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# The leftover effect: How shelf spacing between leftover products affects purchase intention of subsequent consumers

**Abstract:** Product spacing on retail shelves can arise from either deliberate merchandising decisions or gaps left after customer purchases. While existing research consistently highlights the positive marketing effects of retailer-controlled spacing, the behavioral impact of customer-induced spacing among leftover products has yet to receive sufficient scholarly attention. Drawing on cue utilization theory and inference theory, we show across one field study and four experiments that customer-induced product spacing significantly lowers purchase intentions. This effect occurs through consumers' leftover inference and perceived deficiency regarding these products. Importantly, this negative effect is weaker for high-reputation brands or low-variance products. These findings advance theoretical understanding of how environmental cues are processed in retail and provide practical recommendations for optimizing shelf layouts to minimize unintended sales losses due to such spacing.

**Keywords:** product spacing, leftover inference, perceived deficiency, brand reputation, product variance

## 1. Introduction

Consumer interaction with products in offline retail often alters shelf arrangements and displays (Castro et al. 2013). Prior work acknowledges consumers' active role in shaping the in-store environment (Argo et al. 2006; Barton et al. 2022; Reynolds-McIlnay et al. 2017). However, limited knowledge exists regarding the effect of product spacing resulting from such interactions (Roose & Vermeir 2023). This gap is striking given that consumer-induced spacing is not a rare occurrence but a pervasive and often unavoidable feature of physical retail environments. Product spacing is a critical element of offline retail design, serving as both a visual stimulus and a spatial cue that shapes consumer perceptions and decisions (Zhang et al. 2021). Ignoring how such unintended spatial configurations influence subsequent consumers risks undermining the effectiveness of even the most carefully designed shelf layouts.

Consider a common scenario: upon entering a clothing store, you find only a few T-shirts remaining on a sparsely stocked shelf. Such a leftover arrangement may evoke two opposing interpretations. On the one hand, the scattered items might imply popularity, encouraging impulse purchases. On the other hand, it could suggest that premium or higher-quality items have already been taken, leaving only undesirable stock, thereby discouraging purchase. Similar consumer-induced spacing is frequently observed in retail categories such as apparel, food, and home goods. Despite its prevalence, little is known about how the spacing of leftover products affects subsequent consumer evaluations and decisions.

Existing research has thoroughly examined the effects of product spacing (Huang et al. 2019; Sevilla & Townsend 2016; Zeng et al. 2017; Zhang et al. 2021), as well as element spacing in advertisements and branding (Chae et al. 2013; Gupta & Hagtvedt 2021; Kwan et al. 2017; Su et al. 2019). However, most studies have concentrated on product scarcity effect

(Parker & Lehmann 2011; Van Herpen et al. 2009) or pre-sales product arrangement (Sevilla & Townsend 2016; Zhang et al. 2021), while largely neglecting that spacing may indicate that products are leftover and deficient in some way. This omission is noteworthy given the prevalence of such spacing in retail environments once items have been sold. To address this gap, our research investigates how product spacing on shelves creates a leftover cue that subsequently influences purchasing decisions, offering insights that are both theoretically novel and managerially actionable.

As an initial test for this idea, we conducted a pilot study ($N = 254$) using T-shirts and coffee cups. The results confirmed that consumers interpret spacing in product displays as an indication that the remaining items are leftover (see Web Appendix A for details). Building on this finding, we propose that product spacing reduces purchase intentions by triggering leftover inferences and perceived deficiency—that is, consumers' belief that remaining products are inferior or defective. Importantly, we identify two boundary conditions: brand reputation and product variance. We test these propositions across one field study and four experiments, finding consistent support for our hypotheses.

This research advances theoretical understanding in three key ways. First, we extend the product spacing literature, which has primarily examined the effects of retailer-controlled spacing (Barton et al. 2022; Zhang et al. 2021). Consumer-induced changes to product display have largely been assessed through the lens of scarcity (Parker & Lehmann 2011; Reynolds-McIlnay et al. 2017), with limited attention to the effect of product spacing per se. We introduce the concept of leftover products and demonstrate that consumer-induced product spacing can be negative, fundamentally differing in its behavioral consequences from retailer-controlled spacing.

Second, we offer novel insights into the relationship between product spacing and purchase intention using innovative theoretical frameworks. While prior work highlights

spacing's positive effects—such as enhancing product aesthetics and store reputation (Sevilla & Townsend 2016), improving attention focus (Zhang et al. 2021), and strengthening social identity (Zeng et al. 2017)—we introduce cue utilization theory and inference theory to uncover spacing's potential downsides. Specifically, our findings reveal that spacing between leftover items initially triggers leftover-based inferences, which subsequently lead to perceptions of product deficiency, ultimately reducing purchase intentions. Our research therefore provides a more nuanced understanding of the spacing effect in physical retail environments.

Third, we identify two critical moderators reshaping the spacing effect: (1) brand reputation (high vs. low) and (2) product variance (high vs. low). Our results show that the negative effect of spacing is attenuated when consumers feel confident about a product, such as in contexts of high brand reputation or low product variance. These findings advance retail strategy literature by specifying when and how spacing influences consumer decisions, providing retailers with actionable guidelines for optimizing inventory displays.

In the following sections, we review the literature on product spacing and introduce cue utilization theory and inference theory. We then develop and empirically test our hypotheses across five studies. Finally, we discuss our findings, outline their theoretical and managerial implications, and suggest directions for future research.

## 2. Theoretical Framework

### *2.1. Product spacing*

Products are embedded within a broader environmental context, and consumers' perceptions and attitudes toward them are shaped by two key factors: the product's inherent

attributes and contextual cues from its surroundings. Among these contextual elements, the physical distance between a focal product and adjacent items plays a particularly influential role (Hong et al. 2016; Hsee & Leclerc 1998). Empirical research has consistently demonstrated that in physical retail settings, product spacing significantly influences how consumers form judgments, make decisions, and evaluate product value (Kwak et al. 2020; Sevilla & Townsend 2016; Zhang et al. 2021). Operationally, spacing is defined as the measurable distance between a target object and other objects in its vicinity (Sample et al. 2020). In retail contexts, this refers specifically to the physical gap between a given product and other merchandise displayed nearby (Roose & Vermeir 2023).

We classify product spacing in offline retail environments into two distinct types: retailer-controlled spacing and customer-induced spacing. Retailer-controlled spacing refers to the intentional product placement and shelf organization strategies implemented by retailers, typically prior to store opening. In contrast, customer-induced spacing emerges naturally from consumer interactions: as items are purchased, gaps appear among the remaining products, altering the original layout. This consumer-generated spacing is particularly prevalent in stores where staff have limited ability to maintain shelf organization due to operational challenges. Prior research indicates that time constraints often prevent employees from promptly restocking and rearranging items (Castro et al. 2013). Consequently, shoppers frequently encounter partially depleted displays where noticeable gaps create spatial arrangements that diverge substantially from the retailer's initial plan.

Existing research has primarily focused on how retailer-controlled product spacing shapes consumer perception. For example, studies show that placing products closer to related promotional claims can enhance advertising effectiveness. Chae et al. (2013) illustrated this principle using acne cream advertisements: when the product was visually positioned near an image of clear skin, consumers perceived it as more effective. Sevilla and

Townsend (2016) revealed that greater spacing between products can enhance a store's perceived reputation and the aesthetic appeal of its products, leading to higher purchase intentions. Product spacing can also reinforce social identity associations. Zeng et al. (2017) demonstrated that appropriately spaced layouts can strengthen consumers' sense of social identity, which in turn improves their product evaluations. These spacing strategies have also proven effective in digital settings (Huang et al. 2019). Supporting this, Zhang et al. (2021) showed that spacing between products on websites helps draw visual attention and can make products appear larger, thereby improving consumer response (see Table 1).

**Table 1**
Difference between retailer-controlled and consumer-induced spacing.

| Study | Stimuli | Outcome | Mechanism | Key findings |
|---|---|---|---|---|
| Van Herpen et al. 2009 | Wine, clothing | Product preference and choice (+) | Product scarcity | Empty shelf space conveys scarcity and thus induces product preference and choice. |
| Parker & Lehmann 2011 | Wine, convenience products, motor oil | Product choice (+) | Popularity inference | Relative stocking level depletion leads to popularity inferences that drive product choice. Prior preferences and price promotion reduce effect. |
| Sevilla & Townsend 2016 * | Jewelry, hand cream, analgesic balm, earrings, chocolate | Product value and purchase likelihood (+) | Store prestige and product aesthetics | Interstitial space increases perceptions of individual products as more aesthetically pleasing and stores as more prestigious. |
| Zeng et al. 2017 * | Watches, mugs | Product evaluation (+) | Social identity inference | Lower product density increases consumers' evaluation of the product. |
| Huang et al. 2019 * | Bookmarks, mugs, shoes | Store evaluation (+) | Store price perception | Online stores with larger online product catalog space are perceived to sell more expensive products. |
| Kwak et al. 2020 * | Snacks, smoothies, ice water, tomato juice | Purchase intention (±) | Consumer's motivation for uniqueness | (No) space between products reduces (enhances) the effectiveness of multiple (vs. single) unit price promotions. |
| Zhang et al. 2021 * | Cans, mixed nuts, shampoo, crackers, water bottles | Product choice and purchase intention (+) | Consumer attention | Interspace in product display increases consumers' perceived estimations of product size. |
| **Current study** | **Bread, cookies, T-shirts, coffee cups** | **Purchase intention (-)** | **Leftover inference and perceived deficiency** | **Product spacing significantly reduces purchase intentions.** |

Notes: * indicates studies where spacing was strategically applied by retailers; + denotes positive effect, - signifies negative effect.

However, customer-induced product spacing remains insufficiently explored. Our research focuses specifically on the physical gaps that typically arise when consumers pick products from a shelf, particularly in non-luxury retail categories. While product spacing occurs in both luxury and non-luxury settings, its implications differ significantly. In luxury retailing, spacing is often intentionally used to communicate social status (Sun et al. 2021).

Retailers strategically isolate high-end items to strengthen their exclusivity and reinforce consumers' sense of elevated social identity (Zeng et al. 2017). In contrast, this symbolic association between spacing and social standing is less relevant in non-luxury contexts. Non-luxury products are usually displayed in dense arrangements to maximize shelf efficiency. Nevertheless, spacing still emerges organically—especially after periods of high consumer traffic—as items are purchased and gaps are left among the remaining inventory. Our study therefore distinguishes itself from prior research on product spacing in several important ways.

### *2.2. Consumer-induced product spacing*

In offline retail, consumer purchasing can lead to two primary display patterns when shelves are not restocked. The first pattern features visible gaps between remaining products—a phenomenon we term "product spacing." For instance, as illustrated in the left panel of Fig. 1, five products may remain on the shelf with noticeable gaps, which can be uneven or occasionally evenly distributed. We classify both as instances of product spacing, as such gaps suggest that certain products were unwanted by previous consumers. To ensure conceptual rigor, we later empirically confirm that equal and unequal spacing yield similar effects. The second pattern involves a tightly clustered arrangement of leftover products with minimal or no gaps, as shown in the right panel of Fig. 1. In this case, products appear closely clustered together, an arrangement unlikely to result from prior consumer selections. Although both patterns may involve the same number of leftover products, they differ substantially in spatial arrangement. Our central research question, therefore, is how the spacing between leftover products influences subsequent consumers' perceptions and purchase behavior. To address this question, the research draws on two theories: (1) cue

utilization theory and (2) inference theory.

**Fig. 1.** Spacing between leftover products.

*2.3. Cue utilization theory and inference theory*

In situations where later buyers cannot observe the behaviors of previous purchasers, the physical arrangement of products—such as how they are spaced—acts as a visual cue that consumers interpret to form judgments. To explain how people use such information in decision-making, Cox (1962) introduced cue utilization theory. This framework suggests that when information is incomplete or asymmetric, consumers rely on available cues to assess a product's value and quality. Research distinguishes between two types of product cues: extrinsic and intrinsic. Extrinsic cues are external features that can be altered without changing the product itself, such as price, brand, or packaging. In contrast, intrinsic cues are inherent to the product's physical nature, such as its flavor, size, or shape (Olson & Jacoby 1972; Richardson et al. 1994; Yazdanparast & Kukar-Kinney 2023). Studies show how these cues work in practice. For example, Yazdanparast and Kukar-Kinney (2023) reveal that tactile information (an intrinsic cue) interacts with price framing (an extrinsic cue) to affect purchase intentions. Similarly, Visentin and Tuan (2021) find that extrinsic visual cues—such as belly bands on books—can strengthen emotional response and buying intent. Notably, extrinsic cues often play a larger role in shaping quality perceptions, because intrinsic attributes can be difficult to evaluate, especially when consumers lack expertise (Dodds et al. 1991). Moreover, extrinsic cues reduce the time and mental effort required to make decisions, making them a practical tool for consumer inference.

Product displays play a key role in attracting consumers in retail settings. Building on this idea, we propose that the spacing between leftover products may act as an extrinsic cue that shoppers use to make inferences in physical stores. Inference theory describes how people form judgments about unknown information based on available clues (Huber & McCann 1982; Kardes et al. 2004). Similarly, consumer inference is a mode of information processing in which people use visible and available cues to draw conclusions and reduce mental effort when evaluating products (Gunasti & Ross 2010). When direct information about quality is lacking, consumers naturally rely on such observable cues to assess products (Wang et al. 2023). Previous studies have shown that shoppers consciously use cues such as brand names (Dodds et al. 1991) or logos (Wang et al. 2023) to infer quality before making a purchase.

## 3. Hypotheses Development

### *3.1. The effect of product spacing on purchase intentions*

When a product is purchased, the number of items still available decreases, potentially leaving an empty space on the shelf. In other words, product spacing results from consumer purchases. Later shoppers tend to interpret these gaps as a basis for evaluating products and making decisions (Baker et al. 2002; Sevilla & Townsend 2016). When consumers see items spaced apart, they may infer that these are "leftovers"—products that previous customers considered but rejected. This leads them to assume that superior items have already been taken, leaving behind potentially inferior choices. We refer to this psychological mechanism as perceived deficiency and name the overall phenomenon the "leftover effect." Specifically, we argue that consumers first make a leftover inference—an initial social inference about

why a product remains unsold—and then develop a deeper perception of deficiency, which involves a negative evaluation of the product's attributes or value. Although closely related, these stages are distinct within the cognitive process. Leftover inference serves as the foundational step: it is a spontaneous explanation for why the product was left behind. Perceived deficiency follows, representing a more subjective and value-laden judgment. Consequently, consumers perceive leftover products as lower in value and become less willing to purchase them (Argo et al. 2006). It is worth noting that such negative perceptions can occur even when no actual product handling is observed (Meng et al. 2022). For example, even minor packaging flaws, such as a loose label, can trigger negative consumer reactions (White et al. 2016). Conversely, when products are displayed tightly together without gaps, they appear untouched and fresh. This reduces both leftover inference and perceived deficiency. Therefore, we propose the following hypotheses:

**H1**. Product spacing lowers consumers' purchase intentions.

**H2**. The negative effect of product spacing on purchase intentions is sequentially mediated by leftover inference and perceived deficiency. Specifically, product spacing increases leftover inference, which then heightens perceived deficiency, and ultimately lowers purchase intentions.

### *3.2. The moderating effect of brand reputation*

We propose that the spacing of leftover products reduces purchase intention by eliciting consumers' leftover inference and perceived deficiency. To counteract this effect, we investigate potential moderating factors, among which brand reputation appears particularly influential. Brand reputation refers to the overall impression formed by focal stakeholders, such as consumers, after thinking, feeling and talking about the brand (Rust et al. 2021). A

strong brand reputation leads consumers to perceive the brand as well-behaved (Iglesias et al. 2019), thereby shaping positive responses toward its product offerings (Johnson et al. 2019).

Brand reputation functions as a key heuristic that consumers employ to reduce uncertainty in decision-making (Akdeniz et al. 2013). Its positive role in product evaluations is largely due to its utility as an indicator of quality (Johnson et al. 2019). Research also indicates that brand presence and reputation generally suggest consistent quality standards (Aaker & Keller 1990; Keller 2003; Zheng et al. 2019). The reassurance provided by such reputational cues helps explain why a well-respected brand reduces consumer skepticism toward leftover items, as the established reputation offsets potential doubts. As a result, consumers are less likely to assume that leftover products are undesirable. Conversely, when brand reputation is low, consumers lack this mental shortcut for inferring quality, making them more likely to question why the products were left behind. Based on this reasoning, we propose the following hypothesis:

> **H3**. Brand reputation moderates the negative effect of product spacing on leftover inference. Specifically, the adverse effect disappears when brand reputation is high, thereby eliminating the downstream indirect effects of product spacing on perceived deficiency and, in turn, purchase intentions. In contrast, the negative effect between product spacing and leftover inference and the negative indirect effect persist when brand reputation is low.

### *3.3. The moderating effect of product variance*

Beyond brand-related factors, the effect of spacing on leftover inference may also vary across product categories. This moderating effect arises because consumers naturally anticipate variation for certain products—even among items within the same stock-keeping

unit. We draw on the concept of product variance, which reflects the extent to which consumers' experiences with a product may differ due to its inherent characteristics (Sun 2012). Such variance can arise from quality inconsistencies, such as defects across individual units (e.g., some water bottles leak while others do not) (Zimmermann et al. 2018). Accordingly, products can be classified as low-variance (high quality consistency) or high-variance (low quality consistency). High product variance increases consumers' perceived uncertainty and risk (Park & Park 2013; Sun 2012).

Consumer perceptions and purchasing behaviors vary substantially with product variance. Low-variance products offer consistent quality across units. Measurable performance attributes and reliable quality assurance thus help alleviate concerns about leftover items. Consequently, product spacing exerts little influence on leftover inference for such products. Conversely, high-variance products depend heavily on individual experience and often require direct contact or consumption for accurate evaluation (Lee & Hosanagar 2020; Zhu et al. 2022). Assessing these products involves sensory engagement and subjective judgment (Babin et al. 1994), leading to considerable heterogeneity in perceived product attributes, including quality. This unpredictability drives selective purchasing, as consumers seek items they believe to be superior. Consequently, physical spacing among leftover high-variance products can subconsciously suggest inferior quality, triggering leftover inference and perceived deficiency, which ultimately reduces purchase intention. The conceptual framework is depicted in Fig. 2.

**H4**. Product variance moderates the negative effect of product spacing on leftover inference. Specifically, this adverse effect disappears when product variance is low, thereby eliminating the downstream indirect effects of product spacing on perceived deficiency and, in turn, purchase intentions. In contrast, the negative effect between product spacing and leftover inference and the negative indirect effect persist when

product variance is high.

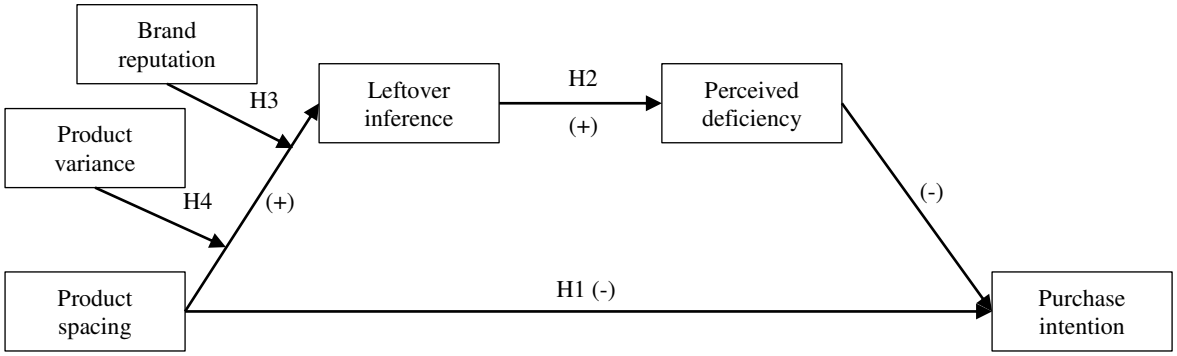


**Fig. 2.** Conceptual framework.

## 4. Methodology

To test the above hypotheses, we conducted five studies using a mixed-methods approach. Study 1 examines the negative effect of product spacing on purchase intention in a field study. Studies 2-5 adopt experimental designs. Specifically, Study 2 confirms the main effect of product spacing on purchase intention while ruling out alternative explanations such as visual aesthetics, contamination fears, and service quality. In Study 3, we test the serial mediating roles of leftover inference and perceived deficiency. Studies 4 and 5 investigate the moderating effects of brand reputation and product variance on the relationship between product spacing and leftover inference.

### *4.1. Study 1*

In Study 1, we conducted a field observation in a convenience store to examine whether the spacing between leftover products negatively affects purchase intentions. The target product was homemade bread, which naturally varies in shapes and sizes, unlike standardized factory-made products. To minimize potential herd effects (Lu et al. 2022), we focused on individual purchasing behavior rather than group dynamics. Data were gathered over four

consecutive days during three peak shopping intervals: 11:00 a.m.-12:30 p.m., 5:00-6:30 p.m., and 9:00-10:00 p.m.

*4.1.1. Procedure*

We conducted a product display experiment in the bread section using two arrangement patterns (Web Appendix B). The study followed an alternating-day design: Condition 1 (varying spacing between products) was implemented on Days 1 and 3, while Condition 2 (products placed without spacing) was applied on Days 2 and 4. Only customers who purchased bread were included as participants. Passersby who did not make a purchase were excluded from the analysis, as their purchase intention could not be reliably assessed. We confirmed the effectiveness of the spacing manipulation through a manipulation check (Web Appendix C).

The bread products used in the experiment belonged to the same categories under both arrangement conditions, and these categories were distinct from the other breads on display. During each session, participants could select products either from these experimental setups or from other available homemade bread categories. To ensure consistent stock levels throughout the study, all items sold—both experimental and non-experimental—were promptly restocked after each purchase. Research assistants, blending in as regular shoppers, unobtrusively observed and recorded participants' final purchasing decisions.

*4.1.2. Results*

A total of 204 valid observations were recorded, of which 64 (31.4%) involved female participants. Under the presence-of-spacing condition, there were 101 participants. Among them, 7 (6.9%) purchased products from the spaced arrangement, while 94 selected items from other homemade bread categories. In contrast, under the absence-of-spacing condition, 21 participants (20.4%) chose products from the target display, whereas 82 opted for other homemade bread categories. A chi-square test indicated that consumers in the presence-of-

spacing condition were significantly less likely to purchase the target bread products compared to those in the absence-of-spacing condition ($\chi^2(1) = 7.80$, $p = .005$, $\varphi = .20$).

*4.1.3. Discussion*

The initial findings suggest that spacing between leftover products negatively affects purchase intention. Specifically, when leftover bread items were placed farther apart, consumers made fewer purchases. However, this spaced arrangement may also convey a sense of irregularity, potentially giving rise to other negative impressions. For example, one possibility is that spaced product arrangements might produce a pictorial effect: while organized layouts can enhance aesthetic appeal, randomly spaced items may evoke negative impressions due to uneven gaps. Another possibility, drawing on the contagion effect (Castro et al. 2013), is that consumers might perceive spaced products as potentially contaminated through prior handling. A third possibility, based on the established link between service quality and purchase intentions (Wang 2014), is that spaced displays might suggest lower service quality. Additionally, the bread products used in Study 1 varied noticeably in flavor and color. Such diversity may itself draw attention and create a sense of choice, potentially influencing purchase decisions regardless of spacing. Therefore, we conduct further experiments to clarify these aspects under more controlled conditions.

*4.2. Study 2*

Study 2 had four main objectives. First, it aimed to confirm the negative effect of product spacing on purchase intention and to replicate the results of Study 1 in a controlled experimental setting. Second, we compared unequal versus equal spacing within the product spacing condition to better understand what drives the psychological inference of leftover products. Product variety was intentionally held constant across conditions to eliminate its

potential influence. Third, the study sought to rule out alternative explanations such as visual aesthetics, contamination fears, and perceived service quality. Fourth, reduced product quantity is known to enhance perceived scarcity (Barton et al. 2022) and perceived popularity (Parker & Lehmann 2011; Van Herpen et al. 2009). We argue that these mechanisms are not applicable here because there was no comparison against the popularity or scarcity of competing products. Similarly, while product disorderliness can affect consumer behavior (Chae & Zhu 2014), we excluded evidently chaotic product arrangements. Although effects related to scarcity, popularity, and disorderliness could be theoretically excluded, we still measured these potential confounding variables in a pretest.

*4.2.1. Experimental design and procedure*

A total of 220 participants were recruited from Credamo and received monetary compensation for taking part in the study. Those who failed the attention check ($N = 5$) were excluded from the analysis. The final sample was 215 (54.8% female, $M_{age} = 34.3$, $SD = 8.21$). Participants were randomly assigned to one of three conditions in a between-subjects design with a single factor: product spacing (unequal spacing vs. equal spacing vs. no spacing). The final allocation was as follows: 66 participants in the unequal spacing condition, 75 in the equal spacing condition, and 74 in the no spacing condition. For all online studies (i.e., Studies 2-5), we targeted approximately 50-100 participants per condition and conducted post hoc power analyses using G*Power 3.1, confirming that all studies were adequately powered ($\alpha = 0.05$, effect size $f = 0.25$, power = 85%; Faul et al. 2007).

After random assignment, all participants began by reading the same contextual scenario: “On a Sunday afternoon, you are shopping at a market close to your house. Upon entering a grocery store, you notice multiple items arranged on a row of shelves.” Those in the unequal spacing condition were then shown an image of cookies placed at uneven distances from one another. Participants in the equal spacing condition viewed cookies

spaced uniformly apart. In the no spacing condition, participants saw an image where the cookies were arranged with no spacing between them (Web Appendix D). The key difference across these visual stimuli was the varied spacing between the cookies. A pretest confirmed that the images were perceived similarly in terms of disorderliness, popularity, and scarcity (see Web Appendix E for measures and results). A manipulation check confirmed that the spacing-based grouping was perceived as intended (Web Appendix C).

Subsequently, participants rated their purchase intention, perceptions of visual aesthetics, contamination fears, and service quality. To reduce potential order effects, the sequence of these mediator measures was randomized across participants. Purchase intention was assessed using a three-item scale adapted from Das et al. (2018), which included: "I am very likely to purchase/am willing to purchase/would consider buying the product shown in the above picture. ($\alpha$ = .88)" Visual aesthetics was measured with two items from Sevilla and Townsend (2016): "How good looking/visually pleasing was the product display? ($r$ = .82)" Contamination fears were gauged using an item from Castro et al. (2013): "I am concerned that the products may be contaminated due to being touched by others." Service quality was evaluated with the item: "How do you rate the service quality of the retail staff?" All items were rated on a 7-point Likert scale (1 = strongly disagree/extremely unappealing/extremely poor, 7 = strongly agree/extremely appealing/extremely good). Finally, demographic information was collected from all participants.

*4.2.2. ANOVA results*

A one-way ANOVA indicated that product spacing had a significant effect on consumers' purchase intention ($F$ (2,212) = 5.85, $p$ = .003, $\eta^2$ = 0.05). Specifically, purchase intention was significantly lower in both the unequal and equal spacing conditions compared to the no spacing condition ($M_{\text{unequal spacing condition}}$ = 4.44, $SD$ = 1.32; $M_{\text{equal spacing condition}}$ = 4.36, $SD$ = 1.30; $M_{\text{no spacing condition}}$ = 5.04, $SD$ = 1.35). Furthermore, no significant difference was

found between the unequal and equal spacing conditions ($t$ (139) = .38, $p$ = .71, $d$ = .06). Thus, H1 was supported.

In line with expectations, product spacing did not have a significant effect on any of the following variables: perceived visual aesthetics ($M_{\text{unequal spacing condition}}$ = 4.03, $SD$ = 1.90; $M_{\text{equal spacing condition}}$ = 4.13, $SD$ = 1.77; $M_{\text{no spacing condition}}$ = 3.67, $SD$ = 1.66; $F$ (2,212) = 1.37, $p$ = .26, $\eta^2$ = 0.01), contamination fears ($M_{\text{unequal spacing condition}}$ = 3.74, $SD$ = 1.69; $M_{\text{equal spacing condition}}$ = 3.72, $SD$ = 1.68; $M_{\text{no spacing condition}}$ = 3.96, $SD$ = 1.55; $F$ (2,212) = .48, $p$ = .62, $\eta^2$ < .01), or perceived service quality ($M_{\text{unequal spacing condition}}$ = 4.05, $SD$ = 1.66; $M_{\text{equal spacing condition}}$ = 4.13, $SD$ = 1.73; $M_{\text{no spacing condition}}$ = 3.81, $SD$ = 1.82; $F$(2,212) = .68, $p$ = .51, $\eta^2$ < .01).

*4.2.3. Assessment of alternative mediating mechanisms*

To examine three alternative mediating mechanisms, we conducted a parallel mediation analysis comparing the unequal spacing condition with the no spacing condition. The correlations between each pair of mediators were statistically non-significant (all $p$-values > .1), ranging from -.04 to .04. Using the bootstrapping method with 5,000 resamples (Hayes 2022; Model 4), we treated product spacing (1 = no spacing, 2 = unequal spacing) as the independent variable, purchase intention as the dependent variable, and visual aesthetics, contamination fears, and perceived service quality as mediators. The results showed that none of the indirect effects were significant, specifically via visual aesthetics ($b$ = -.07, $SE$ = .07; $CI$ = [-.21; .04]), contamination fears ($b$ = .003, $SE$ = .03; $CI$ = [-.05; .06]), or perceived service quality ($b$ = -.02, $SE$ = .03; $CI$ = [-.09; .04]). This indicates that none of these mediators accounted for the effect of product spacing on purchase intention. The results are summarized in Web Appendix F. Similar findings were obtained when comparing the equal spacing condition with the no spacing condition.

*4.2.4. Discussion*

Study 2 confirms the main effect of product spacing on purchase intention within a

controlled experimental setting. Consistent with Study 1, product spacing reduced purchase intention, and this effect replicated in equal and unequal spacing conditions. In addition, we ruled out several alternative explanations—namely, those related to visual aesthetics, contamination fears, and service quality. Moreover, as product variety was held constant across conditions, the observed decrease in purchase intention cannot be attributed to such variety. In Study 3, we turn to investigating the underlying mechanism driving this negative effect.

### *4.3. Study 3*

We propose that consumers first form a leftover inference, which then leads to a deeper sense of perceived deficiency. To examine this sequential process, Study 3 was designed to test the serial mediation effect through both leftover inference and perceived deficiency.

#### *4.3.1. Experimental design and procedure*

A total of 195 participants were recruited through Credamo and received monetary compensation for taking part in the study. After excluding 11 individuals who failed the attention check, the final sample consisted of 184 participants (57.1% female, $M_{age}$ = 32.6, *SD* = 7.22). Using a between-subjects design, participants were randomly assigned to one of three product spacing conditions: unequal spacing ($N$ = 58), equal spacing ($N$ = 63), or no spacing ($N$ = 63).

First, all participants read a contextual introduction similar to the one from Study 2. Participants in the unequal spacing condition were shown T-shirts arranged at varying distances from one another. Those in the equal spacing condition saw T-shirts spaced evenly apart, while those in the no spacing condition viewed a store scene in which T-shirts were placed very close together (Web Appendix G). Importantly, the only difference across the

three images was the spacing between T-shirts on the shelf. A pretest confirmed that participants perceived the images consistently in terms of disorderliness, popularity, and scarcity (Web Appendix H). A manipulation check confirmed the effectiveness of the spacing-based grouping.

Participants were then asked to evaluate their purchase intention ($\alpha$ = .91), leftover inference, and perceived deficiency. Leftover inference was measured using a single item: "To what extent do you think the products on the shelves are leftover?" Perceived deficiency was assessed with three items: "Compared to the other products being bought, I think the product shown in the picture may be inferior/defective/of low quality (1 = strongly disagree, 7 = strongly agree, $\alpha$ = .89)." We calculated pairwise correlations between all variables. A moderate correlation ($r$ = 0.56) was observed between leftover inference and perceived deficiency. A correlation at this level is generally not considered strong enough to cause severe multicollinearity (Sung et al. 2021; Vossen et al. 2015).

*4.3.2. ANOVA results*

A one-way ANOVA showed that product spacing significantly influenced consumers' purchase intention ($F$ (2,181) = 8.25, $p$ < .001, $\eta^2$ = 0.08). Specifically, purchase intention was significantly lower in both the unequal and equal spacing conditions compared to the no spacing condition ($M_{\text{unequal spacing condition}}$ = 4.03, $SD$ = 1.64; $M_{\text{equal spacing condition}}$ = 3.83, $SD$ = 1.63; $M_{\text{no spacing condition}}$ = 4.92, $SD$ = 1.54). However, no significant difference was observed between the unequal and equal spacing conditions ($t$ (119) = .70, $p$ = .48, $d$ = .13).

Similarly, leftover inference differed significantly across spacing conditions ($F$ (2,181) = 6.56, $p$ = .002, $\eta^2$ = 0.07). The unequal spacing condition ($M$ = 5.33, $SD$ = 1.29) and equal spacing condition ($M$ = 5.13, $SD$ = 1.25) both elicited stronger leftover inference than the no spacing condition ($M$ = 4.44, $SD$ = 1.66), but again, the difference between the two experimental conditions (unequal vs. equal) was not significant ($t$ (119) = .87, $p$ = .39, $d$

= .16).

Lastly, perceived deficiency also varied significantly by spacing condition ($F$ (2,181) = 3.67, $p$ = .03, $\eta^2$ = 0.04). Ratings were higher in both the unequal spacing ($M$ = 5.24, $SD$ = 1.51) and equal spacing ($M$ = 5.32, $SD$ = 1.11) conditions compared to the no spacing condition ($M$ = 4.66, $SD$ = 1.78). No significant difference was observed between the unequal and equal spacing conditions ($t$ (119) = -.32, $p$ = .75, $d$ = -.06).

*4.3.3. Serial mediation analyses*

To test the hypothesized pathway (spacing → leftover inference → perceived deficiency → purchase intention), we first performed a serial mediation analysis comparing the unequal spacing condition (coded as 2) with the no spacing condition (coded as 1), using a bootstrapping approach with 5,000 samples (Hayes 2022; Model 6). As shown in Fig. 3, the serial mediation effect through leftover inference and perceived deficiency was significant ($b$ = -.15, $SE$ = .08, $CI$ = [-.33; -.03]), supporting H2. In contrast, neither of the alternative pathways was significant: the path through leftover inference alone (spacing → leftover inference → purchase intention) was not significant ($b$ = -.17, $SE$ = .11, $CI$ = [-.43; .01]), nor was the path through perceived deficiency alone (spacing → perceived deficiency → purchase intention; $b$ = -.03, $SE$ = .09, $CI$ = [-.20; .16]). Furthermore, the reverse causal order of the serial mediation (spacing → perceived deficiency → leftover inference → purchase intention) also yielded a non-significant indirect effect ($b$ = -.05, $SE$ = .04, $CI$ = [-.16; .01]).

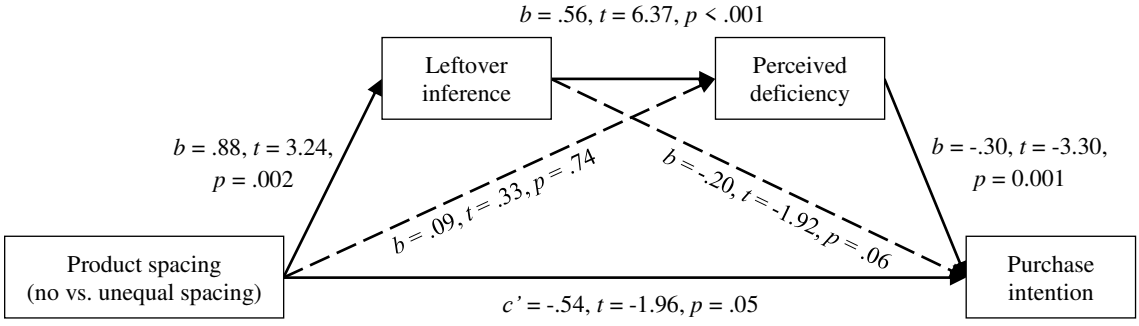

**Fig. 3.** Serial mediation effect of leftover inference and perceived deficiency (unequal spacing and no spacing conditions, Study 3).

We then conducted a serial mediation analysis comparing the equal spacing and no spacing conditions. As shown in Fig. 4, the serial mediation effect was also significant ($b$ = -.10, $SE$ = .07, $CI$ = [-.27; -.002]). In contrast, none of the alternative or reverse pathways were significant: neither the indirect effect through leftover inference alone ($b$ = -.13, $SE$ = .11, $CI$ = [-.38; .03]), nor the indirect effect through perceived deficiency alone ($b$ = -.08, $SE$ = .08, $CI$ = [-.26; .05]), nor the indirect effect through the reverse causal sequence ($b$ = -.07, $SE$ = .05, $CI$ = [-.19; .02]). Moreover, we observed a marginally significant effect from the leftover inference to purchase intention in both serial mediation analyses ($p$ = .06 and $p$ = .07, respectively). The serial mediation effect was not significant when comparing the unequal and equal spacing conditions ($b$ = .08, $SE$ = .09, $CI$ = [-.10; .26]).

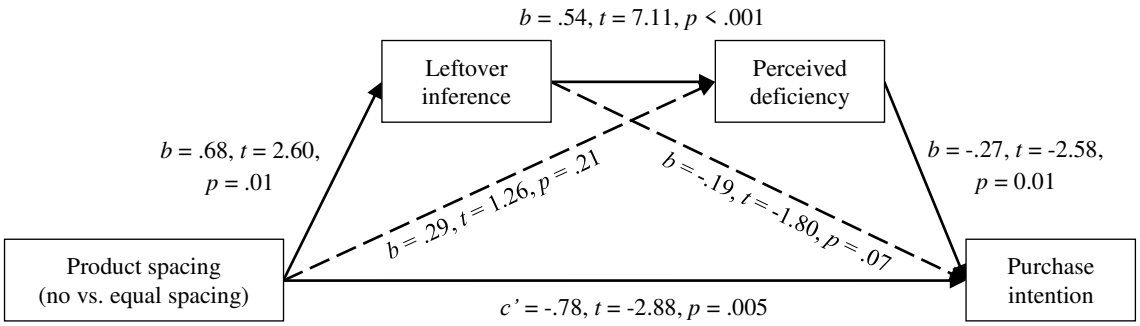


**Fig. 4.** Serial mediation effect of leftover inference and perceived deficiency (equal spacing and no spacing conditions, Study 3).

*4.3.4. Discussion*

This study supports the serial mediating roles of leftover inference and perceived deficiency. The results demonstrate that both equal and unequal spacing between leftover products consistently reduce purchase intention, indicating that the mere presence of spacing has a negative effect. Furthermore, the findings suggest that this effect stems from the spacing itself, rather than its specific pattern (i.e., whether it is equal or unequal). Building on

these results, Studies 4 and 5 examine potential moderators that may attenuate the adverse effect of product spacing on leftover inference.

### *4.4. Study 4*

We propose that brand reputation serves as a moderating factor that attenuates the negative impact of product spacing. As stated in H3, we hypothesize that higher levels of brand reputation diminish the adverse effect of spacing on leftover inference, thereby reducing perceptions of product deficiency and mitigating its detrimental influence on purchase intention. In contrast, when brand reputation is low, the negative effect of product spacing on leftover inference is expected to persist, maintaining the significance of the entire serial mediation chain. Given that unequal spacing among leftover products is more commonly observed in practice, it was selected as the focal condition for subsequent analyses.

#### *4.4.1. Experimental design and procedure*

A total of 370 participants were recruited from Prolific[1] and received monetary compensation for their involvement. After excluding 14 individuals who failed an attention check, the final sample comprised 356 participants (58.9% female, $M_{age} = 36.2$, $SD = 9.7$). Participants were randomly assigned to one of six conditions in a 2 (product spacing: presence vs. absence) × 3 (brand reputation: high vs. low vs. control) between-subjects design. Specifically, in the presence of product spacing, there were 58, 59, and 62 participants in the high-reputation, low-reputation, and control groups, respectively; correspondingly, under the absence of product spacing, the group sizes were 60, 60, and 57.

[1] In Study 4, we collected data via Prolific, recruiting participants from both the United Kingdom and the United States. A cross-country sample design was employed to ensure that the observed effect is driven by contextual factors rather than cultural differences.

We used the same product spacing stimuli as in Study 3 (Web Appendix I). Following Yun et al.'s (2020) method for manipulating reputation, we operationalized brand reputation using different rating tiers (A–high reputation through E–low reputation). In the high-reputation condition, participants were told: "The product is from Yoro clothing, which has an A-level brand reputation." In the low-reputation condition, the statement was: "The product is from Yoro clothing, which has an E-level brand reputation." In the control condition, a neutral message was shown: "The store is open daily from 9 a.m. to 6 p.m. on weekdays." (see Web Appendix J for pretest results). To avoid potential bias from prior brand preferences, we used the fictitious brand name "Yoro" and kept the word count nearly identical across conditions. Each condition included either of two image versions (presence or absence of spacing). Participants were randomly assigned to one of the six groups. To ensure adequate exposure to the stimuli, a minimum viewing time of 35 seconds was set for each condition. After viewing, participants completed scales measuring purchase intention ($\alpha$ = .88), leftover inference, and perceived deficiency ($\alpha$ = .90). The purchase intention and perceived deficiency scales mirrored those in Study 2. Leftover inference was assessed with three items: "To what extent do you agree that the arrangement of clothes as shown in the picture appears to be leftover/unwanted/not desired by other shoppers?" (1 = strongly disagree, 7 = strongly agree, $\alpha$ = .87).

*4.4.2. ANOVA results*

A two-way ANOVA was conducted to examine purchase intentions. Confirming our predictions, the results revealed a significant interaction between spacing and brand reputation ($F$ (2, 350) = 4.46, $p$ = .012, $\eta^2$ = .03), as shown in Fig. 5. Follow-up analyses showed distinct patterns across levels of brand reputation. In both the low-reputation ($M_{\text{presence-of-spacing condition}}$ = 4.36, $SD$ = 1.55, $M_{\text{absence-of-spacing condition}}$ = 5.27, $SD$ = 1.21, $F$(2, 350) =12.77, $p$ < .001, $\eta^2$ = .07) and control ($M_{\text{presence-of-spacing condition}}$ = 4.24, $SD$ = 1.70, $M_{\text{absence-of-spacing condition}}$ = 5.09, $SD$ = 1.46,

$F(2, 350) = 11.27$, $p = .001$, $\eta^2 = .06$) conditions, purchase intentions were significantly lower when spacing was present. However, for the high-reputation brand condition, there was no significant difference in purchase intentions between the spacing conditions ($M_{\text{presence-of-spacing condition}} = 5.33$, $SD = 1.15$, $M_{\text{absence-of-spacing condition}} = 5.28$, $SD = 1.11$, $F(2, 350) = .04$, $p = .85$, $\eta^2 < .001$). The control condition, in which no brand reputation information was provided, effectively represented an "unknown reputation" condition. Therefore, as expected and supported by our manipulation check which assessed only low vs. high reputation, no significant differences emerged between the low-reputation group and the control group.

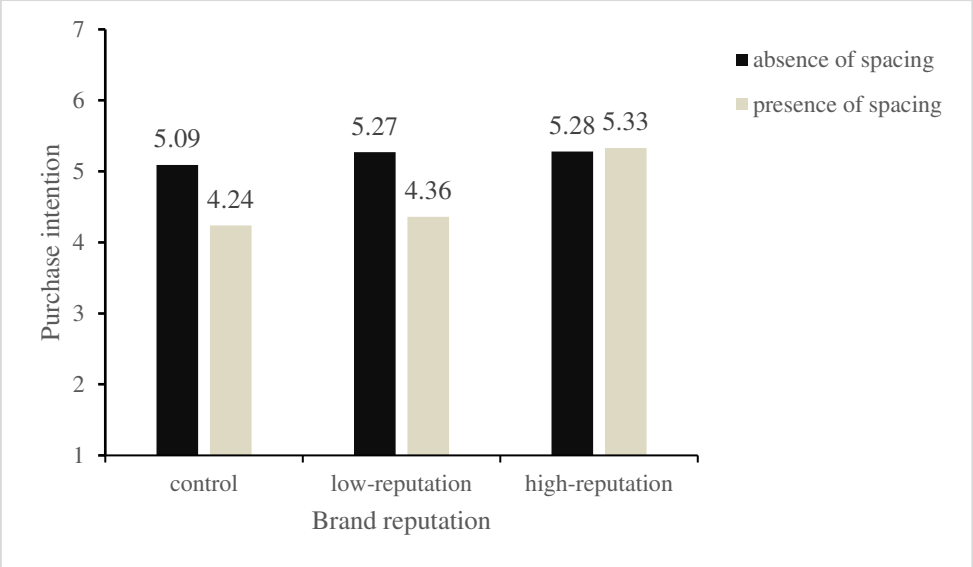


**Fig. 5.** Study 4: moderating role of brand reputation.

*4.4.3. Moderated mediation assessment*

We performed a moderated serial mediation analysis to examine whether leftover inference and perceived deficiency mediate the interaction effect of product spacing and brand reputation on purchase intention. Using PROCESS Model 83 (Hayes 2022) with 5,000 bootstrap samples, we specified product spacing (1 = absence, 2 = presence) as the independent variable, brand reputation (1 = low, 2 = high) as the moderator, leftover inference as the proximal mediator, perceived deficiency as the distal mediator, and purchase intention as the dependent variable. The results supported our hypothesized process. A

significant interaction effect was found on leftover inference ($b$ = -.83, $SE$ = .41; $t$ = -2.03, $p$ = .04). Specifically, under the low-reputation brand condition, spacing substantially increased leftover inference ($b$ = .74, $SE$ =.29; $t$ = 2.57, $p$ = .01). Conversely, for the high-reputation brand condition, the effect of spacing was not significant ($b$ = -.09, $SE$ = .29; $t$ = -.31, $p$ = .76). After controlling for the effect of spacing, leftover inference had a significant positive effect on perceived deficiency ($b$ = .36, $SE$ = .06; $t$ = 5.79, $p$ < .001). Furthermore, when controlling for both spacing and leftover inference, perceived deficiency negatively influenced purchase intention ($b$ = -.13, $SE$ = .06; $t$ = -2.30, $p$ = .02). Finally, the conditional indirect effects supported our predictions: the serial mediation path through leftover inference and perceived deficiency was significant for the low-reputation brand condition ($b$ = -.03, $SE$ = .02, $CI$ = [-.08; -.001]). However, it was not significant for the high-reputation brand condition ($b$ = .004, $SE$ = .02, $CI$ = [-.03; .04]). No other indirect effects reached significance.

Similar results were also observed when including the high-reputation and control conditions. Specifically, under the control condition ($b$ = 1.21, $SE$ = .29; $t$ = 4.21, $p$ < .001), spacing substantially increased leftover inference. Conversely, for the high-reputation brand condition, the effect of spacing was not significant ($b$ = -.09, $SE$ = .29; $t$ = -.31, $p$ = .76). After controlling for the effect of spacing, leftover inference had a significant positive effect on perceived deficiency ($b$ =.33, $SE$ = .07; $t$ = 5.11, $p$ < .001). When controlling for both spacing and leftover inference, perceived deficiency negatively influenced purchase intention ($b$ = -.13, $SE$ = .06; $t$ = -2.31, $p$ = .02). The serial mediation path through leftover inference and perceived deficiency was significant for the control condition ($b$ = -.05, $SE$ = .03, $CI$ = [-.13; -.003]). However, it was not significant for the high-reputation brand condition ($b$ = .004, $SE$ =.01, $CI$ = [-.03; .03]). These results support H3.

*4.4.4. Discussion*

The results indicate that high brand reputation reduces the negative effect of product

spacing by attenuating consumers' leftover inference. This highlights the role of well-respected brands as a protective mechanism that can alleviate—or even eliminate—consumer concerns about product quality. Based on these findings, companies should focus on building high-reputation brands to help boost sales of leftover products, especially when prompt adjustment of product spacing is not feasible.

### *4.5. Study 5*

We propose that product variance acts as another boundary condition that shapes the negative effect of spacing on leftover inference. As outlined in H4, low-variance products weaken the adverse effect of spacing on leftover inference, thereby lowering the product deficiency perception and the negative impact on purchase intention. However, for high-variance products, the negative effect of product spacing on leftover inference is expected to persist, maintaining the significance of the entire serial mediation chain.

#### *4.5.1. Experimental design and procedure*

A total of 408 participants (51.4% female, $M_{age} = 35.3$, $SD = 8.76$) were recruited from Credamo and monetarily compensated for this study. Participants were randomly assigned to one of four conditions in a 2 (product spacing: presence vs. absence) × 2 (product variance: high vs. low) between-subjects design. Specifically, in the presence of product spacing, the high and low product variance groups comprised 108 and 103 participants, respectively; under the absence of product spacing, the corresponding group sizes were 98 and 99. Coffee cups were selected as the experimental stimulus due to their high familiarity among respondents (Web Appendix K).

First, participants were randomly assigned to either a "presence of spacing" or an "absence of spacing" condition. Both groups were presented with a contextual description

and a corresponding image. All participants read the same introductory scenario: "On a Sunday afternoon, you are shopping at a mall. You plan to buy a coffee cup. Upon entering a coffee shop, you notice multiple cups arranged on a shelf." The key difference between the conditions lay in the spacing between the products, which was visually distinct (Web Appendix C). Next, participants were assigned to either a high-variance or low-variance product group. Those in the high-variance group were told: "This coffee cup exhibits batch-to-batch quality variations. Some cups have thick, uniform walls, while others have fragile thin walls or uneven bases, compromising durability and stability." Conversely, the low-variance group read: "This coffee cup undergoes strict quality control, ensuring high consistency. Each cup features uniformly thick, smooth walls and a flat base, guaranteeing reliable performance." The effectiveness of this product variance manipulation was confirmed through pretesting (Web Appendix L). Finally, participants completed the same variable measures used in Study 4, which included scales for purchase intention ($\alpha$ = .90), leftover inference ($\alpha$ = .87), and perceived deficiency ($\alpha$ = .84).

*4.5.2. ANOVA results*

We performed a two-way ANOVA on purchase intentions. The analysis revealed a significant two-way interaction between spacing and product variance ($F$ (1,404) = 7.04, $p$ = .008, $\eta^2$ = .02), consistent with our predictions. Specifically, for high-variance products, purchase intention was significantly lower under the presence-of-spacing condition compared to the absence-of-spacing condition ($M_{\text{presence-of-spacing condition}}$ = 4.11, $SD$ = 1.27, $M_{\text{absence-of-spacing condition}}$ = 4.93, $SD$ = 1.25, $F$ (1,404) = 20.42, $p$ < .001, $\eta^2$ = .05). In contrast, for low-variance products, there was no significant difference in purchase intention between the spacing conditions ($M_{\text{presence-of-spacing condition}}$ = 4.88, $SD$ = 1.37, $M_{\text{absence-of-spacing condition}}$ = 5.02, $SD$ = 1.32, $F$ (1,404) = .55, $p$= .46, $\eta^2$ = .001). Findings are presented in Fig. 6.

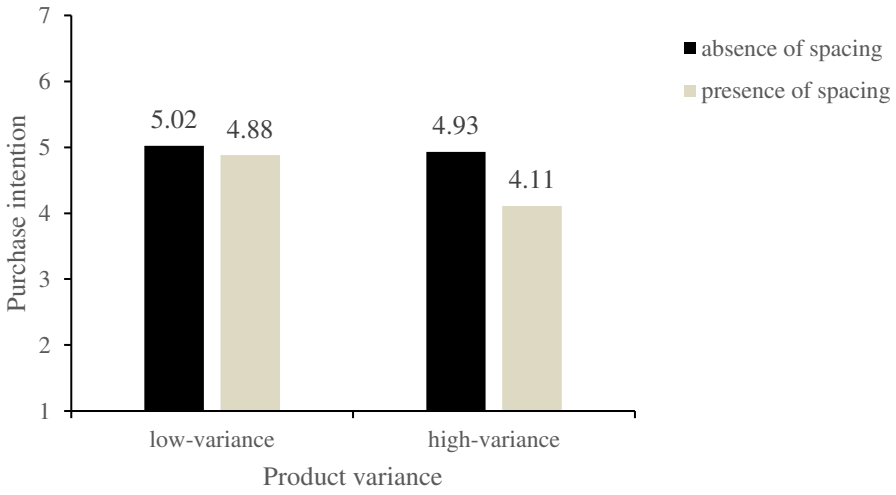


**Fig. 6.** Study 5: moderating role of product variance.

*4.5.3. Moderated mediation assessment*

Next, we examined the role of leftover inference and perceived deficiency in explaining the observed interaction effect of spacing and product variance. Using Hayes's (2022) Model 83 with 5,000 bootstrap samples, we specified product spacing (1 = absence, 2 = presence) as the independent variable, product variance (1 = low, 2 = high) as the moderator, leftover inference as the proximal mediator, perceived deficiency as the distal mediator, and purchase intention as the dependent variable. A significant interaction effect was found on leftover inference ($b$ = .64, $SE$ = .29; $t$ = 2.20, $p$ = .03). For high-variance products, spacing substantially increased leftover inference ($b$ = .76, $SE$ = .20; $t$ = 3.74, $p$ < .001). Conversely, for low-variance products, the effect of spacing was not significant ($b$ = .13, $SE$ = .21; $t$ = .61, $p$ = .54). After controlling for the effect of product spacing, leftover inference had a significant positive effect on perceived deficiency ($b$ = .27, $SE$ = .05; $t$ = 5.40, $p$ < .001). Furthermore, when controlling for both product spacing and leftover inference, perceived deficiency showed a significant effect on purchase intention ($b$ = -.40, $SE$ = .04; $t$ = -9.99, $p$ < .001). Finally, the conditional indirect effects aligned with our predictions: for high-variance products, the indirect effect through leftover inference and perceived deficiency was significant ($b$ = -.08, $SE$ = .03, $CI$ = [-.14; -.03]). However, for low-variance products, this

indirect effect was not significant ($b$ = -.01, $SE$ = .02, $CI$ = [-.06; .03]). These results provide evidence for H4.

*4.5.4. Discussion*

The findings of this study show that the effect of product spacing on leftover inference is less pronounced for low-variance products compared to high-variance products. From a shelf management perspective, this suggests that retailers may have less cause for concern regarding spacing among leftover items when dealing with low-variance products. However, for high-variance products, greater caution is warranted; minimizing spacing among products is advisable to prevent negative consumer inferences that could adversely affect purchase intentions.

## 5. General Discussion

Existing research on product spacing has largely focused on pre-purchase product arrangement and its marketing implications. However, a critical real-world scenario remains relatively underexplored: the spacing that emerges among leftover products after consumer purchases. Through a multi-method approach, we demonstrate that the spacing between leftover items—whether even or uneven—significantly lowers purchase intentions. This negative effect operates through leftover inference and perceived deficiency. We systematically eliminate alternative explanations such as visual aesthetics, contamination fears, and service quality. Moreover, we identify two important moderators: high-reputation brands and low-variance products can weaken this negative spacing effect. The robustness of these conclusions is supported by a series of five studies spanning several product categories, including bread (Study 1), cookies (Study 2), clothing (Studies 3 and 4), and coffee cups (Study 5).

*5.1. Theoretical contributions*

This study advances our understanding of shelf management strategies in physical retail settings by offering three key contributions to the literature. First, it extends the product display literature by demonstrating how the spatial arrangement of leftover items influences consumer behavior. While prior research has primarily examined spacing strategies implemented by retailers (Sevilla & Townsend 2016; Zeng et al. 2017; Zhang et al. 2021), we introduce a novel and important aspect: the spacing that naturally emerges as a result of consumer purchases.

Although prior studies show that the quantity of remaining items affects consumer decision-making (Parker & Lehmann 2011; Van Herpen et al. 2009), the role of the spatial configuration of those products warrants further exploration. The current research presents a notable conceptual distinction from this literature. Scarcity studies have predominantly manipulated relative product quantity (e.g., Parker & Lehmann 2011). Although having relatively fewer products than competing offerings in the same product category can lead to differences in spacing, product spacing itself was not the focal construct in those studies. In contrast, the present research directly manipulates product spacing by presenting spacing conditions separately, while controlling for product quantity.

Beyond relative quantity, a second key distinction concerns the presence or absence of product quality-consistency cues. Prior scarcity research typically incorporated clear cues indicating consistent product quality. Under such conditions, scarcity effects have been attributed to bandwagon effect (Van Herpen et al. 2009), perceived popularity (Parker & Lehmann 2011), or uniqueness-driven motivations (Amaldoss & Jain 2005). In the present research, however, the experimental scenarios imply quality inconsistency—with the

exception of the high brand-reputation condition in Study 4 and the low product-variance condition in Study 5.

This contrast naturally raises a central question: under what conditions does the scarcity effect emerge, and when does the leftover effect prevail? Synthesizing prior scarcity research with the current research, we argue that relative-quantity cues and quality-consistency cues are the two core determinants of whether consumers interpret product spacing as scarcity or leftover effect. Prior scarcity research demonstrates that when relative product quantity is emphasized while quality remains consistent, product spacing is more likely to elicit a scarcity effect (Parker & Lehmann 2011; Van Herpen et al. 2009). Conversely, our findings suggest that when quality consistency cues are absent and relative quantity is not depicted, product spacing tends to be interpreted as a leftover effect. Put differently, whereas previous work on product spacing has predominantly examined relative product quantity under conditions of quality consistency, this study isolates the role of product quality and spatial differences in the absence of emphasized relative quantity. Moreover, disorderliness describes an environment where objects are arranged without order, scattered without clear distinction or boundaries (Chae & Zhu 2014). In contrast, the product spacing under investigation does not imply such indiscriminate scattering across shelves. Rather, it represents a minimal degree of disorder. By conducting controlled experiments in which the number of leftover products is held constant, we isolate and test the specific impact of spacing on consumer perceptions and intentions. In so doing, we offer new theoretical insights into how visual cues in physical retail environments shape consumer behavior.

Second, while prior research has consistently highlighted the positive effects of product spacing on consumer behavior, such as enhanced attentional focus (Zhang et al. 2021), strengthened social identity perceptions (Zeng et al. 2017), and improved product aesthetics and store reputation (Sevilla & Townsend 2016), its potential negative consequences have

received limited attention. Although Sevilla and Townsend (2016) demonstrated that spaced arrangements enhance consumer preference in full-store contexts, our findings challenge the generalizability of this principle to shelf-based displays. Specifically, we find that visible gaps between leftover products can reduce consumer appeal. Moving beyond contamination-based explanations (Castro et al. 2013), we introduce a novel psychological mechanism triggered by product spacing: the "leftover effect," whereby consumers infer product deficiency or inferiority from the gaps left by previous shoppers. By systematically controlling for contamination fears and other extraneous factors, our research isolates this previously underexplored pathway. Grounded in cue utilization theory and inference theory, we investigate how the spacing among products on shelves shapes consumers' leftover inference and deficiency perception. Through the establishment of a sequential relationship among product spacing, leftover inference, perceived deficiency, and purchase intentions, we offer new theoretical insights into the nuanced effects of product display strategies.

Third, our study broadens the theoretical applications of brand reputation and product variance in shaping consumer responses. Prior research indicates that (1) reputational brand cues enhance perceived product quality (Aaker & Keller 1990; Johnson et al. 2019) and (2) low-variance products are ascribed standardized features and consistent quality (Zimmermann et al. 2018). Building on these insights, we argue that high-reputation brands and low-variance products can significantly strengthen consumer purchase intention despite product spacing. The reason is that assured quality perceptions reduce leftover inference and mitigate perceptions of product deficiency. By integrating these firm-level and product-level characteristics with retail space dynamics, we develop a comprehensive framework that positions offline retailing as a complex yet manageable environment. This integrative approach contributes to a more nuanced understanding of how brand and product attributes interact with spatial cues to influence consumer behavior.

*5.2. Managerial implications*

This study offers practical insights for optimizing shelf management in offline retail settings, with direct implications for operational efficiency, brand strategy, and category management. As retail formats evolve—particularly through the global expansion of convenience stores, unattended outlets, and 24/7 operations—the ability to mitigate unintended negative cues arising from shelf displays is becoming not merely a tactical detail but a strategic priority. Based on our findings, we propose three actionable recommendations.

First, retailers should treat shelf spacing as a dynamic operational variable rather than a static design choice. In practice, this involves adopting real-time monitoring—through staff observation or, increasingly, accessible in-store sensors—to identify emerging gaps among leftover products and promptly rearrange items before such gaps trigger negative consumer inferences. Our findings indicate that visible gaps lead shoppers to infer that previous customers selectively removed "better" items, thereby lowering perceived value and purchase likelihood. Importantly, maintaining tight arranged displays is often more labor- and time-efficient than reactive restocking, particularly during peak hours. With the global rise of unattended retail formats, where no staff could intervene, systematic shelf organization becomes an essential safeguard against subtle but potentially costly sales losses.

Second, when operational constraints—such as limited staffing or high customer traffic—make immediate shelf reorganization impractical, retailers can strategically deploy brand-related cues to offset the negative effects of spacing. Our findings demonstrate that even simple communications indicating that leftover products belong to a high-reputation brand can significantly attenuate consumers' leftover inference and perceived deficiency. Notably, this buffering effect emerged even for fictional brands. For managers, this suggests

that investments in brand building yield not only long-term equity benefits but also immediate operational resilience. In unmanned or minimally staffed retail environments, where visual cues strongly shape the consumer experience, leveraging brand reputation may serve as a critical low-cost intervention to protect sales from unintended shelf-layout consequences.

Third, product variance should inform how retailers prioritize shelf-maintenance efforts across categories. Our research reveals that low-variance, standardized products are inherently more resilient to the negative effect of spacing, meaning they can tolerate minor display irregularities without significant sales loss. By contrast, high-variance products—where quality inconsistency is perceived—demand closer display monitoring. For such products, consumers are particularly sensitive to gaps, which they interpret as evidence that previous shoppers selectively removed superior units. From a resource-allocation perspective, retailers may therefore focus shelf-reorganization efforts on high-variance categories, where the potential sales lift from maintaining tight spacing is greatest. This targeted approach balances operational efficiency with category-specific consumer psychology and offers a practical path to mitigate the leftover effect without overextending staff resources.

### *5.3. Research limitations and prospects*

Our study has several limitations that warrant consideration. First, the research focused on everyday products typically found in convenience stores and supermarkets. Consequently, the negative spacing effect observed here may be less applicable to upscale retail settings (Sevilla & Townsend 2016), where premium products often carry strong branding that could counteract such effect. Second, the "leftover effect" identified in this study may vary depending on whether products are standardized or custom-made. For instance, in the case of

unique items such as designer clothing, previous customers' selections may reflect personal taste rather than perceived quality, which could alter how spacing is interpreted. Third, there may be additional strategies to alleviate negative spacing effects that were not covered in this study. For example, customers under cognitive load (Shiv & Fedorikhin 1999) may pay less attention to spacing cues, which could reduce the adverse impact on purchase decisions. Finally, in the theoretical contribution section, we posited relative quantity and quality-consistency cues as two core determinants of whether product spacing elicits a scarcity effect or a leftover effect. Building on this dual-cue framework, we further identify an important theoretical gap worthy of future investigation: how the scarcity and leftover effects manifest when both cues are present or when both are absent. Further exploration of this relative quantity–quality consistency framework will yield a more comprehensive theoretical understanding of how consumers interpret shelf-display cues.

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