Consumer Evaluations of Sale Prices: Role of the Subtraction Principle

How exactly does the display location of a sale price relative to the original price affect consumers’ evaluations? Across multiple studies, including field studies with actual choices and studies with nonstudent samples, this article shows that consumer evaluations are a function of the display location of the sale price, but such evaluations are moderated by discount depth. First, presenting the smaller number to the right (vs. left) makes it easier to initiate the subtraction task, a phenomenon the authors refer to as the “subtraction principle.” Second, given that evaluating sale prices inherently involves a subtraction task, locating sale prices to the right (vs. left) of the original price facilitates calculation of discount depth, increasing evaluations for moderate discounts but not for low discounts. These effects are potentially reversed in cases of both very low discounts and exaggerated discounts. The findings in this article offer novel and nonintuitive insights into how sale price display locations and discount depth interact to influence numerical cognitions, processing of sale prices, and subsequent evaluations.

Keywords: sale price, sale price display location, discount depth, numerical cognition, price perceptions

There is no consensus for how retailers should present sale prices. A review of websites of various online and catalog retailers revealed that some display sale prices to the right of the original prices (e.g., The Body Shop, Saks, Neiman Marcus), whereas others display sale prices to the left (e.g., Kmart, REI, Zappos.com). For example, a 30% discount for a product may be presented either as [original price of $349.99/sale price $239.99] or as [sale price $239.99/original price $349.99]. In this article, we examine whether and how the location of the sale price relative to the original price results in different consumer evaluations. Because sale prices constitute an important marketing cue (Biswas and Blair 1991; Grewal, Marmorstein, and Sharma 1996; Lichtenstein, Burton, and Karson 1991; Thomas and Morwitz 2009), we believe that academics, retailers, and public policy makers should all be interested in understanding which sale price display locations systematically result in better consumer evaluations.

We build on literature in numeric processing (e.g., Beishuizen, Van Putten, and Van Mulken 1997), subtraction strategies (Selter 2001), and the ease of verifying equations (Yip 2002) to posit that it is easier to initiate a subtraction task when the larger number is presented on the left-hand side and the smaller number is presented on the right-hand side, a phenomenon we term the “subtraction principle.” Consequently, we propose that the location of the sale price relative to the original price is likely to influence whether consumers actually initiate the subtraction task to calculate discount depth; we posit that this difference in the propensity to initiate, in turn, affects consumer evaluations. We suggest that, consistent with the subtraction principle, when retailers present the sale price (smaller number) to the right of the original price (larger number)—that is, when an offer is presented as [original price $349.99/sale price $239.99]—more consumers are likely to initiate the subtraction task and calculate the actual discount depth (i.e., 30%). When retailers present an offer as [sale price $239.99/original price $349.99], fewer consumers are likely to initiate the subtraction task. Furthermore, the (many) consumers who do not initiate the subtraction task will focus mainly on the sale price and likely estimate a lower discount depth of approximately 10%–12%. This 10%–12% estimate is based on prior work by Blair and Landon (1981), wherein participants who were shown various consumer durables with only the sale price displayed and then asked to approximate the discount amount estimated the average discount level in 10%–12% range. Thus, we posit that for those consumers who do not initiate discount calculations, discount estimates will be directionally biased toward the 10%–12% level, leading to lower evaluations. The previous supposi-
tions are consistent with an extensive body of prior work indicating that a cue can be processed in a variety of ways (e.g., Chaiken 1980).

In general, the impact of sale prices on consumer evaluations, is also influenced by discount depth, or the original price less the sale price (Grewal, Marmorstein, and Sharma 1996). In general, low discounts (approximately 10%) are unlikely to increase evaluations, whereas moderate to large discounts (30% or more) are likely to increase evaluations (Lichtenstein, Burton, and Karson 1991). In this article, we examine how discount depth moderates the impact of differences in sale price display location (right vs. left of original price) on consumer evaluations.

To preview our findings, we first find support for the subtraction principle (Study 1). In the context of sale prices and consumer evaluations, we show that the location of sale price to the right of the original price facilitates initiation of the subtraction task to calculate discount depth, and in the case of moderate discounts, this results in higher consumer evaluations (see Studies 2a, 2b, 3b, 4a, and 4b). Thus, for moderate discounts, locating sale price to the right of the original price “helps.” However, initiating this subtraction calculation fails to improve consumers’ evaluations if discount depth is low. In such instances, it matters little whether consumers (1) initiate the subtraction task and then discover that the discount is low or (2) do not initiate the subtraction task and thus assume the discount is low (see Blair and Landon 1981; also see Studies 2a, 2b, and 4a). Studies 2a, 2b, 3a, and 3b examine (1) alternative explanations and (2) the mechanism underlying our results. Studies 4a and 4b test external validity by examining the effects (1) on nonstudent samples and (2) of incorporating actual choices. Finally, in Study 5, we illustrate that in some specific cases (i.e., very low discounts that are much lower than 10% and exaggerated discounts that are much greater than 30%), displaying sale prices to the right of the original price can “hurt” by reducing consumer evaluations. In Figure 1, we present our conceptual model (Panel A) and the full sequence of related studies and proposed results (Panel B); the latter panel effectively presents a road map for the rest of our article.

**FIGURE 1**
Conceptual Framework and Roadmap

**A: Conceptual Model**

| Display location of smaller number (or sales price) relative to larger number (or original price) |
| • Right vs. left |

Discount Size

| Moderate/Low/Very Low/Exaggerated |

| Perceived Difficulty/Estimated Discount |

| Evaluations Value Perceptions Purchase Intentions Choice |

**B: Related Studies and Proposed Results**

| Display Location × Moderate Discount |
| Studies 2a/2b/3b/4a/4b/5 |

| Sale price left | Sale price right |

| Display Location × Low Discount |
| Studies 2a/2b/3a (easy calculations)/4a |

| Sale price left | Sale price right |

| Display Location × Extremely Low Discount |
| Studies 5/5a |

| Retailer Opportunism |

| × Credibility Enhancement |

| Quality Concerns |

| × Quality Enhancement |

| Study 5a |

| Sale price left | Sale price right |

| Display Location × Exaggerated Discount |
| Studies 5/5b |

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This research contributes to both the pricing and the numerical cognition literature streams. First, we develop and find support for the subtraction principle. Second, we show how ease of subtraction affects sale price evaluations. Third, previous works in the literature stream have assumed that consumers typically calculate discount depth (for exceptions, see Inman, McAlister, and Hoyer 1990; Mayhew and Winer 1992). Here, we are the first to propose (and demonstrate) that differences in sale price display locations relative to the original price influence consumers’ likelihood of calculating discount depth and consequently affect their evaluations. Fourth, this study identifies discount depth as a key moderator of the impact of the sale price display location on consumer evaluations and explores specific cases in which the retailer may benefit by making it more difficult for consumers to calculate discount depth. Fifth, this research contributes to practice by offering specific, actionable policy recommendations regarding when and how retailers should use different sale price display locations.

**Should Differences in Sale Price Display Location Matter?**

The marketing literature has long postulated that differences in sale price presentation formats play a key role in consumers’ perceptions of value (Monroe 2003; Thomas and Morwitz 2009). For example, researchers have specifically investigated the various effects of sale price presentations, including how the sequence of digits in a price influences consumers’ evaluations through a left-digit anchoring effect (Thomas and Morwitz 2005), right-digit effect (Coulter and Coulter 2007), or price precision effect (Thomas, Simon, and Kadiyali 2010). Other researchers have examined how fonts affect price evaluations, whether in larger or smaller sizes (Coulter and Coulter 2005) or in different colors, such as red (Puccinelli et al. 2013).

What has remained unexplored is how differences in the location of the sale price (right vs. left of original price) may influence consumer evaluations. This is an important issue, because consumer evaluations of offers are affected by the comparison between the sale price and the original price. That is, consumers gauge the depth of the discount by subtracting the sale price from the original price (Alba et al. 1999; Grewal, Marmorstein, and Sharma 1996) and then develop their evaluations (e.g., Biswas and Blair 1991; Lichtenstein, Burton, and Karson 1991). To the extent that location of the sale price makes the subtraction task easier (or alternatively, more difficult) to initiate, perceptions of the offered discount and, consequently, evaluations of the offer might vary.

The key question in this research is whether differences in sale price display location—that is, sale prices to the right (vs. left) of the original price—affect consumers’ propensity to initiate the subtraction task. It is generally accepted that consumer inferences are governed by spatial rules that extract meanings from a specific display location of a stimulus (Valenzuela and Raghubir 2011). Such shared beliefs influence consumers’ willingness to pay, quality inferences, effort, and time estimation (Nelson and Simmons 2009). Nevertheless, existing research (in pricing and other domains) shows mixed evidence for influence of right versus left processing. For example, Valenzuela and Raghubir (2011) find that consumers judge products as more expensive the further to the right these products are in a horizontal shelf display. Dehaene (1989) suggests that unconscious recollection of the number line sets consumers’ expectations for left-to-right processing of numbers. However, Shapiro and MacInnis (1992) find no evidence of any systematic visual processing in left-right display.

In this article, we posit that sale price display locations to the right (vs. left) of the original price facilitate initiation of the subtraction task. Building on this subtraction principle, we next examine how the joint effect of sale price location and discount depth affects consumers’ evaluations. We develop these two ideas in the sections that follow.

**The Subtraction Principle**

Cognitive scientists and psychologists have examined how people handle subtraction tasks (e.g., Campbell and Xue 2001; Hecht 1999; Imbo, Vandierendonck, and Rosseel 2007) and show that subtraction computations are difficult and prone to errors (Baroody 1984; Fuson, Smith, and LoCicero 1997; Selter 2001). However, is it possible that the perceived difficulty of the subtraction task is influenced by the presentation format of the two numbers? We posit that, in general, computations appear easier if the presentation format conforms to common norms or conventions. We surmise this on the basis of Yip’s (2002) suggestion that inaccurate equations presented in “normal” format (e.g., 3 + 5 = 7) are easier to verify than in the reversed format (7 = 5 + 3). It should be noted that Yip (2002) focuses only on (1) addition and multiplication rather than subtraction and (2) verification of equations rather than the impact of location of a smaller number versus a larger number. Nevertheless, we build on insights gleaned from Yip’s work, which suggests that typical presentation formats might be easier to process.

In general, consumers expect to visualize a series of numbers with smaller numbers to the left of larger numbers, consistent with how numbers appear on a number line (Dehaene 1989) and also in accordance with the right-heavy effect (i.e., that items placed on the right side are perceived as relatively heavier; Deng and Kahn 2009). By this logic, the “normal” position for a smaller number should be to the left of the larger number. However, we believe that the more relevant question here is where consumers expect to see a smaller number (sale price) relative to a larger number (original price) in the specific context of a subtraction task. Elementary school math books generally follow a consistent format, with the smaller number to the right of the larger number, such that they ask students to calculate [100 – 75 = ?] rather than [-75 + 100 = ?]. (In addition, this format is similar to calculations used as numerical cognition research exemplars; e.g., Selter 2001.) This suggests that in the context of a subtraction task, people expect the “normal” format to be one in which the smaller number appears to the right of the larger number.

Furthermore, researchers have found that stepwise calculations are more frequently and successfully used as a
strategy for solving subtraction problems (Beishuizen, Van Putten, and Van Mulken 1997; Selter 2001). That is, when calculating \([701 - 698]\), people performed the tasks \([701 - 600], [-90], [-8]\). Such stepwise calculations are easier to do when the larger number is to the left than to the right because the person does not have to mentally flip the numbers around before beginning the stepwise calculation. This, too, suggests that in the context of a subtraction task, people expect the smaller number to appear to the right of the larger number in the “normal” format. This is (a priori, and in light of some previous findings) not obvious, and it is especially worth noting that this is exactly the opposite of how numbers are typically displayed on a number line; in addition, this contradicts findings in prior research (e.g., Valenzuela and Raghubir 2011, although we note that these findings were not in the context of a subtraction task).

To determine whether, in the context of a subtraction task, smaller numbers to the right of the larger number is viewed as “normal,” we showed 52 undergraduate students (Pilot Study 1) at a U.S. midwestern university a series of subtraction problems, such as \([34,582 - 28,901 = 5,681]\). Each subtraction problem appeared with either the smaller number to the right (i.e., normal format) or the smaller number to the left (i.e., \(-28,901 + 34,582 = 5,681\); reverse format). For each problem, participants indicated on a five-point scale which format they were “more likely to see in daily life” (1 = “more likely to see smaller number to the left,” and 5 = “more likely to see smaller number to the right”). The responses revealed that participants believed they were more likely to see the smaller number to the right (M = 4.38, one-sample t-test, significantly greater than the midpoint; t(51) = 10.05, p < .05). Thus, given that (1) in the specific context of a subtraction task, presenting smaller numbers to the right of larger numbers is the norm and (2) computations are easier when presentation formats conform to norms, we predict the subtraction principle:

\[H_1: \text{Subtraction tasks are easier to initiate when the smaller number is located to the right (vs. left) of the larger number.}\]

**Study 1: Testing the Subtraction Principle**

In Study 1, we examine H1—specifically, whether presenting smaller numbers to the right of the larger number, rather than to the left, creates a greater propensity to initiate a subtraction task. In effect, we sought support for the subtraction principle.

Two groups of participants (N = 57, undergraduate students at a U.S. midwestern university) were given two minutes to solve 16 subtraction problems, each of the type \([922 -345]\) (i.e., involving two three-digit numbers). The first group (the normal presentation group) calculated problems with the smaller number shown to the right \([922 -345]\). The second group (the reverse presentation group) assessed problems with the smaller number to the left \([-345 + 922]\).

To ensure that participants took the subtraction task seriously, we told them that the person(s) who answered the most problems correctly (in each group) would earn $20. We assumed that participants would attempt to solve more problems when the task seemed easier. As we expected, participants in the normal presentation group attempted more questions (M = 11.24) than those in the reverse presentation group (M = 9.04; t(55) = 2.48, p < .05). These data support H1 and the subtraction principle; we found that for a subtraction task, presenting the smaller number to the right of the larger number made it easier for consumers to initiate the task. We expect these results to hold for sale prices in which the (smaller) sale price is to the right of the (larger) original price.

**Sale Price Location: The Moderating Role of Discount Depth**

In the previous sections, we develop and provide empirical support for (independent of any linkage to sale prices) the subtraction principle. We next examine how the subtraction principle may influence sale price evaluations and how such evaluations might be moderated by discount depth.

Adaptation-level theory suggests that discount depths that result in prices close to consumers’ adaptation levels evoke a neutral response (Helson 1964), whereas discount depths that produce prices markedly different from those adaptation levels evoke stronger responses (Alba et al. 1999). Along similar lines, assimilation and contrast theory suggests that smaller discounts are absorbed within consumers’ latitude of acceptable prices, with little impact on their valuations in comparison with the original price, whereas larger discounts create a salient contrast with the original price and thus trigger increased evaluations (Sherif 1963). Thus, a moderate discount depth of 30% is far more effective for increasing consumers’ evaluations than a low discount depth of 10% (e.g., Grewal, Marmorstein, and Sharma 1996; Lichtenstein, Burton, and Karson 1991).

This is not to say that consumers always need to know discount depth to evaluate a sale price. In the event that no original price is provided or consumers do not/cannot calculate discount depth, they typically assume a discount depth biased in the direction of 10%–12% (Blair and Landon 1981) and evaluate sale prices using this assumption. Consequently, we examine how differences in discount depth moderate the impact of the sale price display format on consumers’ evaluations. At this stage, we consider only moderate discounts (e.g., 30%) versus low discounts (e.g., 10%); in a subsequent section, we consider cases in which discount depth is (1) much lower than 10% and (2) much higher than 30%.

Two components of a sale price advertisement likely influence consumer evaluations. First, the sale price influences evaluations because it represents the effective price
the consumer pays. Second, and more important from the standpoint of this research, discount depth influences consumer evaluations because larger discounts suggest increased deal value. As we noted previously, calculating discount depth inherently involves a subtraction task, which is a key determinant of evaluations relating to sale prices. Given the criticality of this subtraction task, any elements in the sale price display that relate to the subtraction principle may in turn drive evaluations. We elaborate on the latter point in the next paragraph.

First, consider the case of a moderate discount (i.e., 30%). When sale price is to the right of the original price, consistent with the subtraction principle, consumers perceive the subtraction task as (relatively) easier to initiate and consequently calculate discount depth. Consumers identify the discount depth close to the true value (approximately 30%) and thus have high(er) evaluations. In contrast, when sale price is to the left of the original price, consumers perceive the subtraction task as (relatively) more difficult to initiate, inhibiting them from initiating the task. As a result, many focus only on the sale price, estimate discount depth at 10%–12% (Blair and Landon 1981), and thus have lower evaluations. In the case of moderate discounts, therefore, locating sale price to the right (vs. left) leads to relatively higher evaluations. Potentially, assuming this chain of logic holds, any differences in evaluations across the right versus left sale price locations should be mediated by (1) differences in perceived difficulty of initiating the subtraction task and (2) differences in estimated discount depth.

Now consider what happens when the discount depth is low (i.e., 10%). We follow the same chain of logic outlined previously, except here we adjust for the lower true discount depth. When sale price is displayed to the right of the original price, more consumers are likely to initiate the subtraction task to calculate discount depth but then discover the discount depth to be low (in line with the true 10% discount). This will not raise evaluations. When sale prices appear to the left of the original price, fewer consumers initiate the subtraction task. Consumers more likely focus only on the sale price to arrive at their evaluations and, consistent with Blair and Landon (1981), assume a discount depth of approximately 10%–12%. Again, this is a low discount depth and will not raise evaluations. Thus, irrespective of whether sale prices are located to the right or left, discount depth estimates will be approximately 10%–12% (i.e., low), leading to similar, low evaluations.

H2: Discount depth moderates the relationships between the display location of the sale price (right vs. left of the original price), value perceptions, and purchase intentions. When the discount is moderate, (a) value perceptions and (b) purchase intentions are higher if the sale price is located to the right (vs. left) of the original price, but (c) when the discount is low, value perceptions and purchase intentions are not affected by sale price location.

Study 2a: Examining the Moderating Role of Discount Depth

Study 2a examines H2. Here, we next investigate whether presenting the sale price to the right (vs. left) of the original price leads to increased consumer evaluations and whether such increases are moderated by discount depth (low vs. moderate).

Method

We used a 2 (discount depth: moderate vs. low) × 2 (sale price display location: left vs. right of original price) between-subjects design, with random assignment across conditions. In parallel, we ran a fifth cell, the details of which we provide subsequently. Data were collected online from undergraduate students at two large U.S. public universities in return for course credit. The final data set included 179 participants across all five conditions.

Participants first saw an advertisement for a Blu-ray player with an original price of $349.99. To manipulate discount depth, we showed a sale price of either $239.99 (moderate, 30% discount) or $309.99 (low, 10% discount). Depending on the experimental condition, the sale price was located either to the left or right of the original price. The dependent variables were value perceptions (VP) and purchase intentions (PI) (see Appendix A). We also asked two manipulation check questions: “Was the sale price located to the right or to the left of the original price?” (left/right) and “Comparing the sale price to the original price of the product mentioned in the ad, I think the discount offered is of…” (1 = “extremely low value,” and 5 = “extremely high value”).

Results

The sale price location manipulation worked as we intended: 94.5% of participants correctly identified the location of the sale price (χ^2(1) = 132.59, p < .001), and we excluded from further analysis the 5.5% of participants who incorrectly identified the location of the sale price.2 The 2 × 2 analysis of variance (ANOVA) revealed a significant main effect of discount depth (F(1, 153) = 84.35, p < .01) for the second manipulation check question but (importantly) no interaction effect (F(1, 153) = .09, p > .76). Participants regarded the discounts as we expected (Mlow = 2.48, Mmoderate = 3.64; t(155) = 9.25, p < .01), with the moderate discount being perceived as larger than the low discount.

For value perceptions (see Figure 2), the ANOVA showed a significant interaction of discount depth with the sale price display location (F(1, 153) = 18.59, p < .05). In the moderate discount condition, value perceptions were significantly higher when the sale price appeared to the right rather than to the left of the original price (Mright = 4.69, Mleft = 3.69; t(77) = 4.67, p < .05), in support of H2a. In the low discount condition, value perceptions did not differ significantly across the two sale price display conditions (Mright = 3.53, Mleft = 3.82; t(76) = 1.21, p > .30), in support of H2c.

The pattern of means for purchase intentions (Figure 2) paralleled that for value perceptions. The two-way interaction

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2Excluding participants who fail manipulation checks is consistent with prior academic research (e.g., Carter and Gilovich 2010, p. 153). Full sample results (which were provided to reviewers) are similar and are available upon request.
between discount depth and sale price display location was significant (F(1, 153) = 6.48, p < .05). In the moderate discount condition, purchase intentions were significantly higher when the sale price appeared to the right of the original price (M_right = 4.19, M_left = 3.01; t(77) = 3.18, p < .01), in support of H2b. In the low discount condition, purchase intentions did not differ significantly across the sale price display conditions (M_right = 2.82, M_left = 2.89; t(76) = .23, p > .80), in support of H2c.

Study 2a results might also arise because consumers simply focus on the number to the right-hand side of the advertisement to arrive at their evaluations. People generally are right-eye dominant (Porac and Coren 1976) and pay more attention to objects on the right (Deng and Kahn 2009). If a sale price is presented on the right-hand side, it is possible that consumers only fixate on the sale price, in which case the evaluations of the moderate and low discounts could differ because the sale price varies (i.e., $239.99 vs. $309.99). When the sale price is to the left, consumers focus only on the original price, which appears to the right and remains the same ($349.99) across both conditions, leading to similar evaluations in both.

To test this alternative explanation, we included an additional condition (n = 22) in our experiment, with a sale price of $239.99 on the right (as in the low discount condition) and an original price of $265.99, so the discount was only 10% (i.e., a low discount). We contrasted this cell with the moderate discount cell with the sale price shown on the right. That is, in this comparison, both conditions showed the same sale price of $239.99 on the right, but one indicated a moderate (~30%) discount off the original price of $349.99, whereas the other indicated a low (~10%) discount off a different original price of $265.99.

We found significantly higher value perceptions in the moderate discount condition (M = 4.69) than in the low discount condition (M = 3.60; t(59) = 3.8, p < .05) as well as higher purchase intentions in the moderate versus low discount condition (M_{moderate} = 4.19, M_{low} = 2.68; t(59) = 3.08, p < .05). These data do not fit the alternative explanation we described previously; rather, they align with the results in Study 2a.

Study 2b: Examining the Mediating Role of Discount Depth Estimates
Study 2a’s results indicate that discount depth moderates the relationship between the display location of the sale price and consumer evaluations. In Study 2b, we attempt to replicate these results. In addition, we examine another alternative explanation for our main results—the possibility that the results in Study 2a were due to differences in the leftmost digit of the two sale prices [$239.99 vs. $309.99].

Finally, we examine two process check measures, which may illustrate the mechanism underlying our result. Specifically, we examine (1) consumers’ discount estimates across right versus left presentation of sale price, which we elicited after participants responded to the dependent variables, and (2) response latency measures. Study 2b otherwise uses methods similar to those we used in Study 2a.

Method
In Study 2b, we used a 2 (discount: 10% vs. 30%) × 2 (sale price display location: left vs. right of original price) design, with an additional control cell (which we explain and discuss subsequently). The data set included 130 participants across all five conditions. The key dependent variables, value perceptions and purchase intentions, were similar to those we used in Study 2a. The major difference
was that the original price was $329.99 and the sale price was either $296.99 or $230.99. Note that, in this case, the left-hand digits (2) across the two sale prices were the same, which addresses a potential alternative explanation for the difference across the 10% and the 30% conditions in Study 2a. In addition, we elicited participants’ estimates of discount amount. Furthermore, the software we used (Qualtrix) captured the time taken from seeing the stimuli to the time the participant responded to the first dependent variable measure.

**Results**

First, we replicated Study 2a results. The interaction was significant for both value perceptions (F(1, 102) = 4.15, p < .05) and purchase intentions (F(1, 102) = 5.89, p < .05). In the moderate discount condition, both value perceptions and purchase intentions were higher when the sale price appeared to the right rather than to the left of the original price (VP: \( M_{right} = 4.91, M_{left} = 3.83; t(54) = 3.42, p < .01; PI: M_{right} = 4.54, M_{left} = 3.26; t(54) = 3.43, p < .01 \)), in support of \( H_2a \) and \( H_2b \). In the low discount condition, value perceptions and purchase intentions did not differ significantly across the two sale price display conditions (VP: \( M_{right} = 3.56, M_{left} = 3.43; t(48) = .39, p > .69 \); PI: \( M_{right} = 3.08, M_{left} = 3.18; t(48) = -.24, p > .81 \)), consistent with \( H_{2c} \).

Next, in the 2 × 2 design, we examined dollar value of discount estimates across right versus left presentation of sale price. In the 30% discount condition, participants estimated a $91.04 (i.e., 27.59%) discount when sale price was to the right versus a $52.90 (i.e., 16.03%) discount when sale price was to the left of the original price (\( t(54) = 5.42, p < .01 \)). The estimates were again consistent with our earlier assertions. When the sale price was to the right, relatively more participants initiated calculation of discount depth and calculated it to be moderate (\( M = 27.59\% \), close to 30%). When the sale price was to the left, relatively fewer participants initiated calculation of discount depth, and relatively more participants assumed a discount depth of approximately 10%–12%. The study estimates of 16.03% were consistent with relatively more participants imputing a discount of approximately 10%–12% and only a few calculating a discount depth of 30%. This pattern of discount depth estimates was consistent with the buildup to \( H_2 \).

In contrast, participants in the 10% discount condition reported discounts of $40.04 (i.e., 12.13%) versus $38.29 (i.e., 11.6%) in the right versus left sale price display, respectively (\( t(48) = .31, p > .75 \)), indicating no significant difference across conditions. These estimates were consistent with our previous assertions. When the sale price was to the right, relatively more participants initiated calculation of discount depth but then identified the discount depth as low (approximately 10%). When the sale price was to the left, relatively fewer participants initiated calculation of discount depth and relatively more participants assumed a discount depth of 10%–12%. This is consistent with participants either identifying the discount as low or imputing a discount depth of approximately 10%–12%.

Next, following the procedures indicated in Preacher, Rucker, and Hayes (2007), we ran a mediated moderation analysis for each dependent variable. With value perceptions and purchase intentions as the dependent variables, the significant interaction effect of discount level and sale price display location (VP: \( \beta = .94, t = 2.04, p < .05 \); PI: \( \beta = 1.39, t = 2.43, p < .05 \)) was fully mediated by discount depth estimates (VP: \( \beta = .33, t = .71, p > .40; PI: \beta = .48, t = .85, p > .40 \)), while the direct effect of the mediator remained significant (VP: \( \beta = .02, t = 3.53, p < .01; PI: \beta = .03, t = 4.39, p < .01 \)). In addition, the bootstrap confidence intervals (VP: .18 to 1.31; PI: .39 to 1.69) for the mediation effect did not include zero, implying that the effect of mediation was nonzero.

Finally, we examined response latency, that is, how long participants took before responding to the first dependent variable. We found that participants spent less time responding when sale price was displayed to the left (\( M_{left} = 38.2 \) seconds) versus right (\( M_{right} = 47.7 \) seconds; \( t(99) = 2.15, p < .05 \)), and there was no interaction effect (\( F(1, 97) = .04, p > .80 \)). These findings are consistent with \( H_1 \). When sale price was displayed on the left, participants were less likely to initiate the subtraction task, resulting in lower average processing time. However, when sale price was displayed on the right, participants were more likely to initiate the subtraction task, resulting in higher average processing time.

We also examined differences in the frequency distribution of response times across the left versus right sale price presentation conditions. When sale price was to the left (vs. right), relatively more participants responded in less than 25 seconds, possibly indicating the use of a simple (10%–12% discount) heuristic. In contrast, when sale price was to the right (vs. left), relatively more participants responded in more than 50 seconds, possibly reflecting active calculation of discount depth (for a detailed analysis of the frequency distribution, see the Web Appendix at www.marketingpower.com/jm_webappendix).

**Additional Analysis**

As we noted previously, we also included a control cell incorporating a 30% discount that displayed the sale price only. By definition, subtraction was not possible in this condition. From prior literature, we know that many consumers would (in the absence of specific information) impute a discount of approximately 10%–12%. We contrasted the aforementioned cell with the 30% discount cell with the sale price displayed to the left of the original price (for which fewer consumers would initiate the subtraction task to calculate the discount depth and relatively more consumers would impute discount depth of approximately 10%–12%). Across both cells, value perceptions (\( M_{sale \ price \ left \ of \ original \ price} = 3.83, M_{no \ original \ price} = 3.70 \)) and purchase intentions (\( M_{sale \ price \ left \ of \ original \ price} = 3.26, M_{no \ original \ price} = 3.19 \)) were not significantly different (both ts(52) < .4, both ps > .60). This equivalency, across a cell in which no subtraction was possible and a cell in which subtraction was possible but sale price was displayed to the left, was consistent with our proposition that participants who saw sale price to the left were less likely to initiate the subtraction task to evaluate
the sale price and were more likely to make evaluations using discount heuristics (as per Blair and Landon 1981). Furthermore, considering the previously discussed response latency data, it is unlikely that response latency was lower when sale price was to the left, because it was easier to initiate the subtraction task. If this were so, both value perceptions and purchase intentions should have been higher in the 30% discount condition with sale price to the left versus the 30% discount condition with no original price shown. However, the equivalency across these two cells was more consistent with fewer participants initiating the subtraction task to calculate the discount depth when sale price was to the left of the original price.

**Study 3: Examining the Role of Perceived Difficulty of Discount Calculations**

In Studies 3a and 3b, we examine the effect of perceived difficulty of discount calculations on value perceptions and purchase intentions. In Study 3a, we examine a case in which all calculations are very simple. In such an instance, most participants should be able to calculate discount depth quickly, so differences in the display location of the sale price should not matter. In Study 3b, we contrast a case in which we did not explicitly provide discount depth with one in which we did. When we do not explicitly provide discount depth and consider only the 30% discount condition, we expect to replicate the results in Studies 2a and 2b (i.e., evaluations are higher when the sale price is on the right [vs. left]). When discount depth is explicitly provided, there is no need to perform calculations, so evaluations should be similar regardless of whether the sale price is to the right or the left. We provide full details for Study 3a; however, in the interest of brevity, we only provide Study 3b’s key results (we list full details for Study 3b in the Web Appendix at www.marketingpower.com/jm_webappendix).

**Study 3a**

**Method.** We collected data online using participants from Amazon.com’s Mechanical Turk (N = 164). Study 3a was similar to Study 2b, with two exceptions. First, we used an original price of $299.99 and sale prices of $269.99 and $209.99. Thus, in this study, discount depth calculations were simple, with [(300 – 270)/300 = 10%] and [(300 – 210)/300 = 30%]. Second, we only collected data about value perceptions and purchase intentions (in addition, the Qualtrix software collected response latency information).

**Results.** We found only a main effect of discount depth (VP: F(1, 160) = 34.79, p < .01; PI: F(1, 160) = 28.69, p < .01). Unlike Study 2b, there were no interaction effects (both variables: F(1, 160) < .23, p > .60). In the 30% discount condition, there were no significant differences in evaluations across sale price (right vs. left) conditions (VP: 5.33 vs. 5.27; PI: 4.79 vs. 4.81; in all cases, t(77) < 1, p > .7). Similarly, in the 10% discount condition, there were again no significant differences in evaluations across sale price (right vs. left) conditions (VP: 4.37 vs. 4.24; PI: 3.54 vs. 3.33; in all cases, t(83) < 1, p > .5). In addition, unlike Study 2b, we found no effect of left versus right presentation of sale prices in terms of response latency (Mleft–right = 32.03–31.20; t(162) = .16, p > .80), implying that participants are equally likely to initiate the subtraction task in both presentation conditions. Thus, when discounts are (very) easy to calculate, all consumers calculate discounts regardless of differences in sale price display location. This indicates that discount calculations and the associated difficulty in computing such discounts are at the heart of the results of Studies 2a and 2b.

**Study 3b**

**Method.** In Study 3b, participants were exposed to just the moderate discount (30% discount) condition, with sale price displayed either to the right or to the left of the original price. In addition, in each sale price display condition, half the participants were provided with the specific discount percentage (30%), whereas the rest were not. The primary measures of interest were related to value perceptions, purchase intentions, and perceived difficulty of the computation task.

As we expected, ANOVAs indicated significant interactions between the percentage discount cues and sale price display location for both value perceptions (F(1, 157) = 6.76, p < .01) and purchase intentions (F(1, 157) = 4.12, p < .05). Furthermore, without the percentage discount, just as in Study 2a, evaluations were significantly higher when sale price was to the right (vs. left) of the original price. In contrast, when the discount discount was explicitly provided, value perceptions and purchase intentions were similar regardless of the sale price display location. Again as we expected, the perceived difficulty variable fully mediated the aforementioned moderation. We provide full details in the Web Appendix (www.marketingpower.com/jm_webappendix).

**Discussion.** Studies 3a and 3b provide convergent support for our theory that performance of discount calculations and their associated difficulty levels underlie our results. In Study 3a, in which calculations were extremely simple, there was no difference in evaluations across sale price location (right vs. left). In Study 3b, in the case in which the discount depth was explicitly provided and there was no need to do calculations, there was (again) no difference in evaluations across sale price location (right vs. left). In contrast, when (in Study 3b) discount depth was not provided, we replicated our previous results (in which evaluations were higher when sale price was located to the right vs. left): differences in evaluations were mediated by perceived difficulty of calculations, implying that differences in sale price display location (right vs. left), consistent with Study 1 and the subtraction principle, led to differences in the perceived difficulty of engaging in the subtraction task associated with calculating discount depth.

**Study 4: Generalizing the Results**

Studies 4a and 4b establish the external validity of our primary findings. We do so by determining whether the results of Studies 2a and 2b extend to (1) nonstudent samples (Studies 4a and 4b) and (2) actual choices (Study 4b).
Study 4a

Method. We reran Study 2b (similar 2 × 2 research design as we used in previous studies except we used a 32-inch high-definition television) on a nonstudent sample (N = 172). In this paper-and-pencil study, participants first saw an advertisement with an original price of $329.99 and a sale price of either $230.99 (moderate, 30% discount) or $296.99 (low, 10% discount). They responded to questions pertaining to (1) value perceptions and purchase intentions; (2) location of sale price, as a manipulation check; and (3) demographics. We excluded the 3.5% of the participants who incorrectly identified the location of the sale price. Regarding the participant profile, (1) 46.7% were male, (2) 40.3% were older than 35 years, and (3) 38.2% reported yearly earnings of more than $50,000.

Results. We replicated the results of Study 2b. Briefly, in the moderate discount condition, value perceptions and purchase intentions were significantly higher when the sale price appeared to the right (vs. left) of the original price (VP: M_right = 4.93, M_left = 3.79; t(81) = 4.60, p < .01; PI: M_right = 4.81, M_left = 3.23; t(81) = 4.97, p < .01; see Figure 3), in support of H2a and H2b. In the low discount condition, value perceptions and purchase intentions did not differ significantly across sale price display locations (VP: M_right = 3.72, M_left = 3.96; t(81) = .91, p > .30; PI: M_right = 3.15, M_left = 2.92; t(81) = .83, p > .40), in support of H2c.

Study 4b

The purpose of Study 4b was twofold. First, we aimed to replicate the key results from Studies 2a and 2b using another nonstudent sample. Second, we also incorporated a binary dependent variable, reflecting choice between two items (the previous studies reported evaluations for a single item, i.e., value perceptions and purchase intentions), in which participants would actually receive the chosen item. Consequently, the choice was real and specifically reflected whether the relative choice share of the focal product would increase if the sale price appeared on the right as opposed to the left.

Method. Participants (N = 73) were adults signed up for a cooking class in a gourmet food store in an upscale suburb of a major U.S. city. Of the participants who explicitly provided gender details (n = 62), 75.8% were female. All participants provided age range details, as follows: <30 years = 6%, 30–39 years = 17%, 40–49 years = 22%, ≥50 years = 55%.

Before the start of the class, the owner–instructor introduced the researchers and asked the attendees to participate in the study. Participants were then handed a booklet wherein, on the cover page, they were asked to provide purchase intention judgments about cooking-related household items. The first page displayed a single food processor (original price = $184.99, sale price = $129.99, approximately 30% discount) in catalog-style format. Participants were shown the sale price located either to the left or to the right of the original price (two-cell, between-subjects design) and asked to indicate their purchase intentions (on a scale similar to that used in Study 2a).

The second page displayed two good-quality wooden spoons, imported from Western Europe, again in catalog-style format. Spoon A had a sale price of $8.49 (no original price shown). Spoon B had an original price of $12.29 and a sale price of $8.59 (i.e., approximately 30% discount). In the case of Spoon B, participants were (similarly) shown the sale price either to the left or to the right of the original price. Participants were asked to pick which spoon they preferred and were explicitly told that they would be given this spoon. Finally, on the last page, respondents provided demographic data.
Results. For the food processor, purchase intentions were higher when sale price appeared to the right versus left (M_{right} = 4.50, M_{left} = 3.62; t(71) = 2.18, p < .05). Regarding the wooden spoons, relative choice of focal Spoon B (vs. Spoon A) was higher when sale price appeared to the right versus left (M_{right} = 38.9%, M_{left} = 18.9%; χ^2(1) = 3.55, p = .06). These results were consistent with those of Studies 2a and 2b and thus generalize to nonstudent samples as well as to actual choices.

Moderating Role of Very Low and Exaggerated Discounts

Motivation

Our findings consistently reveal that displaying the sale price to the right of the original price facilitates initiation of the subtraction task. In addition, because initiating a subtraction task leads to calculation of discount depth, such initiatives “help” (i.e., increase) evaluations, particularly for moderate discounts (Studies 2a, 2b, 3b, 4a, and 4b). Furthermore, placing sale price to the right does not “hurt” when discounts are low (Studies 2a, 2b, and 4a). These results make it tempting to conclude that retailers should always display sale prices to the right of the original price.

In our next study, we examine whether there are circumstances in which displaying sale price to the right of the original price might “hurt” (i.e., decrease) consumer evaluations. In the course of such an examination, we consider two discount depth exemplars that we have not examined previously in the context of sale price display location. Specifically, we examine the effects of (1) very low discount (much lower than 10%) and (2) exaggerated discount (much higher than 30%). We propose that the effects of displaying sale price to the right (vs. left) of the original price might “hurt” evaluations when the discounts are either very low or exaggerated. This is likely because when calculating the discount depth, revelation of either a very low or an exaggerated discount may lead to negative consumer inferences, which in turn decrease evaluations. We also propose that the mechanisms underlying these reversals should vary for the two types of discounts, because arguments primed by exaggerated discounts should differ from those primed by very low discounts.

Very Low Discounts

Very low discounts may trigger negative beliefs about the retailer, such as suspicions that the retailer is being opportunistic or aiming to manipulate consumers by advertising a sale that is not “truly” a sale (Simonson, Carmon, and O’Curry 1994). Typically, consumers resent such transparent attempts at motivating purchase and manipulating choice, view such tactics as manipulative, and even “punish” offending retailers by restricting their purchases (i.e., “consumers use this as a reason not to choose the promoted brand” [Simonson, Carmon, and O’Curry 1994, p. 31]; see also Brehm 1966). If the consumer believes that the retailer is merely trying to motivate purchase without offering anything substantive in return, those beliefs arouse resentment and negatively affect consumers’ evaluations.

Consider a sale price presented to the right of the original price when the discount is very low. The sale price’s display location on the right makes it easier to undertake the subtraction task (Study 1). Thus, more consumers are likely to initiate the subtraction task and identify the discount depth as “very low,” which (1) does not increase evaluations but (2) may signal that the retailer is merely being opportunistic (i.e., not offering a “true sale”). This negative attribution would (strongly) decrease evaluations, and consequently, consumers would be less likely to purchase the product. However, when the sale price appears on the left, fewer consumers are likely to initiate the subtraction task, resulting in fewer identifying the discount depth as “very low.” In parallel, the relatively more consumers who do not initiate the subtraction task will base their value judgments primarily on the sale price and infer a discount depth of approximately 10%–12%, which should not prompt perceptions of retailer opportunism. For very low discounts, we posit that a sale price presented to the right of the original price is less likely to adversely affect consumers’ evaluations compared with a sale price presented to the right. We thus hypothesize the following:

H₃: Discount depth moderates the relationships between the display location of sale price (to the right vs. left of the original price) and value perceptions and purchase intentions. When the discount is moderate, both (a) value perceptions and (b) purchase intentions are higher if sale price is located on the right, but when the discount is very low, (c) value perceptions and (d) purchase intentions are lower if the sale price is located on the right instead of the left.

Exaggerated Discounts

In the case of exaggerated discounts, consumers may see a high offer value even if they “discount the discount” (Gupta and Cooper 1992; Urban, Bearden, and Weilbaker 1988). However, in certain instances, consumers also may perceive that the product is of lower quality, essentially because of the price–quality heuristic (Dodds, Monroe, and Grewal 1991; Grewal and Compeau 2007; Lichtenstein and Burton 1989). Consequently, when consumers see an exaggerated discount that is unlike what they typically see or that is for an unknown product, they may perceive the exaggerated discount (i.e., very low selling price) to reflect poor product quality (Dodson, Tybout, and Sterntahl 1978). Consequently, despite the exaggerated discount, consumers may be less likely to buy the product (in some cases) due to negative quality perceptions.

Consider a sale price presented to the right of the original price when the discount is exaggerated. The sale price’s
location on the right makes it easier to undertake the subtraction task (Study 1). Thus, more consumers are likely to initiate the subtraction task and identify the discount depth as exaggerated, which (1) increases evaluations but (2) may signal problems with product quality. In some specific instances, negative attributions about quality may overwhelm any benefit of exaggerated discounts, thus decreasing overall evaluations and lowering likelihood of purchase. However, when the sale price is presented to the left, fewer consumers are likely to initiate the subtraction task, resulting in fewer identifying the discount depth as exaggerated. In parallel, the relatively more consumers who do not initiate the subtraction task will base their evaluations primarily on the sale price, and their inferred savings will be biased in the direction of the default 10%–12% discount, mitigating any negative quality attributions. For exaggerated discounts, we posit that a sale price presented to the right of the original price is more likely to adversely affect consumers’ evaluations compared with a sale price presented to the left. We thus hypothesize the following:

$H_5$: Discount depth moderates the relationships between display location of sale price (to the right vs. left of the original price) and value perceptions and purchase intentions. When the discount is moderate, (a) value perceptions and (b) purchase intentions are higher if the sale price is located on the right, but when the discount is exaggerated, (c) value perceptions and (d) purchase intentions are lower if the sale price is located on the right rather than the left.

**Study 5: Examining the Effect of Very Low and Exaggerated Discounts**

**Method**

We used a 3 (discount depth: very low vs. moderate vs. exaggerated) $\times$ 2 (sale price display location: left vs. right of original price) between-subjects design, with random assignment across conditions. Data were collected online from undergraduate students (N = 228) from two U.S. public universities in return for course credit.

Participants were asked to imagine that they were responsible, on behalf of their family, for buying a Turkish carpet as a wedding present for a cousin. The Turkish carpet purchase was from a relatively unknown online retailer, about which little information was available. We chose this context because we anticipated that participants typically would not have prior exposure to this domain, nor would they likely be able to distinguish good retailers from bad. In this context, consumers would thus need to rely more on price and less on their prior knowledge to determine retailer intentions, product quality, and purchase decisions. Participants viewed an advertisement for a Turkish carpet, described as follows: “This is a colorful Turkish carpet incorporating stylized motifs and a geometric design. It is a detailed yet understated carpet that will add a touch of sophistication to any room.”

**Pretests.** We ran two pretests to select the very low and exaggerated discounts. Two groups of participants (discount levels: very low [N = 31] and exaggerated/very high [N = 41]) were instructed to assume that they were shopping online for Turkish carpets. They indicated the discount level at which they would begin to become concerned about why the discount was very low or very high, respectively. Next, they chose the motivation (from a list) for the retailer to offer a very low (or very high) discount.

For the very low discount group, 90% of participants indicated that they would be concerned if the discount was 4%. Furthermore, a significant majority of participants (M = 80.6%; binomial z = 3.24, $p < .05$) indicated that offering a sale price of such a small discount level was likely motivated by the retailer being opportunistic and trying to trick consumers into buying the carpet. Such response patterns were consistent with our arguments leading into $H_3$. In a confirmatory pretest (N = 35), respondents indicated their view about the 4% discount by selecting one of the following options: (1) [it is a] trick to attract consumers or (2) generally, small discounts are irritating. Similar to the first pretest result, 71.4% participants (significant choice share, binomial z = 2.36, $p < .05$) viewed the 4% discount as a trick to attract consumers.

For the exaggerated discount group, 90% of participants indicated that they would be concerned if the discount was 85%, and a significant majority of the participants (M = 78.0%; binomial z = 3.44, $p < .05$) indicated that their main concern was that the retailer was trying to hide poor quality, consistent with our arguments for $H_4$. In a confirmatory pretest (N = 29), respondents were asked to indicate their view of this 85% discount by selecting one of the following options: (1) low-quality carpet, (2) carpet not selling well, or (3) outdated model. Here, 58.6% of participants (significant choice share, binomial z = 2.6, $p < .05$) indicated that they had quality concerns, similar to the earlier pretest results.

**Stimulus.** The original price of the Turkish carpet was $976. To manipulate discount depth, we displayed sale prices of $939 (very low discount, 4%), $679 (moderate discount, 30%, approximately the same as in Studies 2–4), or $139 (exaggerated discount, 85%). Depending on the experimental condition, the sale price appeared either to the left or to the right of the original price. Immediately after exposure to the treatment, the participants responded to scales measuring value perceptions and purchase intentions. Only after obtaining measures of the main dependent variables did we assess participants’ perceptions of retailer opportunism using a three-item, seven-point scale (Dutta, Biswas, and Grewal 2011) and of product quality using a two-item, seven-point scale (see Appendix A). We also included two distractor items in this section, the responses to which we did not expect to vary across conditions.3 Finally, we asked the two manipulation check questions to assess what participants thought about the discount depth

3The items were as follows: “The retailer is probably offering a discount for a special occasion,” and “The retailer is offering a discount as part of an event promoting ethnic goods.” The ANOVA results showed no significant interaction effects, and the individual contrasts showed no significant differences across discount levels (all cases, $p > .05$), implying that these items were not correlated with the dependent variables.
and whether they recalled if the sale price was located to the right or left of the original price. Implicitly, the Qualtrix software measured response latency (i.e., the time before participants responded to the first dependent variable).

Study 5 differs from previous study formats in two important respects. First, we examined the effects of two extreme discount conditions in addition to the moderate discount condition. Unlike Study 2a, we did not examine the low discount condition. Second, we included two process-check variables (retailer opportunism and quality perceptions), which we hoped would vary in such a way that they would explain the dependent variables. Note that we measured these process-check variables after we elicited the dependent variables, and thus, there should be no demand effect or priming effects on responses to the dependent variable measures. We did not include the 1.7% of participants who incorrectly indicated whether the sale price was on the right or left of the original price.

**Results**

A $2 \times 3$ ANOVA indicated the absence of either an interaction effect ($F(2, 217) = .14, p > .81$) or main effect ($F(1, 217) = .30, p > .50$) of sale price display location on the manipulation check variable related to discount depth. However, the effect of discount depth was significant ($F(2, 217) = 113.45, p < .01$). Participants perceived the various discounts as we expected ($M_{\text{very low}} = 2.05, M_{\text{moderate}} = 3.16, M_{\text{exaggerated}} = 4.02$; moderate vs. very low: $t(149) = 8.85, p < .01$; exaggerated vs. very low: $t(148) = 14.43, p < .01$; exaggerated vs. moderate: $t(143) = 6.48, p < .01$).

The response latency results were also as we expected, showing a significantly lower response latency value when sale price was displayed to the left versus right ($M_{\text{left}} = 31.06$ seconds, $M_{\text{right}} = 40.45$ seconds; $t(222) = -3.87, p < .01$) and no interaction effect ($F(2, 218) = .87, p > .40$). Given these response latency measures, we reasoned (as in Study 2b) that fewer participants likely initiated the subtraction task when the sale price was displayed to the left. In addition, as in Study 2b, we also examined differences in the frequency distribution of response times. The pattern of results was similar to the pattern evidenced in Study 2b. Detailed results appear in the Web Appendix (www.marketingpower.com/jm_webappendix).

In line with $H_3$ and $H_4$, the ANOVA for value perceptions showed that the interaction between discount depth and sale price display location (right vs. left) was significant ($F(2, 218) = 18.73, p < .01$). According to the individual contrasts in Figure 4, in the moderate discount condition, value perceptions were significantly higher when sale price was located to the right of the original price ($M_{\text{right}} = 4.66, M_{\text{left}} = 3.85; t(72) = 3.59, p < .01$), which wholly replicated the results for the moderate discount condition in Study 2a. In contrast, in the very low discount condition, value perceptions were significantly lower when the sale price was located to the right of the original price ($M_{\text{right}} = 2.49, M_{\text{left}} = 3.59; t(76) = 4.34, p < .01$), in support of $H_3$. Finally, in the exaggerated discount condition, value perceptions (again) were significantly lower when the sale price was located to the right of the original price ($M_{\text{right}} = 3.90, M_{\text{left}} = 5.29; t(70) = 4.12, p < .01$), in support of $H_4$.

The results for purchase intentions mirrored the results for value perceptions. An ANOVA showed a significant interaction between discount depth and sale price display location ($F(2, 218) = 15.35, p < .01$). As in Figure 4, purchase intentions were significantly higher in the moderate discount condition when the sale price was located to the right ($M_{\text{right}} = 4.31, M_{\text{left}} = 3.21; t(72) = 3.18, p < .01$) but were significantly lower in the very low discount condition ($M_{\text{right}} = 2.21, M_{\text{left}} = 2.99; t(76) = 2.95, p < .01$; in support
of \(H_3\) as well as in the exaggerated discount condition \((M_{\text{right}} = 3.47, M_{\text{left}} = 4.94; t(70) = 3.71, p < .01; \text{in support of } H_4)\). Thus, in addition to reconfirming \(H_{2a}\) and \(H_{2b}\), our findings offer support for \(H_3\) and \(H_4\).

In contrast with the moderate discount condition, in both the very low and exaggerated discount conditions, our display of the sale price to the right of the original price “hurt” consumer evaluations by leading to lower value perceptions and purchase intentions, effectively reversing the (moderate discount) results in Studies 2a, 2b, 3b, and 4a. Although \(H_3\) and \(H_4\) suggest similar patterns of means, we hypothesized the underlying mechanisms to differ; therefore, we investigated, using mediation analyses, whether our data illustrated the presence of two distinct mechanisms.

**Examining process in the very low discount condition.**

In \(H_3\), we posit that differences in evaluations across very low discount conditions primarily reflect differences in consumers’ perceptions of retailer opportunism. The findings support this argument. Consumers’ perceptions of retailer opportunism were significantly higher when the sale price appeared on the right \((M_{\text{right}} = 5.81, M_{\text{left}} = 3.61; t(76) = 7.39, p < .01)\). No such differences in evaluations emerged in the moderate discount condition \((M_{\text{right}} = 4.37, M_{\text{left}} = 4.32; t(72) = .12, p > .90)\). Furthermore, quality perceptions were similar regardless of the sale price location in both the very low \((M_{\text{right}} = 4.04, M_{\text{left}} = 4.37; t(75) = .97, p > .30)\) and moderate \((M_{\text{right}} = 3.71, M_{\text{left}} = 3.59; t(71) = .44, p > .60)\) discount conditions, suggesting that differences across these conditions were not driven by quality-related differences.

Next, drawing on Preacher and Hayes (2004), we examined whether, in the very low discount condition, retailer opportunism mediated the effects of sale price location. With value perceptions as the dependent variable, the significant effect of differences in sale price display location \((\beta = -1.1, t = -4.34, p < .01)\) was completely eliminated \((\beta = -0.52, t = -1.63, p > .10)\) when we included retailer opportunism as the mediator, while the direct effect of retailer opportunism remained significant \((\beta = -0.26, t = -2.79, p < .01)\). We found similar results for purchase intentions. The significant effect of differences in sale price display location \((\beta = -0.78, t = -2.95, p < .01)\) was completely eliminated \((\beta = -0.20, t = -0.61, p > .50)\) by retailer opportunism, while the direct effect of the mediator remained significant \((\beta = -0.26, t = -2.68, p < .01)\). The bootstrap confidence intervals for the mediation for both value perceptions \((-1.15 \text{ to } -0.06)\) and purchase intentions \((-1.19 \text{ to } -1.13)\) did not include zero, implying significant mediation. These results were wholly consistent with the theory we espoused to develop \(H_3\).

It is worth examining why we found full mediation. Consider the cell with the sale price located to the right. Here, many participants are likely to initiate the subtraction task and identify the discount as 4%. In turn, the 4% discount depth prompts perceptions of opportunism. However, when sale price is located to the left, few are likely to initiate the subtraction task, and therefore, many will assume a discount of approximately 10%–12%. Overall, (1) neither the 4% nor the 10% discount increases consumer evaluations, but (2) the 4% discount prompts perceptions of retailer opportunism. Thus, the only difference between the two cells is related to perceptions of retailer opportunism, which fully mediates differences in evaluations.

**Examining process in the exaggerated discount condition.**

In \(H_4\), we theorized (in a departure from \(H_3\)) that differences across sale price display location in the exaggerated discount condition would be driven primarily by differences in perceptions of quality and not by perceptions of retailer opportunism. We argued that sale price displayed to the right of the original price should prompt more participants to initiate the subtraction task and identify the discount as exaggerated, leading them to suspect the product’s quality. We found support for this mechanism as well. Quality perceptions were significantly lower when the sale price appeared to the right of the original price \((M_{\text{right}} = 2.39, M_{\text{left}} = 4.15; t(70) = -4.94, p < .01)\), but those differences disappeared in the moderate discount condition \((M_{\text{right}} = 3.71, M_{\text{left}} = 3.59; t(71) = .44, p > .60)\). Furthermore, perceptions of retailer opportunism were similar regardless of the sale price location (exaggerated: \(M_{\text{right}} = 4.11, M_{\text{left}} = 4.08; t(70) = .08, p > .90\); moderate: \(M_{\text{right}} = 4.37, M_{\text{left}} = 4.32; t(72) = .12, p > .90\)), suggesting that differences across the exaggerated and the moderate discount conditions were not driven by opportunism-related perceptions. This pattern of results is wholly consistent with the theory we used to develop \(H_4\) as well as indicative of a different mechanism underlying the very low discount condition \((H_3)\).

Drawing on Preacher and Hayes (2004), we examined whether, in the exaggerated discount condition, perceived quality differences mediated the effects of sale price display location. We found that the significant main effects of differences in sale price location on value perceptions \((\beta = -1.39, t = -4.11, p < .01)\) and purchase intentions \((\beta = -1.46, t = -3.71, p < .01)\) were (partially) eliminated when we included quality perception as the mediator in the model \((\beta = -0.84, t = -2.25, p > .01 \text{ but } p < .05 \text{ for value perceptions and } \beta = -0.79, t = -1.82, p > .05 \text{ for purchase intentions})\), while the main effect of the mediator remained significant \((\beta = -0.31, t = -2.89, p < .01 \text{ for value perceptions, and } \beta = -0.38, t = -3.05, p < .01 \text{ for purchase intentions})\). The bootstrap confidence interval for mediation for both value perceptions \((-1.08 \text{ to } -2.00)\) and purchase intentions \((-1.33 \text{ to } -2.22)\) did not include zero, implying significant differences in evaluations significantly lower when the sale price appeared to the right (vs. left) of the original price, consistent with the results in Study 5.
(partial) mediation. This analysis was also consistent with the theory we espoused in H4.

This partial mediation result is consistent with the mechanism we explained previously. When the sale price is located to the right, many participants are likely to initiate the subtraction task and identify the discount as 85%. This large discount can (1) increase evaluations but (2) also prompt perceptions of reduced quality, a negative attribution that decreases evaluations. Thus, in case of the large discount, the reduced evaluations reflect a trade-off between (1) increased evaluations due to the discount and (2) reduced evaluations due to perceptions of reduced quality. Thus, perceptions of reduced quality only partially mediate any differences in evaluations.

Discussion

Retailers use a variety of display locations to present sale prices. Specifically, a survey of online and catalog retailers indicates that retailers display sale prices both to the right and to the left of the original price. An open question, therefore, is whether some sale price display locations are more effective than others in influencing consumer evaluations. We examined right versus left sale price display locations and found convergent and reinforcing evidence that (1) sale prices displayed to the right (vs. left) of the original price, consistent with the subtraction principle, facilitate initiation of the subtraction task necessary to calculate discount depth and (2) whether initiation of this subtraction task increases consumer evaluations is contingent on discount depth.

The current research makes five key contributions. First, we provide evidence that supports the subtraction principle—that is, subtraction is more difficult to initiate when the smaller number appears before the larger number. This is novel to both the numerical cognition literature and the marketing literature. Second, we show that the subtraction task plays a key role in the evaluation of sale prices by influencing the propensity to calculate discount depth. Third, we demonstrate that not all consumers will initiate the subtraction task, and whether they do so is dependent on the sale price display location. Fourth, we show that whether initiation of the subtraction task affects sale price evaluations is contingent on discount depth. For example, as Studies 2a, 2b, and 4a demonstrate, when discount depth is low, the use of a sale price display location that facilitates the initiation of the subtraction task to calculate discount depth does not affect evaluations. Even if consumers calculate the discount depth, they identify it as so low that it does not increase their evaluations. However, when discount depth is moderate (see Studies 2a, 2b, 3b, 4a, and 4b; see also Appendix B), the use of a sale price display location that facilitates initiation of the subtraction task causes more consumers to identify this larger discount such that more consumers have higher evaluations. Such results are mediated by perceived difficulty/ease of initiating the subtraction task (Studies 3a and 3b). Fifth, we show some specific cases in which these results are reversed, and we also provide the associated processes.

This multistudy research article presents a unique opportunity to use meta-analytic procedures to assess the robustness of the results. Using procedures suggested by Rosenthal and Rosnow (2008), we first calculated the effect sizes associated with the key planned contrast (i.e., sale price on the left vs. right; for the moderate discount, see Appendix B for a table documenting such results) (VP: Study 2a: η² = .47; Study 2b: η² = .42; Study 3b: η² = .38; Study 4a: η² = .46; Study 5: η² = .39; Study 5r [almost identical to Study 5 and not reported here]: η² = .53; PI: Study 2a: η² = .34; Study 2b: η² = .42; Study 3b: η² = .33; Study 4a: η² = .48; Study 4b: η² = .25; Study 5: η² = .35; Study 5r: η² = .44), suggesting that these effect sizes are not significantly different (VP: χ²(5) = 1.66, n.s.; PI: χ²(6) = 3.71, n.s.). The average weighted η² was .44 (VP) and .37 (PI), and the overall relationship between the two variables was significant at p < .001. Second, we used Rosenthal and Rosnow’s (2008) file drawer technique to determine that it would take more than 180 null studies to reduce the significance of the results to the .05 level, suggesting that the results in this article are robust.

Managerial Implications

Retailers seek methods and tactics to increase the impact of sale prices, and such tactics have widespread implications for consumers, retailers, academics, and public policy makers. As a result, extensive research has focused specifically on either the optimal discount depth or optimal sale price display locations. Relatively little work has linked these concepts to determine whether and how the optimality of a certain sale price display locations might be contingent on discount depth.

Retailers typically want to present prices in ways that increase consumers’ evaluations. Our research suggests that when they offer moderate discounts, retailers should use the sale price display location to facilitate consumers’ initiation of the subtraction task. If consumers initiate the subtraction task and identify the moderate discount, they develop higher evaluations. These findings might tempt retailers to believe that they should always display sale prices to the

5As Appendix A indicates, the measures relating to perceived quality refer to the price discount, and we show that these quality measures mediate differences in evaluations. In response to a query raised by one of the reviewers, we ran a separate study (not reported here) to show that this mediation result remains even if we use (other) quality measures that do not refer to the price discount.

6Study 5b: We again directly tested the mechanisms underlying the results in Study 5 by conducting a study similar to that conducted by Thomas and Morwitz (2009). We used a 2 (quality cue: absent vs. present) × 2 (sale price display location: left vs. right of original price) between-subjects design (N = 86) to directly test the mechanism underlying Study 5’s results. We presented the quality cue to nullify perceptions of inferior product quality. In the quality cue–absent condition, given that the cue suppressed perceptions of quality suspicions, consistent with both H4 and the results from Study 5, value perceptions and purchase intentions were significantly lower when the sale price appeared to the right of the original price. In contrast, in the quality cue–present condition, evaluations were significantly higher when sale price appeared to the right. These findings were consistent with the moderate discount condition results in Study 2a and with our proposed mechanism underlying H4. Full details are available on request.
right of the original prices. With Study 5, we challenged this premise and show that at both very low discount depths and exaggerated discount depths, retailers should use sale price display locations that hinder initiation of the subtraction task. This is because when consumers calculate these discount depths, they may either suspect the retailer of opportunistic motives (in the case of very low discounts) or question product quality (in the case of exaggerated discounts). In either case, consumers’ evaluations diminish. The complex connections across sale price display locations and discount depths thus reveal nonobvious key implications for retailers.

This research also offers clear recommendations by helping retailers understand which sale price display location leads to the highest consumer evaluations under different discount conditions. If a retailer is able to change its sale price display location often, contingent on whether it offers moderate, very low, or exaggerated discounts, it should follow the guidelines we have established to design its sale price display locations and increase consumers’ value perceptions and purchase intentions. However, if a retailer is locked into a certain sale price display location, it still can gain insights from our study. We present two exemplar applications, although more applications are possible.

If the retailer’s sale price display location hinders the subtraction task (e.g., sale price displayed to the left of the original price), it will suffer from lower value perceptions and purchase intentions even when it offers moderate discounts. Because this retailer recognizes the root cause of this problem, it can provide other information to mitigate the negative effect, such as the percentage discount information we considered in Study 3b. If, however, the retailer’s sale price display location encourages the subtraction task, the retailer should, in certain cases, either avoid offering very low discounts or exaggerated discounts, which lower value perceptions and purchase intentions (Study 5), or mitigate the problem by providing external indicators, such as credibility cues or quality cues (e.g., the cues we used in Studies 5a and 5b).

From a public policy perspective, both consumers and policy makers should recognize that retailers can present sale prices to influence or potentially mislead consumers. For example, in the case of very low discounts, retailers might choose to post sale prices to the left of the original price so that fewer consumers initiate the subtraction task to calculate the actual discount depth. Such a practice is not illegal, but it may reduce market efficiency and consumer surplus (see concerns raised in Carlin 2009). Such insights may be useful for both consumer education and formulation of effective regulatory policy.

Further Research
We realize that spatial representation is not just confined to the horizontal dimension (Meier and Robinson 2004; Schubert 2005; Schwarz and Keus 2004). Consistent with the top-heavy effect (similar to the right-heavy effect; Deng and Kahn 2009), top numbers are expected to indicate larger magnitudes. In addition, people’s eyes shift to lower locations when they expect to find smaller (vs. larger) numbers (vertical spatial–numerical association of response codes effect; Ito and Hatta 2004). Therefore, displaying the smaller number below the larger number is likely the norm, and because of this, initiating subtraction tasks may be easier when the smaller number appears below the larger number. It would be useful to examine whether we can generalize the subtraction principle across other sale price presentation formats, such as sale prices presented above (vs. below) the original price.7

In this article, we considered only sale prices, which always involve a subtraction task (i.e., original price minus sale price) and not prices in general. Further research could examine whether conceptually similar results arise when considering price formats that involve addition tasks, such as in partitioned pricing contexts. Finally, Dutta, Biswas, and Grewal (2011) demonstrate how the effects of pricing tactics (e.g., low-price guarantees) on consumers’ behaviors are moderated by consumers’ regulatory focus (e.g., prevention vs. promotion focus). It would be useful to assess whether regulatory focus also plays a moderating role in influencing the effects of sale price location. Finally, it would be worthwhile for future studies to investigate the effects of other dimensions of sale price display, such as font color or font salience, or to consider the role of additional moderator variables, such as individual differences or goals.

Appendix A: Measures
All items are anchored on seven-point scales.

Value Perceptions
We used four items (1 = “strongly disagree,” and 7 = “strongly agree”). Reliabilities were .86 (Study 2a), .93 (Study 2b), .90 (Study 3a), .88 (Study 3b), .85 (Study 4a), and .85 (Study 5).

- The [product] offered by the retailer provides an excellent buy for the money.
- The advertised offer represents an extremely large savings.
- The price charged by the retailer for the [product] is extremely fair.
- The price at which the [product] is offered by the retailer provides an extremely good value.

Purchase Intentions
We used three items (1 = “very low,” and 7 = “very high”). Reliabilities were .94 (Study 2a), .93 (Study 2b), .95 (Study 3a), .92 (Study 3b), .94 (Study 4a), .96 (Study 4b), and .94 (Study 5).

- The likelihood that I would buy the [product] at the sale price is:
- The probability that I would consider buying the [product] is:
- My willingness to buy the [product] at the sale price is:

7The results of two studies we conducted suggest that locating the sale price below the original price is more effective than locating it above the reference price. These results are available on request.
Difficulty of Subtraction Task
We used four items (1 = “strongly disagree,” and 7 = “strongly agree”; all reverse-scaled). Reliability was .91 (Study 3b).
• I found it easy to figure out the percentage discount.
• The retailer made it easy to figure out the percentage discount.
• The price display made it easy to figure out the percentage discount.
• A typical consumer would have found it easy to figure out the percentage discount.

Math Self-Concept
We used four items (1 = “strongly disagree,” and 7 = “strongly agree”; all reverse-scaled). Reliability was .96 (Study 3b). For full details, see the Web Appendix (www.marketingpower.com/jm_webappendix).
• I always believed that mathematics is one of my favorite subjects.
• I learn mathematics quickly.
• I understand even the most difficult concepts in my mathematics class.
• I have always received good grades in mathematics.

Preference for Numerical Information
We used eight items (1 = “strongly disagree,” and 7 = “strongly agree”). Reliability was .90 (Study 3b). For full details, see the Web Appendix (www.marketingpower.com/jm_webappendix).
• I enjoy work that requires the use of numbers.
• I find it satisfying to solve day-to-day problems involving numbers.
• Numerical information is very useful in daily life.
• I like to make calculations using numerical information.
• I like to go over numbers in my mind.
• I prefer not to pay information to decisions involving numbers.
• I don’t like to pay attention to issues involving numbers.
• I don’t find numerical information relevant for most situations.

Quality Perceptions
We used two items (1 = “strongly disagree,” and 7 = “strongly agree”; reverse-scaled). Correlation was .74 (Study 5).
• The retailer offered the discount to stimulate sales of a not-so-good Turkish carpet.
• Given the discount level offered, there must be something wrong with the Turkish carpet.

Retailer Opportunism
We used three items (1 = “strongly disagree,” and 7 = “strongly agree”). Reliability was .92 (Study 5).
• The retailer advertises sale prices to attract consumers despite knowing that the sale prices are not very attractive.
• The retailer uses its sale prices as a trick to attract people.
• I feel that the retailer is trying to take advantage of the value people place on merely seeing sale prices.

APPENDIX B
Overview of Results Across All Studies

<table>
<thead>
<tr>
<th>Study</th>
<th>Value Perceptions</th>
<th>Purchase Intentions</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>2a 30%</td>
<td>L = 3.69 vs. R = 4.69**</td>
<td>L = 3.01 vs. R = 4.19**</td>
<td>H2 supported</td>
</tr>
<tr>
<td>10%</td>
<td>L = 3.82 vs. R = 3.53</td>
<td>L = 2.89 vs. R = 2.82</td>
<td></td>
</tr>
<tr>
<td>2b 30%</td>
<td>L = 3.83 vs. R = 4.91**</td>
<td>L = 3.26 vs. R = 4.54**</td>
<td>H2 supported</td>
</tr>
<tr>
<td>10%</td>
<td>L = 3.43 vs. R = 3.56</td>
<td>L = 3.18 vs. R = 3.08</td>
<td></td>
</tr>
<tr>
<td>3a 30%</td>
<td>L = 5.23 vs. R = 5.27</td>
<td>L = 4.79 vs. R = 4.81</td>
<td>H2 not supported when calculations are very small</td>
</tr>
<tr>
<td>10%</td>
<td>L = 4.37 vs. R = 4.24</td>
<td>L = 3.54 vs. R = 3.33</td>
<td></td>
</tr>
<tr>
<td>3b</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cue absent</td>
<td>L = 3.71 vs. R = 4.69**</td>
<td>L = 3.50 vs. R = 4.35**</td>
<td>H2 supported, but not when calculations were unnecessary</td>
</tr>
<tr>
<td>Cue present</td>
<td>L = 4.88 vs. R = 4.87</td>
<td>L = 4.41 vs. R = 4.42</td>
<td></td>
</tr>
<tr>
<td>4a 30%</td>
<td>L = 3.79 vs. R = 4.93**</td>
<td>L = 3.23 vs. R = 4.81**</td>
<td>H2 supported with nonstudent sample</td>
</tr>
<tr>
<td>10%</td>
<td>L = 3.96 vs. R = 3.72</td>
<td>L = 2.92 vs. R = 3.15</td>
<td></td>
</tr>
<tr>
<td>4b</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30%</td>
<td>L = 3.62 vs. R = 4.50**</td>
<td>L = 18.9% vs. R = 38.9%*</td>
<td>H2 supported with nonstudent sample evaluating a real choice</td>
</tr>
<tr>
<td>Preferring focal spoon:</td>
<td>L = 2.89 vs. R = 2.21**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L = 3.59 vs. R = 2.49**</td>
<td>L = 2.99 vs. R = 2.21**</td>
<td>H3 and H4 supported</td>
<td></td>
</tr>
<tr>
<td>20%</td>
<td>L = 3.85 vs. R = 4.66**</td>
<td>L = 3.21 vs. R = 4.31**</td>
<td></td>
</tr>
<tr>
<td>5a Cue absent</td>
<td>L = 3.84 vs. R = 3.11**</td>
<td>L = 3.10 vs. R = 2.16**</td>
<td>H3 supported, but not when retailer opportunism perceptions were reduced</td>
</tr>
<tr>
<td>Cue present</td>
<td>L = 3.94 vs. R = 3.97</td>
<td>L = 3.36 vs. R = 3.58</td>
<td></td>
</tr>
<tr>
<td>5b Cue absent</td>
<td>L = 4.90 vs. R = 3.88**</td>
<td>L = 4.75 vs. R = 3.69**</td>
<td>H4 supported, but not when poor product quality perceptions were reduced</td>
</tr>
<tr>
<td>Cue present</td>
<td>L = 3.95 vs. R = 4.99**</td>
<td>L = 3.60 vs. R = 4.79**</td>
<td></td>
</tr>
</tbody>
</table>

*p = .06.
**p < .05.
Notes: n%: L (R) = mean value for n% discount depth when sale price appears to the left (right) of the original price.
REFERENCES


