

Size Does Matter: The Effects of Magnitude Representation Congruency on Price Perceptions and Purchase Likelihood

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The numerical cognition literature suggests that numerical stimuli (and hence prices) are represented and encoded in memory as magnitude representations (i.e., judgments of relative “size”). The magnitude representation associated with the numerical value of a price may be the same as (congruent) or different from (incongruent) the magnitude representation associated with some other related dimension. We conducted 3 experiments to examine the effects of congruent versus incongruent magnitude representations on price perceptions and purchase intentions. We find that congruent magnitude representations result in more favorable price knowledge (i.e., greater value perceptions and lower price judgments) and increased purchase likelihood. Our findings suggest that consumers are not consciously aware of the role of magnitude representations in influencing price perceptions.

For more than a century, researchers have considered the manner in which consumers process price information. An assumption of classical economic theory is that comparative price information is processed in a conscious, deliberate, and rational manner (Marshall, 1890). Consumers are presumed to have perfect information about the prices for a set of products, as well as the utility received from those products. Such may be the case in retail point-of-purchase settings, in which prices can be directly observed and compared. However, recent studies have demonstrated that buyers do not always process pricing stimuli in a conscious, deliberate manner, but instead frequently rely on the nonconscious, automatic processing of price information (Coulter, 2003; Xia, 2003). These consumers make decisions based on what they implicitly know, rather than what they explicitly remember (Krishnan & Chakravarti, 1999; Monroe & Lee, 1999).

When price information is processed at a nonconscious level it receives minimal attention. Consumers typically demonstrate a lack of price awareness and are unable to recall the exact price of the product at a later time. Nonetheless

those same consumers who are unable to consciously remember and report the exact price of the product may still judge the product as “expensive,” a “bargain,” or “a good deal.” In other words, implicit estimates regarding the price and value of the product can still be made. These assessments may drive purchase decisions in the absence of more concrete empirical information (Roediger & McDermott, 1993).

In practice, consumers’ processing of price information typically involves both conscious and nonconscious processes. Consumers may attend to a pricing stimulus and process the comparative price information in a conscious, deliberate, and rational manner, yet nonconscious processes may operate simultaneously at encoding to influence price and value assessments, and hence purchase choice. For example, buyers might attend to the \$99 sale price of an item and consciously attribute a certain “value” to that item based upon the amount it is discounted from the stated “regular” price. However that valuation might also be (nonconsciously) influenced by some other aspect of the stimulus. In the case of a comparative price advertisement, those aspects of the stimulus influencing value perceptions could involve any number of peripheral cue elements such as color, spokesperson, or layout (Babin, Hardesty, & Suter, 2003; Coulter, 2002). If no such executional cues are present, research on numerical

cognition suggests that certain properties of the numbers themselves may influence the manner in which a price is perceived (Xia, 2003).

Recent studies suggest that numerical stimuli are nonconsciously and automatically represented and encoded in memory as magnitude representations. Magnitude representations are judgments of relative “size” arrayed in analog format along a left-to-right oriented mental number line, and may reflect either the exact value (e.g., 8), or an approximation of the exact value (e.g., “large”) of the number (Dehaene, 1992; Dehaene, Bossini, & Giroux, 1993). Studies have demonstrated that consumers accomplish the encoding and retrieval of magnitude representations effortlessly, automatically, and apparently without awareness (Pavese & Umiltà, 1998; Tzelgov, Meyer, & Henik, 1992). Research further suggests that the magnitude representation that sustains the processing of numeric value may be highly related to the underlying magnitude code that sustains the processing of physical stimuli (Dehaene & Akhavein, 1995). Thus, interference may ensue if the magnitude representation associated with the numeric value of a number (e.g., large) is inconsistent with the magnitude representation associated with the physical size or appearance of that number (e.g., small).

In this article, we report on three experiments designed to examine the effects of certain size-related dimensions on price perceptions in a comparative price context. In Experiments 1 and 3, these dimensions involve numeric value and physical font size. In Experiment 2, the dimensions involve numeric value and a size-related verbal product description. Our research contributes to the literature on the processing of price information in several important respects. First, we examine whether the same size–value congruency effects that have been demonstrated to occur in the case of immediate reactions to simple numeric digits (Dehaene, 1989; Dehaene & Mehler, 1992) also occur with regard to the encoding and retrieval of price information. Second, we investigate these effects not only in terms of price and value assessments, but also in terms of purchase likelihood and brand choice. Third, we examine whether the same interference effects that occur as a result of physical font size also occur as a result of another, less closely related dimension (i.e., verbal description).

We investigate and compare size–value congruency effects under conditions of both low (Experiments 1 and 2) and high (Experiment 3) involvement, and in the context of high versus low prices for both a single brand (Experiments 1 and 2) and multiple brands (Experiment 3). The involvement manipulation allows us to examine such practical issues as whether the retailer desiring to draw attention to his or her low-price advantage needs to sacrifice consumer awareness in order to take advantage of numeric size—value congruency effects. The single versus multiple price manipulation allows us to examine whether individual item price and value assessments may generalize to an entire product line. Thus, our findings proffer a significant contribution toward the understanding of consumer processing of price information.

BACKGROUND AND THEORETICAL DEVELOPMENT

Numerical Cognition

As noted previously, the numerical cognition literature suggests that numerical stimuli are represented and encoded in memory as magnitude representations (i.e., “size” determinations; Tzelgov et al., 1992). To perform quantitative comparisons between numbers, people must retrieve these referent quantities. One type of quantitative comparison of particular interest to the present study involves distinguishing between the numerical size of digits (Dehaene, 1989). The procedure typically employed in investigating this type of comparison is to have participants view target numerals on a computer screen, and to register comparative judgments (i.e., discern which of the two numerals is “largest,” “smallest,” “highest,” or “lowest”) by pressing either a right- or left-hand key on a computer keyboard (Pavese & Umiltà, 1998). Reaction time in milliseconds is then recorded.

Research has demonstrated that when participants are attempting to determine the larger (smaller) of two numerals, response time is shorter if the larger (smaller) of the compared numerals is displayed in larger (smaller) font size (Dehaene, 1989). Conversely, if the opposite condition applies (i.e., if the larger of the two numerals is displayed in smaller font, or the smaller of the two numerals is displayed in larger font), the size dimension appears to interfere with participants’ judgments of numerical magnitude, resulting in longer response times. This has been termed the “size congruency effect” (Dehaene, 1989).

Interference paradigms have been widely employed to investigate the manner in which magnitude representations are activated when nonrelevant or interfering visual objects are displayed (Dehaene & Akhavein, 1995). Research has demonstrated that the degree of interference depends on the strength of the semantic association between the category of the non-relevant dimension (e.g., physical size), and the category of the response (e.g., numerical value; Fox, Shor, & Steinman, 1971; Pansky & Algom, 1999). Because numerical magnitude (value) and physical magnitude (size) are highly related dimensions, interference occurs in the case of size incongruency (Dehaene & Mehler, 1992). However, evidence of the existence of a “semantic gradient” effect (Dehaene, Dupoux, & Mehler, 1990) raises the possibility that other, perhaps less closely related dimensions, may cause this same type of interference.

Processing Comparative Price Information

Consumers make comparative price judgments when they are exposed to high versus low pricing stimuli for an individual product or brand. One of the most common contexts in which this occurs is a comparative price advertisement (Biswas & Blair, 1991; Biswas, Pullig, Krishnan, & Burton,

1999; Compeau, Grewal, & Chandrashekar, 2002). In the case of the individual firm, the two compared prices may be the higher “regular” price, and the lower “sale” price. In the case of competing firms, the two prices may involve a side-by-side comparison of the sale prices of the item or items in question (e.g., “their” price and “our” price) (Krishna, Briesch, Lehmann, & Yuan, 2002). Research suggests that customer value perceptions may be increased through comparative price advertising, because the higher “regular” or “competitor’s” prices serve as externally-supplied reference prices that enhance perceived transaction value by reducing the perceived benefits of search (Urbany, Bearden, & Weilbaker, 1988).

Because both numbers and prices are represented in memory as magnitude representations (Monroe & Lee, 1999), we expect the same size congruency effects that have been demonstrated to occur when comparing simple numeric digits to also occur when comparing prices (Xia, 2003). Further, because research suggests that the magnitude representations associated with both relevant and nonrelevant numeric dimensions may be automatically and nonconsciously represented in memory upon stimulus exposure (Adaval & Monroe, 2002), we expect that size-incongruent interference should manifest itself not only in terms of immediate response times, but also in terms of the processing and encoding of price information (i.e., as price and value assessments; Coulter, 2003). Finally, because studies indicate that the standards people use when evaluating product prices can be formed unintentionally, and may be influenced by exposure to stimuli of which they are not consciously aware (Bargh, 1997), we expect that consumers will not be cognizant of the role of “size” in driving their price attributions.

We speculate that the psychological processes leading to numeric size–value congruency effects may be similar to those processes reported in the context effects literature. Research has demonstrated that the advertising context can influence viewers’ interpretations of product information in the ad by “priming” (i.e., providing exposure to) certain product attributes (Wyer & Srull, 1981). Exposure to an attribute increases its accessibility from memory (i.e., “brings it to mind”; Yi, 1990). An accessible attribute is subsequently more likely to be used in processing ad information and in forming or altering beliefs about the advertised brand, which ultimately affects brand evaluations (Mitchell & Olson, 1981). If the primed attribute has positive implications for the evaluation of the advertised brand, overall brand evaluations may be enhanced (Martin, Seta, & Crellia, 1990). Conversely, if the primed attribute has negative implications for the evaluation of the advertised brand, overall brand evaluations may be diminished.

In the case of numerical size–value congruency, what is “primed” is not an attribute (i.e., price) but rather a rating on an attribute (i.e., low or small). Nevertheless those attribute ratings may still have positive or negative implications for the evaluation of the advertised brand. Further, recent research

suggests that the standards people construct in judging product prices can be influenced by attribute ratings (values), even though the attributes themselves are objectively irrelevant to the products that are being evaluated (Adaval & Monroe, 2002). Thus, we expect that the generation of congruent and incongruent magnitude representations (i.e., reflecting attribute values) will impact price perceptions. In Experiment 1, we examine the effects of numerical size and value congruency on perceptions of a single low sale price.

Experiment 1

Research indicates that consumers typically attribute greater value to a particular brand at a lower price than to that same brand at a higher price (Monroe, 2003). Consider, then, a one-page ad containing a comparatively high (standard) price and a comparatively low (sale) price for a single item within a particular product category. The lower price is displayed in either smaller font such that the numerical and physical size dimensions are congruent (e.g., \$12–10), or larger font such that the numerical and physical size dimensions are incongruent (e.g., \$12–10). In the case of the congruent physical size dimension, we argue that the corresponding magnitude representation should facilitate price comparisons. That is, consumers should be better able to encode the sale price as having been “lower” or “smaller” than the standard high price, and the standard price as having been “higher” or “greater” than the low sale price. As a result, consumers should perceive the difference between the standard high price and low sale price as greater, and the superior price or value assessments that they would typically associate with a comparatively low sale price should be reinforced or strengthened. The augmented value assessments should lead to greater demand for the low-priced item, and reduce the perceived benefits associated with external search for a better deal.

Conversely, in the case of the incongruent size and value dimensions, the high or large magnitude representation associated with the physical size of the sale price font should make it more difficult for consumers to encode the sale price as low or small. As a result, the difference between the standard high price and low sale price should be perceived as less, and the superior price or value assessments typically associated with a comparatively low sale price should be weakened or reduced. The reduced value assessments should lead to lower demand for the low-priced item, and increase the perceived benefits of search (Grewal, Krisnan, Baker, & Boring, 1998; Grewal, Monroe, & Krishnan, 1998). Thus we expect the following:

- H1: When the magnitude representations associated with numerical value and physical font size are congruent: (H1a) the perceived benefits of searching for a lower sale price will be less, (H1b) the perceived price and value assessments will be more favorable, and (H1c)

the demand associated with a low (sale) price will be greater, than when they are incongruent.

Method

Procedures. Our sample consisted of 65 graduate and undergraduate students from a major U.S. university. Participants received partial course credit for participation in the study, which took place in a classroom setting. (There was no duplication of participants across any of our three experiments.) Participants were randomly assigned to one of the two (congruent or incongruent) treatment groups. Because research involving the nonconscious processing of price information typically occurs in a low involvement setting (Krishnan & Chakravarti, 1999; Monroe & Lee, 1999), participants were distracted from focusing on the price information in the target ad. Instead they were told that they would be analyzing a video case study involving a retail department store chain, and as background for the case study were asked to first look through a booklet containing eight print ads for products carried by that retail chain.

The target ad for a fictitious brand of in-line skate (the “Earthquake Pro Aggressive”) was the next to last ad. The target ad contained a headline, copy, illustration, and price information (i.e., the regular price and the sale price). In the congruent condition, the higher regular price appeared in larger font than the lower sale price (see Appendix A, Experiment 1); in the incongruent condition, the higher regular price appeared in smaller font than the lower sale price. The other ads, also for fictitious brands, were visually similar to the target ad, however they did not contain price information. Immediately after viewing the stimulus booklet, participants were exposed to a brief “filler” infomercial for a retail store chain, which did not contain price information. After viewing the infomercial, participants completed a paper and pencil questionnaire.

Measurement. Perceived search benefits were assessed with a 7-point Likert-type scale, ranging from 1 (*very unlikely*) to 7 (*very likely*) that asked participants how likely they would be to find the Earthquake in-line skate at a better price at a different location (Urbany et al., 1988). Price and value assessments were measured by asking participants to rate the sale-priced target brand first on a 7-point scale ranging from 1 (*more expensive*) to 7 (*less expensive*), and second on a 7-point scale ranging from 1 (*less value*) to 7 (*more value*; Coulter, 2003; Krishnan & Chakravarti, 1999; Monroe & Lee, 1999). Purchase likelihood was assessed by asking participants to assume they were in the market for a brand of in-line skate, and to rate how likely they would be to purchase the Earthquake Pro Aggressive (at sale price) along a 7-point scale ranging from 1 (*very unlikely*) to 7 (*very likely*). To assess ad involvement and processing motivation, participants completed two 7-point Likert-type scale items (paid attention to the advertisement; was involved in the ad; Laczniaak &

Muehling, 1993). The scale formed by the unweighted average of the two items had a Cronbach’s alpha of .90.

Participants also completed two processing-check measures designed to assess the extent to which they were aware of the nonrelevant dimension. First, participants were asked to recall which of the two fonts was larger in size—that of the regular price or that of the sale price (a third possible response was “unable to recall”). Second, participants were asked to rate the degree to which the size of the font influenced their value assessments on a 7-point scale ranging from 1 (*not at all*) to 7 (*very much*).

Two additional questions measuring participants’ attention to the regular and sale prices served as confound checks. Because it is conventional in printed communication for large type to indicate the importance of information and thereby attract attention to it, we wanted to ensure that participants did not look first and longest at the large font prices. If those large font prices happened to be the standard prices (congruent condition), then participants next would need to look at the sale prices to learn what the “actual” selling prices were. However, if those large font prices *were* the sale prices (incongruent condition), then participants would need to look no further to learn the actual cost of each item. In other words, price-reduction effects could be attenuated in the incongruent condition simply because participants pay less attention to the standard price. To assess this possibility, participants rated the degree of attention that they paid to (a) the regular price and (b) the sale price on two 7-point scales ranging from 1 (*not at all*) to 7 (*very much*).

To avoid any priming effects, the purchase likelihood questions were asked first, followed by the price and value assessments, search benefits, involvement, and finally the processing check and confound questions.

Results

Processing and confound checks. The processing motivation and ad involvement rating ($M = 2.58$) lends face validity to our contention that this experiment reflected low involvement conditions. Involvement means were subsequently compared across experiments. The processing checks indicated that a significant majority of participants (58) were unable to recall which of the stimulus prices had appeared in larger font, $\chi^2(2, N = 65) = 91.42, p < .001$. Of those who reported that either the regular or sale price was larger (7), three were incorrect. Additionally, participants’ evaluations of the degree to which the size of the font influenced their value assessments resulted in a mean rating of 1.12 on a 7-point scale ranging from 1 (*not at all*) to 7 (*very much*). There was no significant difference in mean rating across congruent and incongruent groups, and the number of participants reporting that the size of the font influenced their value assessments *not at all* (57) was significantly greater, $\chi^2(1, N = 65) = 40.02, p < .001$, than the number of participants (8) choosing any of the other six scale categories. These re-

sults indicate that participants were not consciously aware of the effects of font size on their judgments at the time that price and value assessments were reported. The results do not rule out the possibility that participants consciously perceived font size differences at the time of encoding, but later failed to recall them. We address this possibility in our General Discussion section.

Our confound check revealed no significant difference, $t(64) = 1.32, ns$, in degree of attention paid to the regular ($M = 2.15$) versus sale ($M = 2.42$) prices. The same (nonsignificant) results occurred when both the congruent, $t(31) = .30, ns$, and incongruent, $t(32) = 1.67, ns$, subsamples were examined individually. Further, there was no significant difference, $t(63) = .61, ns$, in degree of attention paid to the sale price across congruent (small type; $M = 2.50$) versus incongruent (large type; $M = 2.33$) conditions, and no significant difference, $t(63) = 1.49, ns$, in degree of attention paid to the regular price across congruent (large type; $M = 2.34$) versus incongruent (small type; $M = 1.97$) conditions. Of course, our results do not eliminate the possibility that participants could have paid differing degrees of attention at encoding which they later failed to recall. However we have no reason to expect that the degree of forgetting varied across congruent versus incongruent conditions. Thus, differing degrees of attention caused by the size of the larger or smaller fonts is effectively ruled out as a possible explanation for attenuated price-reduction effects in the incongruent condition.

Dependent variables. To examine our hypotheses, we conducted a series of t tests comparing responses across congruent versus incongruent conditions. Although the same pattern of significant results was observed across the total sample, only those participants who reported being unable to recall which of the stimulus prices had appeared in larger font were considered in our analysis (see Table 1). As expected, the perceived benefits of searching for a lower sale price were less, the perceived price and value assessments were more favorable, and the purchase likelihood was greater when the numerical value and physical font size dimensions were congruent, than when they were incongruent. Thus H1a, H1b, and H1c are supported.

Summary

Results from Experiment 1 support our hypotheses, and the processing and confound checks support our contention that the influence of size on consumer-price inferences occurs without conscious awareness. Nonetheless, an alternative explanation for our findings is that value assessments were enhanced because consumers either consciously or nonconsciously preferred the appearance or aesthetic layout associated with having the lower price displayed in smaller font. To test for this possibility, we conducted a second experiment in which we employed a nonrelevant magnitude representation dimension other than physical size (i.e., verbal product description).

EXPERIMENT 2

As we have noted, the “semantic gradient effect” suggests that dimensions other than physical size may cue the encoding of magnitude representations (Coulter, 2003; Dehaene et al., 1990; Fox et al., 1971; Klein, 1964; Pansky & Algom, 1999; Proctor, 1978). Thus, as was the case with physical size and value congruency, we posit that a congruent magnitude representation on a nonrelevant, semantically related dimension will reinforce the superior value assessments typically associated with a comparatively lower sale price. Conversely, an incongruent magnitude representation on a nonrelevant dimension will weaken the superior value assessments typically associated with a comparatively lower sale price. If Experiment 2 yields an identical pattern of results to Experiment 1, then we can safely conclude that it is the impact of size or magnitude (rather than some other factor such as aesthetic layout) that is affecting price inferences. We expect the following:

- H2: When the magnitude representations associated with numerical value and a related dimension are congruent: (H2a) the perceived benefits of searching for a lower sale price will be less, (H2b) the price and value assessments will be more favorable, and (H2c) the demand associated with a low (sale) price will be greater, than when they are incongruent.

Method

Sixty-two graduate and undergraduate students from a major U.S. university participated in Experiment 2. In this experiment we replicated the procedures and measures used in Experiment 1, but altered the target ad. Rather than varying the size of the physical font, the ad’s verbal product-attribute descriptors were manipulated to cue either a high or low magnitude representation. More specifically, the term *Low Friction* (with **Low** highlighted in bold letters) was utilized to manipulate a small magnitude representation (see Appendix A, Experiment 2), whereas the term *High Performance* (with **High** highlighted in bold letters) was utilized to manipulate a large magnitude representation.

An attribute-importance confound check, in which participants were asked to rate the importance of a number of in-line skate attributes on scales of 1 (*not at all important*) to 5 (*very important*), was also included. Our manipulation would be successful if there was no significant difference between the importance ratings of the low friction and high performance attributes. In addition, participants were asked to rate the degree to which the high or low attribute associated with the sale price influenced their value assessments on a 7-point scale ranging from 1 (*not at all*) to 7 (*very much*).

Results

Processing and confound checks. Our attribute importance measure revealed no significant difference in impor-

tance, $t(60) = 1.86$, *ns*, between the low friction ($M = 2.97$) and high performance ($M = 3.12$) attributes. With regard to the processing checks, participants' evaluations of the degree to which the high–low attribute influenced their value assessments resulted in a mean rating of 1.84 along the 7-point scale ranging from 1 (*not at all*) to 7 (*very much*). Further, there were no significant differences in mean rating across congruent versus incongruent groups, and the number of participants reporting that the high–low attribute influenced their value assessments *not at all* (42) was significantly greater, $\chi^2(1, N = 62) = 31.68$, $p < .001$, than the number of participants (20) choosing any of the other six scale categories. Thus as in Experiment 1, processing check measures support our contention that participants were unaware of the role of “size” in driving their price and value assessments.

Experiment 2 (like Experiment 1) was intended to reflect a low involvement context. The ad-involvement rating ($M = 2.77$) lends face validity to our contention that this experiment reflected low involvement conditions. Examination of our attention variables revealed that a significantly greater, $t(61) = 4.62$, $p < .001$, degree of attention was paid to the sale ($M = 4.19$) than to the regular ($M = 3.18$) price, perhaps due to the fact that the high or low attribute information drew attention to the lower right-hand corner of the ad. However, the degree of attention paid to the sale price was not significantly greater, $t(60) = .95$, *ns*, in the congruent ($M = 4.38$) than in the incongruent ($M = 4.00$) condition, and the degree of attention paid to the regular price was not significantly greater, $t(60) = 1.16$, *ns*, in the congruent ($M = 3.34$) than in the incongruent ($M = 3.00$) condition. These results argue against differing degrees of attention caused by the high or low attributes as contributing toward dependent variable results.

Dependent variables. As in Experiment 1, *t*-test analyses were used to test our hypotheses. Although the same pattern of results was observed across the total sample, only those participants who reported that the high or low attribute influenced their assessments *not at all* were considered in our analyses. As expected, the perceived benefits of searching for a lower sale price were less, the value assessments were more favorable, and the purchase likelihood was greater, when numerical value and verbal description dimensions were congruent, than when they were incongruent (see Table 1). Thus H2a, H2b, and H2c are supported. Although results were in the predicted direction, participants in the congruent condition did not perceive the skate sale price as significantly less expensive than participants in the incongruent condition (see Table 1).

Summary

In both Experiments 1 and 2 we examine the effects of congruent versus incongruent magnitude representations on (sale) price perceptions involving a single item. Results lend support to our hypotheses. In a variety of contexts (e.g., catalogs, retail outlets), however, consumers are often exposed to

TABLE 1
Experiments 1 and 2: Search Benefits, Implicit
Price and Value Judgments, and Purchase
Likelihood Mean Values

	<i>Congruent Condition</i>	<i>Incongruent Condition</i>	<i>t^a</i>
Experiment 1			
Search benefits	3.12	4.19	2.80**
Price judgment ^b	4.65	3.28	4.29***
Value judgment ^c	4.31	3.31	2.93**
Purchase likelihood	4.54	3.63	2.73**
Experiment 2			
Search benefits	3.57	4.48	2.18*
Price judgment ^b	4.05	3.48	1.62
Value judgment ^c	4.00	3.38	2.15*
Purchase likelihood	4.38	3.67	2.17*

^a*t*-value degrees of freedom: 56 for Experiment 1; 40 for Experiment 2.

^bOn a 7-point scale ranging from 1 (*more expensive*) to 7 (*less expensive*).

^cOn a 7-point scale ranging from 1 (*less value*) to 7 (*more value*).

* $p \leq .05$. ** $p \leq .01$. *** $p \leq .001$.

comparative price advertising that includes *multiple* prices for a myriad of items (e.g., in list format). In such contexts it is possible that the necessity of processing an assortment of prices could attenuate the numeric size–value congruency effects associated with any one particular item. Conversely, it is possible that the numeric size–value congruency effects associated with one item (or a group of items) could generalize to other items within that product line. Thus our third experiment is designed to assess whether the same size–value congruency effects associated with individual-item price comparison ads will generalize to a multiple price presentation context.

The simplest multiple price presentation context would involve a single location's standard versus sale prices, for example, a price list containing comparatively high (standard) and low (sale) prices for several items within a particular product category. In this case, the lower prices could all be displayed in either smaller font, such that the numerical value and physical size dimensions are congruent, or larger font such that the numerical value and physical size dimensions are incongruent. In the case of the congruent lists, we would expect that the corresponding magnitude representations should facilitate price comparisons for all of the items in the list—that is, because “small” is cued on the nonrelevant physical size dimension, consumers should more readily associate “small” with the numerical value of the sale prices. Thus they should be more likely to distinguish the sale prices as lower or smaller than the standard high prices, and the standard prices as higher or greater than the low sale prices. As a result, the differences between the standard high prices and low sale prices should be perceived as greater, and the more favorable price or value assessments typically associated with comparatively lower sale prices should be reinforced or strengthened. These effects would be reversed in the case of incongruent lists. Thus we expect that the same effects observed in the case of standard versus sale prices for a

single item would also occur in regard to standard versus sale prices for multiple items (i.e., assuming all sale prices were either congruent or incongruent).

A more interesting situation occurs, however, when we compare multiple sale prices at *different* retail locations. Typically in competitive settings, retail establishments enjoy price advantages on certain items, but not on others. This raises several interesting questions: First, if those items on which the retailer benefits from a price advantage are associated with congruent magnitude representations, will individual item perceptions generalize to the entire product line? Second, if those items on which the retailer is handicapped with a price *disadvantage* are associated with incongruent magnitude representations, will this tend to lessen the perceptions of those disadvantages? These questions are addressed in Experiment 3.

Experiment 3 also differs from Experiments 1 and 2 in terms of our involvement manipulation. Consistent with prior research involving nonconscious price information processing (see Roediger & McDermott, 1993, for discussion), the manipulations in our first two experiments were designed to reflect low involvement conditions. However, the processing of multiple prices for multiple items typically necessitates a higher level of involvement than might be associated with single-item comparative price ad exposure. Moreover, the primary objective of comparative price advertising is to draw attention to the lower sale price, in order to contrast it with the higher regular price (Grewal, Monroe, et al., 1998). Thus, it becomes important to determine whether marketers desiring to draw attention to their comparatively lower price advantages need to sacrifice a certain degree of consumer awareness in order to take advantage of the nonconscious influence of numeric size–value congruency (Monroe & Lee, 1999). In Experiment 3, we address this issue by examining whether the same size–value congruency effects observed under low processing motivation (involvement) conditions will also occur under high processing motivation (involvement) conditions.

EXPERIMENT 3

As noted earlier, retail establishments typically enjoy price advantages on certain items, but not on others. We argue that if all of the items on which the retailer benefits from a price advantage are associated with congruent magnitude representations, then the price–value assessments associated with each of these items should increase. The presence of the small magnitude representation on the nonrelevant physical size dimension should allow consumers to more readily associate “small” with the numerical values of each of the sale price advantages. Thus they should be more likely to perceive the low price advantages as lower or smaller than the competitor’s higher prices, and the competitor’s higher prices as higher or greater than the retailer’s own lower prices. As a result, consumers should perceive the differences

between the competitor’s high prices and retailer’s low prices as greater, and the more favorable price or value assessments they would typically associate with the comparatively lower priced items should be reinforced or strengthened. The augmented value assessments should then lead to greater demand for each of the low-priced items (Grewal, Krishnan, et al., 1998a; Grewal, Monroe, et al., 1998).

Further, because (relative to any given retail location) consumers typically may be unable to recall precisely which of the brands were associated with low-price advantages, it seems reasonable to assume that augmented price–value assessments could generalize to other items within a product line or mix. This would be especially true if those other items within the line (i.e., the ones on which the retailer is at a price *disadvantage*) are associated with incongruent magnitude representations. Noncorresponding magnitude representations should interfere with competitive price comparisons—that is, if the retailer’s own high-price disadvantages are associated with a low value on another dimension, consumers should be less likely to perceive these prices as greater than the competitor’s prices. As a result, the differences between the competitor’s price advantages and the retailer’s price disadvantages should be perceived as less, and the deleterious impact of the comparatively higher prices should be attenuated. In sum, incongruent magnitude representations should have a beneficial effect in terms of each of the items associated with a price disadvantage. We expect that for a comparative price ad involving multiple prices at two different retail locations:

- H3: When the retailer’s price advantages (disadvantages) are associated with congruent (incongruent) numerical size–value magnitude representations: (H3a) the (overall) price and value assessments will be more favorable, and (H3b) the demand associated with the retailer’s products will be greater, than when that retailer’s price advantages (disadvantages) are associated with incongruent (congruent) numerical size/value magnitude representations.

Method

The sample for Experiment 3 consisted of 62 part-time graduate students from a major U.S. university. Participants received partial course credit for participation in the study, which took place in a classroom setting. Participants were randomly assigned to one of the two treatment groups. They were then told that they would be shown a list of brands with associated prices, and that they would be questioned regarding their opinions of the brands. The list of brands and associated prices was shown via a Powerpoint computer presentation. The list was presented in table format, and contained six fictitious brands of hair dryer, their associated prices at two different retail outlets (i.e., “Eddy’s Home Products” or “Philco Pharmacy”), and brief product descriptions. To facilitate ease of comparison, the brands,

prices, and product descriptions appeared in separate columns (see Appendix B).

The hair dryer category was chosen because it represented a common set of price points used in previous research (Coulter, 2003; Gendall, Holdershaw, & Garland, 1997). Brands were listed in descending order of price, with the fictitious target "StyleMax" brand appearing at the bottom of the list. The high and low prices were varied sequentially across purchase locations such that overall absolute savings were equivalent across the two stores, and each of the stores had a (\$4) price advantage on three of the brands. Because percentage savings for the two price-advantage sequences (23.34% and 25.19%) were not exactly equal, sequences were varied across purchase locations, and exposure to each of the variations was randomly determined.

For the congruent advantage and incongruent disadvantage (hereafter referred to as congruent advantage) retail outlet, all prices (i.e., the low-price advantages and high price disadvantages) appeared in smaller font; for the incongruent advantage and congruent disadvantage (hereafter referred to as incongruent advantage) retail outlet, all item prices appeared in larger font. Although all participants were exposed to prices from both purchase locations, the combination of price sequencing and font manipulation meant that the lower priced target brand (i.e., the StyleMax) was presented with a congruent magnitude representation for only half of the participants in our sample ($n = 31$, see Appendix B1). The lower-priced StyleMax brand was presented along with an incongruent magnitude representation for the other half of the participants (see Appendix B2). Exposure to either of the latter two stimulus variations was randomly determined. The source of the information (i.e., Eddy's, Philco, or some other party) was not specified.

Immediately after viewing the stimulus price list, participants were exposed to a 4-minute "filler" infomercial for a brand of lawn tractor. The infomercial did not contain price information. After viewing the infomercial, participants completed a paper and pencil questionnaire.

Measurement. Our ad involvement measure was identical to the measure utilized in Experiments 1 and 2. Participants provided price and value assessments by rating overall prices at both purchase locations on 7-point scales ranging from 1 (*more expensive*) to 7 (*less expensive*) and 1 (*less value*) to 7 (*more value*; Krishnan & Chakravarti, 1999; Monroe & Lee, 1999). In addition, participants were asked to assume they were in the market for a brand of hair dryer, and to choose between purchase locations in terms of where they would buy it.

Due to the high involvement nature of this experiment, we included an explicit price recall measure which involved a single, open-ended question in which participants were asked to record the exact sale price of the target brand at both purchase locations. Participants also were asked whether there was a difference in price between the two purchase locations, and if so, at which location was the target brand

priced lower. Price responses were coded as correct or incorrect for the dollar digits combined, because some research suggests that two-digit numbers are not compared lexicographically (i.e., first by decades, then by units when decades are not discriminable), but rather holistically (the whole magnitudes the two numbers represent are compared (Dehaene & Changeux, 1993). To avoid any priming effects, the purchase likelihood questions were asked first, followed by the price and value assessments, price recall, and finally the ad involvement questions.

Results

Processing and confound checks. As expected, a significant, $\chi^2(2, N = 62) = 83.47, p < .001$, majority of participants (44) reported that they were unable to recall which of the sets of stimulus prices (i.e., Eddy's or Philco) had appeared in larger font. Of those 18 participants who reported that either location's prices were larger, only 8 were correct. Participants' evaluations of the degree to which the size of the font influenced their price and value assessments resulted in a mean rating of 1.34 on a 7-point scale ranging from 1 (*not at all*) to 7 (*very much*). There was no significant difference in mean rating across congruent versus incongruent low-price groups, $t(60) = 1.04, ns$, and the number of participants reporting that the size of the font influenced their value assessments *not at all* (49) was significantly greater, $\chi^2(1, N = 62) = 38.54, p < .001$, than the number of participants (13) choosing any of the other six scale categories. These results support our contention that consumers are unaware of the influence of numerical size-value congruency on their price and value inferences.

Our results also suggest that numerical size-value congruency effects may occur under high involvement conditions (i.e., when participants are actively involved in processing some aspect of the pricing stimulus). Analysis of variance and subsequent Scheffé comparisons revealed that participants in Experiment 3 ($M = 5.33$) were significantly more involved in processing the advertisement, $F(2, 188) = 127.24, p < .001$, than participants in either Experiment 1 ($M = 2.58$) or Experiment 2 ($M = 2.66$).

Finally, our results indicate that differing degrees of attention caused by the size of the larger or smaller fonts could not have accounted for dependent variable results. There was no significant difference in degree of attention paid to Eddy's versus Philco prices, $t(60) = 0.98, ns$, and there were no significant differences in degree of attention paid to either Eddy's or Philco prices across congruent versus incongruent executions.

Dependent measures. *T*-test analyses were used to test our hypotheses. Although the same pattern of results was observed across the total sample, only those participants who reported that they were unable to recall which of the sets of stimulus prices had appeared in larger or smaller font were

considered in our analyses. Our results indicate that participants perceived prices to be significantly less expensive, $t(43) = 3.51, p < .001$, at the congruent advantage ($M = 4.61$) than at the incongruent advantage purchase location ($M = 3.82$). Similarly, participants perceived prices to be a significantly better value, $t(43) = 2.12, p = .04$, at the congruent advantage ($M = 4.39$) than at the incongruent advantage ($M = 3.70$) retail location. Thus H3a is supported.

Overall, 52.3% of participants (23) indicated that they would choose to purchase a hair dryer at the congruent advantage location, 20.5% (9) indicated that they would choose the incongruent advantage location, and 27.3% (12) were indifferent. Of those 72.8% of participants (32) who made a choice, a significantly greater number, $t(31) = 2.71, p = .01$, chose the congruent advantage over the incongruent advantage location. These purchase-choice results support H3b.

Explicit recall. Overall sample results revealed no significant difference between the number of participants correctly recalling the lower target price (17), versus the number of participants correctly recalling the higher target price (14). However, when participants were asked to recall *where* the target brand was priced lower, a significantly greater number were correct, $t(60) = 3.23, p = .01$, when the low-priced location was paired with a congruent numerical size dimension, than when it was paired with an incongruent numerical size dimension.

Results of Experiment 3 suggest that accurate explicit price recall is not a necessary condition for the differences in price and value assessments and purchase choice associated with congruent versus incongruent magnitude representations. However, if the requirements of the price-recall measure are relaxed such that less precise cognitive output is required (Krishnan & Chakravarti, 1999), then a price inference–explicit memory relation may become manifest. The findings associated with our two recall measures are consistent with a number of studies that have suggested that reliance on summary evaluations and abstractions might increase over time, because the ability to retrieve specific facts (i.e., the actual lower price) decays more rapidly than the ability to retrieve more global judgments (i.e., the lower priced location; Chattopadhyay & Alba, 1988; Kardes, 1986).

GENERAL DISCUSSION

Our study addresses the important issue of consumers' processing of price information. Results from our three experiments provide evidence that consumers are frequently unaware of how their price and value inferences are derived, and may typically be unable to articulate the exact reasons why some aspect of the comparative price presentation stimulus may translate into lower (or higher) perceived value. A key finding of our study is that congruent and incongruent

size dimensions impact price assessments, value assessments, and purchase intentions regardless of whether the nonrelevant dimension is manipulated in terms of physical size (Experiments 1 & 3) or verbal product descriptors (Experiment 2). This result, coupled with our findings regarding the processing and confound checks, strongly suggests that the influence of internal magnitude representations is a key factor in determining consumers' evaluations. As such, our findings contribute to the literature on the processing of price information in several important respects.

First, we find that the numeric size–value congruency effects demonstrated in the case of immediate reactions to simple numeric digits (e.g., Dehaene, 1989) also occur with regard to consumers' perceptions of price information. The results of Experiments 1 and 3 illustrate that physical font size influences participants' perceptions of numerical price magnitude. More specifically, presenting the lower sale prices in relatively small font resulted in more favorable value assessments and greater purchase likelihood or choice than presenting the lower sale prices in relatively large font. This finding suggests that exposure to a large magnitude representation on a nonrelevant dimension reduced the likelihood of participants associating small magnitude representations with the lower sale prices. As a result, price inferences were compromised, even in the absence of any observable effects on explicit price recall.

Second, the relatively large effect sizes across our three experiments ($g = .25-.41$) indicate that the manner in which comparative price information is displayed can potentially be even more important than the magnitude of the price reduction itself (depending, of course, on price-elasticity of demand) in driving product sales. One might argue that this would be especially true with regard to delayed purchase decisions (e.g., those occurring as a result of advertising exposure), which are frequently based on subjective value assessments, and on less-than-perfect recall of explicit price information. In addition, results from Experiment 2 suggest that the retailer wishing to convey price information in a manner that is not conducive to physical font size comparisons might consider employing either verbal product descriptors, or some other related dimension in order to reinforce low-price magnitude representations. Future research efforts should be directed toward assessing whether the effects reported in this study can be replicated using other nonrelevant dimensions conveying size or magnitude.

A third important finding of our research concerns numerical size–value congruency effects under conditions of low versus high involvement. In Experiments 1 and 2, instructions were designed to reduce participants' attention to the price information (i.e., to reflect a low involvement condition), whereas in Experiment 3, instructions were designed to encourage participants to attend to prices (i.e., to reflect a high involvement condition). However, in all three experiments, numeric size–value congruence had an impact on price and value assessments, and in all three experiments participants were

unaware of the specific manipulations that were affecting those judgments. Thus, it appears that (a) the processing of nonrelevant numeric dimensions as magnitude representations and (b) the subsequent (nonconscious) impact of those magnitude representations on price and value assessments will occur regardless of whether participants are consciously attending to, or thinking about, the pricing stimuli.

The implication of this finding is that the encoding of comparative price information that occurs at a conscious level and the impact of nonrelevant magnitude values that occurs below the threshold of conscious awareness are separate and distinct, yet simultaneous processes. Both processes may have an impact on price evaluations, perhaps in a manner analogous to the “central” versus “peripheral” (Petty & Cacioppo, 1986) or “systematic” versus “heuristic” (Chaiken, Liberman, & Eagly, 1989) processing of message arguments reported in the persuasion effects literature. Thus, retailers desiring to draw attention to low-price advantages need not sacrifice consumer awareness in order to take advantage of numeric size–value congruency effects. Rather, retailers need only be concerned with the manner in which attention is drawn to the low-price deal.

Of course, one of the stimulus characteristics that is frequently manipulated in order to attract consumers’ attention is the physical size of that stimulus (Olsen, 1995). Larger stimuli are more likely to be noticed than smaller ones (Lohse, 1997). In addition, a relatively large stimulus in the context of similar smaller ones creates contrast, which serves to focus further attention on the larger stimulus (Goodstein, 1993; Pieters, Rosbergen, & Hartog, 1996). In light of this study, however, increasing physical font size in order to garner sale-price attention in comparative price settings may not be the best strategic option. Rather the retailer might consider the use of distinctive color, movement, position, isolation, or contrast (Pieters et al., 1996). By presenting comparably lower prices in smaller physical font size, value assessments and purchase likelihood or choice can be increased.

Consistent with the numerical cognition literature (e.g., Dehaene 1989, 1992; Pavese & Umiltà, 1998; Tzelgov et al., 1992), results of our three experiments indicate that participants were not consciously aware of the effects of the nonrelevant dimension on their price and value assessments. Given participants’ relatively poor price recall, we posit that these effects occurred (and judgments were formed) at the time of stimulus exposure (Kahneman & Miller, 1986). If judgments were formed at encoding, however, it is possible that forgetting occurred by the time those judgments were later reported along our response scales (Lynch, Chakravarti, & Mitra, 1991). Our results do not rule out the possibility that participants consciously perceived font size differences (Experiments 1 and 3) or were consciously influenced by the verbal product descriptors (Experiment 2), but later failed to recall this influence. We consider this possibility unlikely for several reasons. First, if participants in Experiments 1 and 3 were consciously aware of font size differences, we would

expect them to attribute greater importance to the low sale prices appearing in larger font, and therefore infer more, rather than less value (as indicated by our findings). Second, if participants in our three experiments were consciously aware of the nonrelevant dimensions, we would expect them to question and elaborate on this stimulus variation, leading to increased attention and a greater degree of recall than demonstrated by our results. Third, recent research involving the subliminal priming of nonrelevant numerical information (i.e., involving units of weight rather than dollars) suggests that magnitude representations involving these nonrelevant dimensions are encoded, as well as processed, nonconsciously (Adaval & Monroe, 2002). Thus we suggest that future research efforts utilizing more sophisticated physiological awareness measures could help to further our understanding about the level (conscious versus nonconscious) and timing of price judgment formation.

Our findings also provide insights regarding multiple high and low price presentation contexts. Results of Experiment 3 indicate that the same numeric size–value congruency effects that apply to a single item’s standard versus sale prices may apply to competitive price comparisons as well. A congruent (physical size) magnitude representation can reinforce price advantages, whereas an incongruent (physical size) magnitude representation can minimize price disadvantages. Further, because congruency effects generalize to multiple items within a product line, they help to create an overall price or value impression. Thus, numerical size–value congruency can create a competitive advantage in terms of more favorable value assessments, even where no actual price advantage exists. Unfortunately, a limitation of the manipulations employed in Experiment 3 was that they did not allow us to assess what portion of the variance in the dependent measures was explained by congruent price advantages, and what portion was explained by incongruent price disadvantages. We suggest that future research efforts be directed toward an examination of this interesting question.

In addition, our findings suggest that congruent and incongruent magnitude representations may have important implications outside of the pricing realm. For example, one of the most effective automobile print ads of all time featured a small, off-center photo of the Volkswagon “Bug,” suspended amidst a full page of empty white space. The advertisement, which was tagged with a simple, provocative challenge, “Think Small,” scored very high in terms of recall and recognition, and was very effective in generating favorable brand attitudes (Smith & Clurman, 1997). Although in this example it is obvious that the congruent “magnitude representations” were meant to be consciously processed and that other factors such as level of attention and the nature of the product itself may have impacted ad evaluations, nevertheless the effectiveness of the congruence invites further scrutiny into the generalizability of this important phenomenon.

Finally, as mentioned earlier, we speculate that the psychological processes leading to numeric size–value congru-

ency effects may be similar to those processes reported in the context effects literature. Research has demonstrated that the advertising context can influence viewers' interpretations of product information in the ad by "priming" (i.e., providing preliminary exposure to) certain product attributes (Wyer & Srull, 1981), and that brand evaluations may be enhanced or diminished depending on the positive or negative implications of the primed attribute. Although in this study both relevant and nonrelevant attributes (magnitude representation-related dimensions) are presumably primed *simultaneously*, it does appear that exposure to a congruent nonrelevant dimension (i.e., small font size) can have positive implications for the evaluation of the (sale-priced) brand. Thus future research efforts might be directed toward examining whether temporal contiguity is a necessary condition for numeric size-value congruency effects to occur.

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Received, April 1, 2003
 Revision received, October 10, 2003
 Accepted, January 17, 2004

APPENDIX A
 Ad Stimuli for Experiments 1 and 2

Experiment 1 Stimulus–Congruent Condition

Earthquake Pro Aggressive In-Line Skate



The Earthquake Pro-aggressive inline skate is equipped with a UFS frame and a hard-soft construction for a combination of flex and fit. It includes a full-length shock absorber and a flex block for more support on big air tricks. The 3D Customfit washable liner provides you with comfort and precision.

Regular Price:
\$239.99

Sale Price:
\$199.99

Experiment 2 Stimulus–Congruent Condition

Earthquake Pro Aggressive In-Line Skate



The Earthquake Pro-aggressive inline skate is equipped with a UFS frame and a hard-soft construction for a combination of flex and fit. It includes a full-length shock absorber and a flex block for more support on big air tricks. The 3D Customfit washable liner provides you with comfort and precision.

Regular Price:
\$239.99

Sale Price:
\$199.99
LOW FRICTION!

APPENDIX B
Experiment 3 Stimuli

B1. Philco Low Price Advantages Congruent/High Price Disadvantages Incongruent;
Eddy's Low Price Advantages Incongruent/High Price Disadvantages Congruent

<i>Brand</i>	<i>Eddy's Price</i>	<i>Philco Price</i>	<i>Features</i>
FashionPro	\$60	\$64	Easy maintenance; power control
Big Blow	\$59	\$55	Variable volume output settings
Hair Dry 2	\$50	\$54	1875-watt; "cool-shot" feature
Mighty Max	\$49	\$45	Soft-touch finish; 1200-watt
Air Force	\$40	\$44	Extra-long cord; 3-way temp control
StyleMax	\$39	\$35	5-speed settings; ergonomic

B2. Eddy's Low Price Advantages Congruent/High Price Disadvantages Incongruent;
Philco Low Price Advantages Incongruent/High Price Disadvantages Congruent

<i>Brand</i>	<i>Eddy's Price</i>	<i>Philco Price</i>	<i>Features</i>
FashionPro	\$60	\$64	Easy maintenance; power control
Big Blow	\$59	\$55	Variable volume output settings
Hair Dry 2	\$50	\$54	1875-watt; "cool-shot" feature
Mighty Max	\$49	\$45	Soft-touch finish; 1200-watt
Air Force	\$40	\$44	Extra-long cord; 3-way temp control
StyleMax	\$39	\$35	5-speed settings; ergonomic

Note. B1 and B2 represent two of four stimulus variations. In the other two variations the Eddy's/Philco columns are reversed. Each location's retail prices total \$297.

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