable influence of a counting mentality despite tighter control of an apparently strong manipulation of prior beliefs. In addition, the evidence indicates that this influence extends beyond judgments concerning the specific items on the list.

**EXPERIMENT 1C**

To further examine the extent to which the impressions formed about the price list generalize to the entire store, we conducted a follow-up to the magnitude-consistent condition using Bi-Lo and Kroger to establish prior beliefs but manipulated the credibility of the source of the prices. In the high-credibility condition, the price list was attributed to the Retail Grocers Association as in the preceding experiments. In the low-credibility version the prices were attributed to a recent Kroger advertisement that compared Kroger prices to Bi-Lo prices. A total of 100 subjects viewed the prices for four minutes and then completed both the price-list estimation question and the Smith family question described above. Results showed no effect of source credibility on either question. The mean difference between Kroger and Bi-Lo across the 60 items was $-5.80 in the high-credibility condition and $-5.52 in the low-credibility condition (p > .8); these means closely correspond to the estimates for the equivalent (magnitude-consistent) condition in experiment 1. On the more general question, subjects were asked to estimate the price of goods at Kroger, given that the same goods cost $500 at Bi-Lo. The mean estimates were $486 and $484 for the high- and low-credibility conditions, respectively (F < 1). Thus, even when the frequency cue was inconsistent with expectations and subjects were given reason to doubt the credibility of the price information, price impressions of the stores were driven by the frequency differential expressed in the sample of 60 items.

Despite these various attempts to probe the generalizability of frequency effect, it may be argued that the price lists used in the preceding experiments constitute an unusually dense information environment and that processing was unfairly constrained. Although both points are debatable given the nature of some supermarket advertisements and the amount of attention consumers devote to any advertisement, they merit investigation. In the next experiment, subjects were given control over the amount of information to which they were exposed.

**EXPERIMENT 2**

In place of the booklet format used previously, which allowed free inspection of all 60 items, experiment 2 used a computer to present the prices in sets of six items, one set at a time. Each set appeared on the screen for 30 seconds which, on a per-item basis, is equivalent to the five-minute condition in experiment 1A. However, as described below, the number of sets actually inspected was left to the discretion of each subject. Subjects were asked to identify the store that was less expensive and were provided with incentives to be accurate but efficient.

**Method**

*Subjects and Design.* Subjects were 51 volunteers from an introductory marketing class who received extra class credit for their participation. Each subject was randomly assigned to one of the three prior beliefs conditions described in experiment 1, that is, frequency-consistent, magnitude-consistent, or no-priors.

*Prior Beliefs.* This experiment took place in a different market containing different stores. To assess prior beliefs in this market for this subject population, an independent group of 58 respondents ranked the four local supermarket in terms of perceived expensiveness. The two stores receiving the most extreme responses (viz., Winn Dixie and Publix) were selected as the prior beliefs manipulation. Winn Dixie, the store judged to be least expensive, received an average rank of 1.9 (where 1 = least expensive) and was perceived as having the lowest prices or second lowest prices by 79 percent of the subjects. It should be noted also that this store has a long-standing reputation as a price leader, conveys a low price image in its broadcast ads, and frequently runs detailed print ads that compare its prices with those of competing stores across many items. The store judged to be most expensive, Publix, received an average rank of 3.4 and was perceived as having the most expensive or second most expensive prices by 84 percent of the subjects. It has a local upscale reputation and runs television ads that are image oriented rather than price oriented. Thus, the manipulation of prior beliefs was strong by real-world standards. The no-priors condition again relied on the neutral names of Clark's and Taylor's.

*Stimuli.* The items and prices were unchanged from the preceding experiments; only their order was modified. The original list of 60 items was divided into 10 sets of six such that four items in each set were less expensive at one store than the other but that the total prices within each set were identical at each store. The order in which the sets were presented was randomly and independently determined for each subject.

*Procedure.* An individual computer was assigned to each subject. Instructions appeared on the screen that explicitly stated that prices of randomly selected grocery items at the two stores would be presented, six at a time, and that the task was to determine which store was less expensive, on average. The instructions also noted that the number of items presented was under
the participant’s control, and that a judgment was desired as soon as the participant arrived at one. Thus, unlike in experiment 1, in experiment 2 subjects were made explicitly aware of the relationship between the stimulus information and the dependent measure. Their behavior cannot be attributed to misunderstanding of the purpose of inspecting the price information.

As an incentive, each subject was given a $3.00 budget, which decreased by $.30 with each set of items viewed. (All subjects were forced to view at least one set; thus, the discretionary budget was $2.70.) Subjects were told that they would receive the balance of their account if they correctly identified the least expensive store but would receive no payoff for an incorrect choice. Thus, subjects encountered a dilemma. Whereas the costs of inaccuracy were high, the payoff for a correct response varied inversely with amount of search. (Of course, given that the total prices at the two stores were identical, a true “correct” choice was not possible. Our intent was to assess the relative influence of the competing cues by forcing subjects to select one of the options.)

After indicating an understanding of the task and the contingencies, the first set of items was presented for 30 seconds. As in the previous experiments, the items and prices were listed in columns with the store names appearing as headings. Subjects viewed the data but were not allowed to take written notes. After 30 seconds had elapsed, the information on the screen was replaced with a question that asked whether the subject wished to make a decision or view another six items. If the subject indicated a desire to make a decision, the question was replaced by the store names and instructions for entering the decision into the computer. The computer recorded the decision along with the number of sets of items inspected to that point. If the subject wished to collect more data, the screen was cleared and a new, randomly selected (without replacement) set of items appeared. The program provided for the process to continue until a decision was reached or the items were exhausted. In the rare event of the latter, the computer then prompted a decision.

Results and Discussion

Table 2 presents the proportion of subjects in each condition who identified as least expensive the store with the higher number of price advantages, as well as the mean number of sets inspected. The results indicate that frequency of price advantage was again a strong determinant of price perceptions. In each condition the proportion exceeded .5, but the conditions did not differ from each other ($p > .10$). As in experiment 1, however, there is some evidence for the influence of prior beliefs. A binomial test comparing each proportion to .5 revealed that subjects chose the frequently less expensive store at a greater-than-chance level in both the frequency-consistent condition ($z = 3.15, p < .01$) and the no-priors condition ($z = 2.82, p < .01$). In the magnitude-consistent condition, preference for the store with the frequency advantage (and more expensive a priori image) was marginally greater than chance ($z = 1.50, p < .07$). These results almost precisely mimic the outcome of experiment 1. Price judgments were largely determined by the result of a counting heuristic, with prior beliefs exerting a relatively small moderating influence.

The depth of information search was surprisingly small, particularly in the magnitude-consistent condition. The means in Table 2 include the initial mandatory set of items. Thus, regardless of condition, subjects voluntarily examined slightly more than one additional set of items on average. Of course, absolute level of search is affected by the value subjects place on the stated costs and benefits. Nonetheless, it appears that the lack of consistency among the various cues did not prompt a significant amount of additional processing (cf. Hilton et al. 1991). Taken together, experiments 1–2 demonstrate the influence of frequency information at the expense of both magnitude information and prior beliefs across a range of opportunities to process the data and a variety of instantiations of prior beliefs.

**EXPERIMENT 3**

The purpose of this experiment was twofold. First, we wished to address more convincingly the issue of information load. In the preceding experiment we presented the grocery items in sets of six and allowed subjects to terminate search at their own discretion. In addition, the amount of time allotted for inspection of the data corresponded to the five-minute condition in experiment 1A. In the present experiment the number of items was held constant and low at nine, and the amount of time allotted for inspection of the data, on a per-item basis, was doubled.

The second and primary purpose of experiment 3 was to examine a different method for disambiguating the conflicting cues in the data. As noted at the outset, the price data may be considered ambiguous because the two data-based cues (i.e., frequency and magnitude of price advantage) were negatively correlated. In the preceding experiments, we allowed prior beliefs to serve as a disambiguating cue. However, the results showed...
that, when prior beliefs were consistent with the magnitude cue in the data, the magnitude cue did not achieve dominance. In the present experiment, prior beliefs were held constant at a neutral level. Instead, the salience of the magnitude cue was manipulated through the items themselves. In the control condition, all nine items in the set were low in salience, as defined in terms of real-world purchase frequency. In the other condition, the six items favoring one of the stores and possessing relatively small magnitude advantages were identical to those in the control condition. However, the three items possessing larger magnitude differences and favoring the competing store were high in salience. Supermarket managers refer to such items as "screamers" because they are used to attract consumer attention.

Method

Subjects were presented with prices of nine items at two fictitious stores (Clark's and Taylor's). The items were presented on a computer screen in sets of three, with two of the items favoring Clark's and the other favoring Taylor's. The total price within each set of three was identical at the two stores. Each set appeared on the screen for 30 seconds which, on a proportional basis, is equivalent to 10 minutes for a 60-item list.

The prices were identical across conditions and generally conformed to those in the preceding experiments. That is, the six items that favored Clark's were cheaper at Clark's by an average of $.07. The three items that favored Taylor's were cheaper by an average of $.14. To eliminate ambiguity in the magnitude/frequency trade-off, the distributions of the price differences did not overlap. The price advantages at Clark's ranged from $.04 to $.09; the price advantages at Taylor's ranged from $.12 to $.17.

The particular items were selected from the list used previously. Some small modifications in the prices and/or quantities of the items were made, however, in order to satisfy the experimental requirements. The six items that favored Clark's (and common to both the control and screamer conditions) were items that have been identified in prior research as generating low purchase frequency (Fader and Lodish 1990). The three additional items in the control condition that favored Taylor's were similar in nature. In contrast, the three additional items in the screamer condition were items that are both frequently purchased by consumers and frequently promoted by retail stores (as reported by Fader and Lodish [1990]). In making these selections we avoided items that have high category frequency of purchase but low brand or product-form purchase frequency (e.g., cranberry juice). We also employed intuition in selecting items that would appeal to our subject population. The result was three items that were either generic in nature or high in market share: ground beef, Tropicana orange juice, and a locally popular brand of bread. To maximize salience differences, these three items replaced items in the control condition which, on the basis of intuition, appeared to be particularly nonsalient. Thus, ground beef replaced an aerosol disinfectant, orange juice replaced a stomach remedy, and bread replaced razor blades.

A total of 53 subjects participated, 25 of whom were randomly assigned to the control condition. All subjects received identical instructions and viewed the items in the same order. Afterward, the same three questions were posed, which subjects answered at their own pace. The first question asked subjects to identify the store that was likely to offer lower prices overall. The second question was a continuous variable measure of the first question. It asked subjects to estimate the total price for a basket of goods at Taylor's, given that the basket cost $125 at Clark's. (The range of answers was bounded by $110 and $140.) The third question asked subjects to identify the store they personally preferred, if their goal was to obtain good value.

Results and Discussion

The proportion of subjects choosing Clark's (the high-frequency store) was .88 and .71 in the control and screamer conditions, respectively ($\chi^2 = 2.21, p > .10$). In each condition, the proportion of subjects selecting Clark's was greater than chance ($p's < .05$). Similar results were obtained from the second question. Given a $125 basket price at Clark's, the price estimate for Taylor's was $129.44 in the control condition and $128.61 in the screamer condition ($t < 1$). The difference between each mean and $125 is significantly different from zero ($p's < .01$). Nonetheless, the absolute deviations are relatively small, as might be expected given the very favorable learning conditions. The third question, which tapped personal preference, was consistent with these results but also showed that our item manipulation was effective. The proportion of subjects preferring Clark's was .92 in the control condition but only .64 in the screamer condition ($\chi^2 = 5.79, p < .02$). Thus, replacement of nonsalient items with screamers caused a significant shift toward the store that suffered a frequency disadvantage but possessed a relatively large magnitude advantage on items that are purchased often.

Overall, the results are consistent with the preceding experiments. The influence of the frequency cue was attenuated but not neutralized, even though the study time constraints were greatly relaxed and the frequency advantage possessed by one of the stores was established over a small number of items. The latter point is important because it demonstrates that the results of experiment 1 are robust over smaller samples of items.

FURTHER EXPLORATIONS OF FREQUENCY AND MAGNITUDE

Although our results demonstrate that frequency information exerts a dominating influence on price
perceptions, we have not directly explored the reason for its dominance. Our favored hypothesis is that frequency information is especially salient and/or requires fewer cognitive resources to process. Thus, frequency information is more readily learned than magnitude information. An alternative hypothesis is that subjects are equally sensitive to frequency and magnitude but that small price differences receive proportionally greater “weight” than large price differences. This notion is analogous to Thaler’s (1985) model of consumer choice, which assumes a nonlinear value function. Another possibility is that subjects properly treat the task as a simple arithmetic exercise and attempt to compute a running total of the price difference between the stores but simply fail to compute the differences accurately. Such a model would account for the results, if one assumes that small differences are more accurately computed than large differences and that errors are more likely to underestimate than overestimate the true price difference between stores on an item.

To learn more about how subjects react to the conflicting frequency and magnitude cues, we first examined some additional measures taken in experiments 1, 1A, and 1B. After subjects had responded to the primary dependent measures they were asked to explain informally how they “decided to assign the prices the way they did to the two stores.” Responses from a randomly selected subset of 164 subjects were analyzed and categorized in terms of the rationale they represented. Three rationales, representing 78 percent of the responses, clearly emerged. Not surprisingly, these rationales referred to frequency, magnitude, and prior beliefs. The remaining rationales consisted of mere guessing strategies or were indeterminate.

Frequency rationales (e.g., “The majority of Bi-Lo prices appeared cheaper than Kroger’s”) clearly predominated. Of all 164 responses, 67 percent were identified as frequency related. This represents 87 percent of all identifiable, nonguessing responses. Magnitude rationales (e.g., “Each of the stores had lower prices on certain products, but Bi-Lo had a greater difference of price when it had the lower price”) accounted for only 7 percent of the total sample and 8 percent of the identifiable responses. Prior beliefs (e.g., “I had an already formed belief that Kroger is more expensive. I found no concrete evidence that might suggest otherwise.”) accounted for only 4 percent of all rationales and only 5 percent of the identifiable ones.

These results are consistent with the hypothesis that subjects did not experience a great dilemma in deciding which store was less expensive. Rather, they seemed to be captured by the frequency cue and therefore relied on it quite heavily. Given these suggestive findings, we conducted three additional follow-up studies to obtain a better understanding of subjects’ sensitivity to frequency and magnitude information.

Experiment 4: Memory Study

The first follow-up study was conducted to assess subjects’ understanding of the structure of the price list. Given the absence of a direct measure of information processing, a memory measure was employed to determine the extent to which subjects’ recall of the prices would reflect the frequency and magnitude aspects of the data.

Specifically, the 60-item price list used in the initial experiments was presented to 25 subjects, 12 in the frequency-consistent condition and 13 in the magnitude-consistent condition. Four minutes were allotted for free inspection of the data, with a reminder about time remaining provided at the midway point. Prior beliefs were established by labeling the stores as Winn Dixie (low-priced) and Publix (high-priced). Immediately afterward, a distracter task containing a set of numerical information was administered in order to reduce memory for individual prices. Subjects were then presented with a randomly ordered list of the middle 30 products on the price list, along with the prices of the items at one store, and were asked to recall the prices of the same items at the competing store. Across both groups, the given prices were from the store that possessed fewer price advantages.

For each subject, the average magnitude of the price difference between the stores was computed separately for items that were estimated to be less expensive at the recalled store and items recalled to be more expensive at the recalled store. It is important to remember that the recalled store was always the store that possessed the frequency advantage and magnitude disadvantage. Thus, if subjects are highly sensitive to both cues, they should assign twice as many price advantages to the recalled store but the mean advantage on these items should be half the size of the advantages given to items recalled as more expensive at the recalled store.

Results showed that subjects in the frequency-consistent condition were completely insensitive to magnitude information. In this condition, subjects were asked to recall the prices at Winn Dixie, which enjoyed the frequency advantage on the price list. The mean advantage assigned to items judged less expensive at Winn Dixie was $.084; the mean disadvantage assigned to items judged more expensive at Winn Dixie was $.085. However, subjects did appear sensitive to the frequency differential. Of the 30 items, an average of 18.1 were recalled to be less expensive at Winn Dixie. The mean is directionally correct (true answer = 20) and conforms to prior research on frequency estimation, which routinely reports underestimation of high frequencies. No subjects conferred a frequency advantage on Publix.

The results from the magnitude-consistent condition were noisier. In this condition, Publix enjoyed the frequency advantage on the original list. On the items assigned a lower price at Publix, the mean recalled ad-
vantage was $.074; the mean disadvantage assigned to items recalled as more expensive at Publix was $.097. These means are directionally correct but greatly underestimate the true magnitude difference (which were twice as high at the competing store). On the other hand, frequency awareness appeared lower. On average, Publix was assigned lower prices on 16.2 items. However, five subjects appeared to be driven primarily by prior beliefs, inasmuch as they gave the frequency advantage to Winn Dixie. Alternatively, the interpolated task may have led to confusion regarding which store name was associated with the frequency advantage. Such confusion would be expected to be resolved in favor of prior beliefs.

Overall, the results conform to our previous findings and to our hypothesis regarding process. When prior beliefs are consistent with the frequency cue, magnitude information is virtually ignored; when the frequency cue is inconsistent with prior beliefs, sensitivity to magnitude information is increased but to a relatively small degree.

Experiment 5: Sensitization Study

Given the number of subjects who appeared insensitive to the magnitude information, the next study examined the power of the frequency cue by sensitizing subjects to the trade-off between frequency and magnitude. To test the pure effects of the instructions, prior beliefs were held constant at a neutral level. Two different sets of sensitizing instructions were used, and study time was also varied across two levels (two vs. four minutes). These factors were crossed and manipulated between subjects.

Specifically, subjects were shown the same 60-item price list as in preceding experiments for two or four minutes. The competing stores were labeled Clark’s and Taylor’s, with Clark’s enjoying the frequency advantage. Prior to viewing the prices, subjects were informed that the study concerned prices at competing supermarkets. More important, all subjects were told that different stores adhere to different policies, with some stores discounting many items by small amounts and other stores discounting fewer items but by deeper amounts. A subset of the subjects were also told that such conflicting pricing strategies make it difficult for a consumer to discern which store is less expensive overall. This subset was urged to address the problem by keeping a running total of the price differential across the items they were about to see. These instructions acknowledged the difficulty of the task given the time constraints but encouraged subjects to perform to the best of their ability. All subjects were then allowed to inspect the price list, after which they provided total price estimates for the two stores. Because we expected to obtain highly accurate price estimates, subjects were disallowed from assigning the same price to both stores. Rationales for the price estimates were then solicited.

A natural hypothesis is that relatively high accuracy should arise in both conditions because of the explicit warning regarding the competing pricing strategies (i.e., frequency vs. magnitude). Highest accuracy should obtain from subjects urged to treat the task as an arithmetic exercise. One might also anticipate that subjects given more time to inspect the prices would produce the more accurate judgments.

A total of 64 subjects participated, with the number in each cell of the design ranging from 12 to 20. Results showed that neither the main effects of instruction or time nor their interaction exerted a significant influence on the price differences assigned to the two stores ($F$'s $< 1$). Moreover, there were virtually no differences across conditions in terms of the proportion of subjects who assigned a lower overall price to Clark’s than to Taylor’s (range = .65–.71). Thus, the data were collapsed for ease of exposition.

As in the earlier studies, the price difference score was computed by subtracting the estimate made to the store with the lower number of price advantages (Taylor’s) from the alternative store. Across all subjects, the mean was $-$4.38. This figure is lower than the control condition of experiment 1 but remains significantly different from zero ($t = 4.03, p < .01$). Similarly, the proportion of subjects who assigned a lower price to Clark’s was .67. This figure also represents a move toward greater accuracy but remains above chance ($x^2 = 7.56, p < .01$).

It is not surprising that performance improved. The surprising result is that the influence of the frequency cue remained robust despite our efforts to sensitize subjects to the average magnitude differences between the stores. The power of the frequency cue to overcome the instructions is illustrated by the size of the price differentials reported by subjects who assigned a lower price to Clark’s. These subjects granted Clark’s an average price advantage of $.92 (out of a maximum of $30.00). Only three of these 43 subjects estimated the price difference to be less than $.50. Thus, it is not the case that the subjects possessed highly accurate perceptions but tended to give the benefit of the doubt to the store with frequent price advantages. This outcome must be considered in the context of the heavy-handedness of the sensitizing instructions.

The rationales for the price estimates are also instructive. Of the 41 subjects who provided correct and interpretable rationales, 19 referred exclusively to frequency, one referred exclusively to magnitude, and 21 referred to both. Not surprisingly, the 19 frequency subjects assigned a lower price to Clark’s; the lone magnitude subject assigned a lower price to Taylor’s. Of the 21 subjects who were sensitive to both cues, 13 chose Clark’s. Five of the eight subjects who chose Taylor’s had been given four minutes to process the data and were urged to compute a running total. Thus, there is some evidence for accurate perception but only under the most favorable circumstances.
Experiment 6: Explicit Differentials Study

Our next attempt to enhance the salience of magnitude information vis-à-vis frequency involved the presentation of the actual item-by-item price differences. Using the same price template as in the previous study, subjects were presented with the same 60 items along with the prices at Clark’s. However, the price of each item at Taylor’s was replaced with the positive or negative dollar difference between the Taylor’s price and the Clark’s price. It was computed by subtracting the Clark’s price from the Taylor’s price and therefore was a positive number when Clark’s was less expensive and a negative number when Taylor’s was less expensive. As in the previous study, Clark’s was less expensive on 40 of the 60 items. Thus, the entries under the Taylor’s column consisted of 40 positive-signed price differences and 20 negative-signed price differences. Although such a format heightens the salience of the frequency difference, it simultaneously magnifies the price differences while alleviating subjects of the task of computing them. Freed from this computational task, subjects should be able to devote additional resources to understanding the frequency-magnitude trade-off. If, as the preceding experiments suggest, frequency information is salient under any condition, the explicit portrayal of the magnitude differences along with the reduction in demands on processing capacity should produce much more accurate perceptions of the relative prices at the two stores.

Procedurally, the major change from the previous experiment was in the portrayal of the price information. Corresponding changes were made in the cover sheet of the stimulus booklet. The instructions informed subjects of the format of the price information and the meaning of the ± notation under the Taylor’s column. To prevent the task from becoming a simple arithmetic exercise, subjects were asked to examine the information carefully. No mention was made of the dependent measure. The only manipulated variable was the time allotted to inspect the data, which was set at either two minutes or four minutes. A total of 38 subjects participated, 22 of whom served in the four-minute condition.

Results showed an identical mean price differential (Clark’s minus Taylor’s) of −$7.82 in both conditions. In each condition this mean was significantly different from zero (t’s > 4). Clearly, frequency continued to exert a dominant influence on price estimation that was little affected by the time factor. Categorically, there was only slightly more evidence of higher accuracy in the longer study time condition. Whereas 94 percent of the subjects in the two-minute condition assigned a lower price to Clark’s, 77 percent of the subjects in the four-minute condition did so (p > .10). An inspection of subjects’ rationales revealed that virtually all subjects in the two-minute condition who provided an identifiable rationale relied on the frequency cue. In the four-minute condition, rationales for nine subjects were not elicited due to procedural oversight. However, more than half of the remaining subjects alluded to the magnitude differences (in addition to the frequency differences). It is not surprising that magnitude would be more perceptible to subjects given twice the study time. Nonetheless, the overall means suggest that the frequency cue was still quite potent. It is possible that the positive or negative format not only enhanced perception of the magnitude information but also further heightened the salience of the frequency differential, especially given that subjects were not informed about the ultimate task at the time they inspected the prices.

Taken together, these follow-up studies suggest that people are very sensitive to frequency cues but are somewhat less sensitive to magnitude cues. When conditions are very favorable, such as when processing time is generous or when subjects are prompted to attend to both cues by instructions or by presentation formats that explicitly convey magnitude cues, accuracy naturally improves. Nonetheless, even under these conditions, subjects appear to be influenced disproportionately by the frequency cue. Thus, these studies confirm our hypothesis regarding the inherent salience and persuasiveness of frequency cues. We found little evidence to support the alternative hypotheses that subjects are equally sensitive to frequency and magnitude but weigh the former more heavily or that the bias to favor the store with the frequency advantage is due to computational deficits.

GENERAL DISCUSSION

The level of correspondence between these results and previous research differs depending on the domain selected for comparison. Correspondence is lowest to a wide variety of research showing that prior beliefs produce pervasive biases that distort the encoding and retrieval of data in ways that reinforce those beliefs. In our experiments, prior beliefs were operationalized in several ways, all of which appeared to establish firm price expectations. More extreme beliefs are possible, in principle, but the beliefs in the present experiments were designed to be strong within the context of truly competing grocery stores. Moreover, the data were explicitly designed to be ambiguous. Under these conditions of relatively strong prior beliefs and ambiguous data, prior research argues for the dominance of prior beliefs. Our results, therefore, attest to the seductiveness of frequency cues.

To some extent, the results are inconsistent with the notion that conflict among cues results in deeper processing and therefore accurate judgments. We did find that a conflict between prior beliefs and the frequency cue increased the accuracy of subjects’ price perceptions, but the effect was not dramatic. However, in no instance were perceptions biased in favor of prior beliefs when the beliefs conflicted with the frequency cue, nor did a conflict between prior beliefs and the frequency cue produce a level of processing intensity required for
accurate price perceptions. An explicit test of search in experiment 2 found no difference between the magnitude-consistent and frequency-consistent conditions in terms of the amount of data sampled.

The results are more consistent with pricing studies showing that consumers attend to promotional signals but may pay little attention to the magnitude of savings to be realized from special promotions (Dickson and Sawyer 1990; Inman et al. 1990; see also Inman and McAlister 1993; Mayhew and Winer 1992). In those studies, however, consumers were either harried by the demands of everyday shopping and unaware of the subsequent price estimation task when making their selections or they performed a task that made large demands on memory. Our subjects were explicitly informed of the need to attend to the prices, and the task was often stimulus-based in order to minimize demands on memory. In the case of experiment 2, subjects were given precise instructions about the nature of the judgment task and were provided incentives for a correct judgment. Moreover, correct judgments did not require extensive processing of the entire stimulus array. Deep processing of any reasonable subset of the items would have revealed the nature of the price structure. These observations further attest to the biasing effects of frequency cues.

In this vein, our results bear on a popular model of human persuasion. Prior research has suggested that the frequency cue, as with other peripheral cues, is particularly persuasive when involvement or knowledge is low or when information load or the number of decisions required is high (Alba and Marmorstein 1987; Petty and Cacioppo 1984; Russo and Dosher 1983). The present results show that the persuasiveness of the frequency cue may be somewhat greater than implied by the literature. Within experiments, we found that information load (operationalized as study time) had only weak effects on price perceptions. Across experiments we showed that motivation and information load were similarly weak moderators of the influence of the frequency cue. In experiment 2, subjects were provided a reasonably strong incentive to attend to the stimuli and make correct decisions; in experiment 3, a generous amount of time was allotted to process a small number of items; in the follow-up studies, various aspects of the stimuli were made salient. Nonetheless, in virtually all instances the frequency cue was dominant. We do not suggest that this result provides compelling evidence against popular persuasion models. In no experiment did we allow subjects to inspect the data completely free of time pressure. Thus, subjects' ability to process the data was always constrained to some extent. However, given the lack of processing time effects, it appears that the frequency cue may have been perceived as diagnostic to price judgements, causing subjects to truncate processing of the data even when additional processing could have led to more accurate judgments.

Finally, our results are consistent with the limited amount of research that has allowed for frequency effects. However, we are able to extend that research considerably not only by contrasting frequency with prior beliefs but also by virtue of our stimuli. In most prior research the stimuli were constructed in such a way that the majority of attributes favoring one alternative were not commensurate. In such instances it is understandable for decision makers to lapse into a "counting" mentality and choose the alternative that is superior on the majority of dimensions (cf. Russo and Dosher 1983).

In our experiments, however, the differences across items (dimensions) were expressed in a common metric (dollars) and the task implied an equal weighting of each dimension. Thus, the use of a frequency heuristic to discriminate between alternatives was unnecessary.

It might be argued that the time constraints imposed on our subjects ensured reliance on the frequency heuristic. Although it is highly likely that accurate performance would have been achieved had subjects been given unlimited time (and calculators) to perform the task, it does not follow that limits on time or mathematical ability would necessarily lead to dominance by the frequency cue. Indeed, a prediction that is more plausible on the basis of prior research is that time constraints should ensure the dominance of prior beliefs over data (Alloy and Tabachnik 1984; Pechmann and Ratneshwar 1992).

Why then was the frequency cue so influential? Additional research involving process measures may be needed before a definitive answer can be provided. It is likely that part of the answer lies in the ease with which the frequency of an event's occurrence is encoded and remembered (see Hasher and Zacks 1984). Analogously, Bettman, John, and Scott (1988) have shown that the existence of easily encoded data and a mechanical heuristic can provide immunity to the biasing effects of prior beliefs on correlation perception. However, ease of encoding can be only part of the explanation, inasmuch as other cues in the stimulus array were also easy to process. It may be the case that a frequency heuristic, like other heuristics, is persuasive by virtue of its plausibility (cf. Arkes 1991). Options that are superior on most dimensions are often superior overall. Thus, placing equal weights on all dimensions may lead to acceptable decisions while saving a considerable amount of effort. Given the ease of use and plausibility of the frequency cue, consumers may forego deeper processing even when the opportunity exists and prior beliefs appear to be violated.

The effectiveness of the frequency cue may partially explain why comparative and informationally dense advertising remain pervasive despite the increasingly demanding time pressures faced by consumers (Zeithaml 1985). The inherent difficulty in determining retail store price positions (Brown and Oxenfeldt 1972) may prompt consumers to rely on visible extrinsic cues and to peruse newspaper advertisements and fliers on a reg-
ular basis (Progressive Grocer 1993). Advertising that presents large numbers of price specials may reinforce consumer beliefs about the competitiveness of a store’s prices.

Limitations and Future Research

We have tried to argue that the relative influence of the frequency cue was given a fair test. We investigated the effect across an array of stimulus and motivational conditions. Our stimuli were fairly representative of the real world of retail grocery, hardware, and appliance advertising. Our subjects were consumers who shop at the stores of interest and who possess mathematical skills that presumably exceed the national average. It seems unlikely, therefore, that our results are an artifact of the experimental situation. Nonetheless, additional research is necessary to understand the boundary conditions of the effect. Such research would examine processing constraints that are more relaxed, different frequency ratios, larger price magnitude differences, and prior beliefs that are more extreme or are held more resolutely. To the extent that the effect remains robust, future research should focus on implications for public policy. As Inman et al. (1990) note, lack of vigilance to absolute prices may enable retailers to promote heavily while offering little in the way of actual monetary saving to the consumer.

Additional research is also required to understand reactions to competing price signals when the consumer is in control of search. In our experiments we have tried to compare the frequency cue to magnitude data, store image, screamer items, and discount cues. In most cases, however, the subject was compelled to process all the information. The salience of these cues, and therefore their influence on price perceptions, is unknown for contexts in which they compete for attention on unequal footing. One approach would be to employ computer-based shopping methods, which would allow assessment of how consumers form price beliefs when direct store-to-store price comparisons are hindered by the natural sequential nature of shopping (cf. Burke et al. 1992).

Finally, our emphasis on the frequency cue was guided in part by a more general and pragmatic interest in store price image rather than brand price image. However, the existence and influence of frequency cues need not be limited to retail stores if dynamic aspects of price are considered. Market researchers increasingly have expressed interest in the effects of promotion on individual brands. In some categories, promotion occurs quite often. Thus, frequency of promotion and its relative influence vis-à-vis depth of promotion represents an important question that is only beginning to be addressed (e.g., Inman et al. 1990; Kalwani and Yim 1992).

### APPENDIX

A Sample of the Stimuli Used in Experiment 1 (No-Priors Condition)

<table>
<thead>
<tr>
<th>Product Description</th>
<th>Clark's Price</th>
<th>Taylor's Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 oz. Oscar Mayer bologna</td>
<td>1.89</td>
<td>1.95</td>
</tr>
<tr>
<td>7 oz. Banquet chicken pie</td>
<td>.73</td>
<td>.78</td>
</tr>
<tr>
<td>10.5 oz. Progresso clam sauce</td>
<td>1.49</td>
<td>1.34</td>
</tr>
<tr>
<td>15.5 oz. Ragu pizza sauce</td>
<td>1.28</td>
<td>1.35</td>
</tr>
<tr>
<td>32 oz. Wesson corn oil</td>
<td>2.18</td>
<td>2.21</td>
</tr>
<tr>
<td>15 oz. Quaker cinnamon Life</td>
<td>2.03</td>
<td>1.85</td>
</tr>
<tr>
<td>18 oz. Welch’s grape jelly</td>
<td>1.25</td>
<td>1.32</td>
</tr>
<tr>
<td>100 ct. Red Rose tea bags</td>
<td>2.88</td>
<td>2.91</td>
</tr>
<tr>
<td>6.25 oz. Starkist light tuna</td>
<td>.73</td>
<td>.62</td>
</tr>
<tr>
<td>48 oz. Kraft mayonnaise</td>
<td>2.44</td>
<td>2.53</td>
</tr>
<tr>
<td>15 oz. Kellogg raisin bran</td>
<td>2.35</td>
<td>2.44</td>
</tr>
<tr>
<td>32 oz. Heinz ketchup</td>
<td>1.25</td>
<td>1.14</td>
</tr>
<tr>
<td>32 oz. Vlasic Polish dills</td>
<td>2.03</td>
<td>2.12</td>
</tr>
<tr>
<td>24 oz. Log Cabin lite syrup</td>
<td>2.44</td>
<td>2.57</td>
</tr>
<tr>
<td>48 oz. Ocean Spray cran-raspberry juice</td>
<td>2.09</td>
<td>1.93</td>
</tr>
<tr>
<td>24 oz. Hershey’s chocolate syrup</td>
<td>1.80</td>
<td>1.65</td>
</tr>
<tr>
<td>22 oz. USDA Grade “A” Cornish hens</td>
<td>2.07</td>
<td>2.22</td>
</tr>
<tr>
<td>46 oz. HI-C Drinks—assorted flavors</td>
<td>.91</td>
<td>.96</td>
</tr>
<tr>
<td>1 lb. Farmland-Smoked sliced bacon</td>
<td>2.34</td>
<td>2.17</td>
</tr>
<tr>
<td>16 oz. Mueller’s spaghetti</td>
<td>.90</td>
<td>.95</td>
</tr>
<tr>
<td>20 oz. Tide detergent</td>
<td>1.25</td>
<td>1.28</td>
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<tr>
<td>50 oz. Musselman’s apple sauce</td>
<td>1.97</td>
<td>1.83</td>
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<tr>
<td>7 oz. Uncle Ben’s Minute Rice</td>
<td>.98</td>
<td>1.06</td>
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<tr>
<td>26.5 oz. Nestea ice tea mix</td>
<td>2.79</td>
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<tr>
<td>12 oz. Lysol disinfectant spray</td>
<td>3.19</td>
<td>3.05</td>
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<tr>
<td>48 ct. Dixie-9” paper plates</td>
<td>1.74</td>
<td>1.87</td>
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<tr>
<td>10 oz. Wheat Thins crackers</td>
<td>2.22</td>
<td>2.29</td>
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<tr>
<td>12 oz. Thomas’ English muffins</td>
<td>1.69</td>
<td>1.75</td>
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<tr>
<td>10.5 oz. Jenger’s liquid soap</td>
<td>1.27</td>
<td>1.38</td>
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<tr>
<td>46 oz. V-8 vegetable cocktail juice</td>
<td>1.18</td>
<td>1.22</td>
</tr>
</tbody>
</table>

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### REFERENCES


