Framing of Differences:
Visual Product Frames Reduce Consumer Choice Deferrals

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Abstract

Consumer choice deferral contributes to the low conversion rate in online retailing. This paper investigates the impact of visual product frames on consumers' decisions regarding choice deferral. We show that using visual frames to separate options in a product assortment increases consumers' relative use of the by-alternative (vs. by-attribute) approach for option comparisons, which induces greater perception of assortment variety and subsequently decreases choice-deferral rate. Through seven preregistered studies (including an eye-tracking study and a field experiment), we obtain convergent empirical evidence for these proposed effects and suggest actionable guidelines for online retailers regarding how to best design their product displays to nudge sales.

Keywords: visual product frames, consumer choice deferral, visual design, retailing and sales

Choice deferral, defined as a tendency to delay a choice/purchase decision in order to search for new alternatives (Dhar and Nowlis 1999; Tversky and Shafir 1992), is a challenge for many online retailers. According to a survey conducted in July 2023, one of the primary reasons online customers do not complete their purchase is their inclination to search for other alternatives and engage in comparison shopping before checking out (literally labeled "Was conducting research to buy later" in the survey; Serrano 2023). As a result, a considerable share of conversion loss can be attributed to choice deferral (Grieser 2014; Mourali et al. 2018). Based on 12 studies from 2016 to 2020, a meta-analysis revealed that the average conversion rate on e-commerce websites is only 1.96% in the U.S. and 2.27% worldwide (Ogonowski 2021). Therefore, it is crucial for online retailers to identify nuanced situational factors to address consumers' choice deferral and nudge them to make a purchase. The current paper suggests a simple and actionable way of displaying product assortments that can potentially decrease consumers' choice-deferral rate: using visual product frames to separate product options from each other in a product-assortment display.

Visual product frames are closed or semi-closed visual borders that separate and contain product alternatives in a product assortment (Cutright 2012; Fajardo et al. 2016). The use of visual frames in product-assortment display is not rare. For instance, of the top 100 e-commerce websites worldwide, as ranked by Automizely,[1] 49.47% use visual frames of various colors, shapes and designs to separate their products (see Web Appendix E for details). Despite the relative dominance of visual frames used in actual practice, the choice to use them appears random and can change from time to time for no obvious reason. Thus, it remains unclear how to design a product display smartly and what impact this design feature actually has on consumers'

[1] https://www.automizely.com/store-list/top-100-ecommerces-stores

choice deferral and subsequently on sales.

Drawing on past research on visual frame (e.g., Mishra and Mishra 2010; Zhao et al. 2012), assortment variety perception (e.g., Deng et al. 2016; Kahn and Wansink 2004; Mogilner et al. 2008; Townsend and Kahn 2014), and choice deferral (e.g., Broniarczyk et al. 1998; Hoch et al. 1999; Kahn 1998), we propose and then find in the current research that using visual frames to separate product options in an assortment increases consumers' use of the by-alternative approach and decreases their use of the by-attribute approach in option comparison. This leads them to perceive greater variety in an assortment and undermines the propensity to defer their choice from the assortment. In addition, we identify and examine two boundary conditions of this effect. Consistent with our explanation for the underlying mechanism based on the relative use of the by-alternative (vs. by-attribute) approach and perceived assortment variety, this effect is attenuated when consumers are not sufficiently knowledgeable about the choice domain and hence are forced to process product information in a by-alternative (rather than by-attribute) manner, or when they are choosing from a large product assortment that per se has a high level of assortment variety.

By linking visual product frames to consumers' propensity to defer their choice, this research reveals the impact of a novel design feature of an assortment (i.e., product frames) on choice deferral (e.g., Dhar 1997; Dhar and Nowlis 1999; Tversky and Shafir 1992), thereby contributing to this research area. It also contributes to the research on visual marketing (e.g., Cutright 2012; Fajardo et al. 2016; Jiang et al. 2015) by considering the cognitive (rather than symbolic) functions of visual frames in consumer domains, an aspect that has been under-investigated. Finally, this research embarks on exploring effects of the design features of an assortment (in addition to its structure, display direction, or display depiction) on its perceived

variety (e.g., Deng et al. 2016; Hoch et al. 1999; Kahn and Wansink 2004), thereby paving the way for future study in this emerging research area. Practically, our results provide actionable guidelines for online retailers regarding how they can best design their product displays to nudge purchases and sales.

THEORETICAL FRAMEWORK

Choice Deferral and Assortment Variety

Choice deferral refers to the tendency to delay a choice/purchase decision in order to search for new alternatives (Dhar 1997; Dhar and Nowlis 1999; Tversky and Shafir 1992). When considering buying a pair of earbuds from a retailer, for example, one could choose not to buy any of the available earbuds at the moment and instead seek additional information about available options from the retailer, explore alternatives from other retailers, or refer to the word-of-mouth generated by prior users to obtain their recommended alternatives. This phenomenon of choice deferral leads to a wide range of negative consequences for businesses, ranging from a low conversion rate and dropping sales to high customer attrition rates (Chernev 2005b; Mourali et al. 2018).

While choice deferral can be induced by many factors (e.g., Dhar 1997; Iyengar and Lepper 2000; Tversky and Shafir 1992), a finding more relevant to the current research is that when consumers perceive high variety in a given product assortment, they are less likely to defer their choice from that assortment (e.g., Hoch et al. 1999; Kahn 1998). *Assortment variety* refers to the number of distinct options within a specific category (Kahn and Wansink 2004; Townsend and Kahn 2014). In the present research, we do not focus on actual variety but on consumers' perception of variety, which is not necessarily contingent on the actual number of distinct options

presented. For example, by varying the structure (e.g., categorization and symmetry; Kahn and Wansink 2004; Mogilner et al. 2008), the display direction (e.g., horizontal vs. vertical direction; Deng et al. 2016), or the display depiction (e.g., verbal vs. visual depiction; Townsend and Kahn 2014) of an available assortment, marketers can improve consumers' perceived assortment variety without actually offering more options.

Several lines of prior work show that increasing consumers' perceived assortment variety may boost their likelihood of making a choice. For example, consumers are less likely to choose when they perceive the differences among the available options as minimal (Dhar 1997; Tversky and Shafir 1992). They instinctively avoid these homogeneous choice sets so they don't have to experience the difficulty of finding the most attractive option among similar others, nor make a great number of comparisons and trade-offs that are unclear (Dhar 1997; Jia et al. 2014; Tversky and Shafir 1992). In contrast, adding an inferior option that enhances the dominance of an existing option in an assortment and makes the difference between options large and apparent was found to increase the likelihood that a choice will be made from the assortment (Dhar 1997; Dhar and Simonson 2003; Tversky and Shafir 1992).

It has also been argued that consumers might experience additional utility simply from having varied options in an assortment (Hoch et al. 1999; Kahn et al. 1987). Assortment variety, either actual or perceptual, creates an illusion that the available options are representative enough that consumers will be likely to identify the option that best matches their needs and interests. The anticipated likelihood of finding the best "match" among the available options therefore increases consumers' feelings of freedom and autonomy in choosing, which also nudges choice behavior (Greenleaf and Lehmann 1995; Mogilner et al. 2008; Sethuraman et al. 2022). This helps explain consumers' attraction to more varied assortments. For example, they tend to favor

stores offering varied assortments (Broniarczyk et al. 1998; Hoch et al. 1999). This preference not only enhances their satisfaction with the chosen option (Mogilner et al. 2008), but also leads to increased consumption in terms of both quantity and variety (Deng et al. 2016; Kahn and Wansink 2004). Thus, an assortment that seems varied would decrease consumers' choice deferral compared to one with similar and indistinct options. In the current research, we argue that using visual frames to separate product options in an assortment will induce greater perceptions of assortment variety, which subsequently decreases consumers' propensity to defer their choices.

Visual Display of Product Assortment

It has been broadly documented that the visual-design features of a product display can influence consumers' perceptions and behavioral intentions toward that product. For example, endowing a product display with humanlike features (Aggarwal and McGill 2007; Landwehr et al. 2011), adjusting the color of a product's package (Hagtvedt and Brasel 2017; Ye et al. 2020), increasing the amount of empty space dedicated to a product display (Zhang et al. 2021), or visually complicating a product-display environment (Ketron 2018) have all been found to impact consumers' perceptions of the product and subsequently their purchase decision.

However, all the aforementioned research focused on the visual-design features of a *single* product display only. Very few studies have directly investigated the visual-design features of a product assortment (consisting of multiple products), with two notable exceptions that study the impacts of interstitial space (i.e., space-to-product ratio) of an assortment in either online or offline retail settings (Huang et al. 2019b; Sevilla and Townsend 2016). This stream of research suggests that presenting products with more interstitial space increases not only the perceived prestige of the store that offers these products, but also the perceived value of the products. The

theoretical account that these studies offer is based on a consumer's deliberative inference process that products exhibited with a large amount of space must be highly priced, so that the store offering the products can afford the rental costs incurred by such a "wasteful" display.

Adding to this line of research, we examine the impact of visual frames that separate product options in an assortment on consumers' decision to defer choice from the assortment. The present research differs from the aforementioned studies in two respects. First, we focus on a novel visual-design feature in an assortment display that has *not* been systematically studied—visual product frames. Second, we diverge from a consumer inference process and propose an alternative underlying mechanism that involves the adoption of distinct comparative approaches (i.e., the by-alternative vs. by-attribute approaches), which in turn influences perceived assortment variety, discussed next.

Visual Product Frames, Approaches to Option Comparison, and Perceived Assortment Variety

Visual product frames are closed or semi-closed visual borders that separate and contain the alternatives in a product assortment (Cutright 2012; Fajardo et al. 2016). Past research on visual frames has shown that surrounding a single object (e.g., a brand logo) with a frame can signal several symbolic associations, ranging from a sense of "structure" (Cutright 2012) to an association with "confinement" and "protection" (Fajardo et al. 2016). Notably, prior research mainly focused on logo frames and related symbolic meanings. It remains unclear how the frames that separate product options in an assortment influence consumers' perceptions of this assortment and their subsequent choice behavior. In the current research, we argue that visual frames in an assortment enhance perceived variety of that assortment, due to the distinct comparative approach that these frames trigger.

Studies on consumer comparative approaches distinguish two major types: the by-

alternative and the by-attribute approaches (Herpen and Pieters 2002; McGill and Anand 1989). In processing a product assortment, the by-alternative approach leads consumers to consider all product attributes simultaneously (e.g., a round mouse pad with an abstract art pattern). By contrast, when using the by-attribute approach, consumers must sequentially focus on each attribute of the option (e.g., the shape or the pattern of a mouse pad) and process it individually. Multiple factors have been found to vary the relative use of by-alternative versus by-attribute approaches, ranging from choosers' traits such as their dispositional tendency for option imagination (McGill and Anand 1989) to choice options such as option anthropomorphism (Huang et al. 2019a) or visual (vs. verbal) depiction (Townsend and Kahn 2014).

We identify visual product frames as another cue to trigger the use of by-alternative or by-attribute approaches, in addition to the more traditional reasons already identified in the literature based on features of the choosers or the choice options. We propose that using visual frames to separate product options in an assortment can facilitate a by-alternative approach to product evaluation (i.e., processing all product attributes simultaneously) while inhibiting a by-attribute approach (i.e., focusing on each respective attribute sequentially; Herpen and Pieters 2002; McGill and Anand 1989). On the one hand, visual product frames serve as a visual stop-start boundary (Mishra and Mishra 2010; Zhao et al. 2012). As a result, when focusing on each attribute across the product options separated by visual frames, consumers need to expend more cognitive effort to scan beyond these frames (Thorndyke 1981), making it more difficult for them to sequentially focus on the values of each single attribute across those product options (i.e., the by-attribute approach is inhibited). On the other hand, visual frames convey visual emphasis (Cutright 2012), leading consumers to focus on the contents surrounded by the frames and to evaluate each product option on all its attributes simultaneously; that is, a by-alternative

approach is fostered. Thus, we posit that consumers provided with a product assortment separated by visual frames (vs. no visual product frames) will be more likely to evaluate each product option on all its attributes simultaneously (i.e., by-alternative approach) rather than on piecewise comparisons of each attribute (i.e., by-attribute approach).

Since by-alternative approach allows for parallel recognition of all attributes, it facilitates consumers' recognition of not only each individual attributes on which a product option varies, but also the unique combinations of these attributes or attribute synergies (Holbrook and Moore 1981; Veryzer and Hutchinson 1998). As suggested by Kahn and Wansink (2004), as product assortments get more complex and differ on more than one attributes, consumers are likely to perceive the assortments as more various. Consequently, the recognized multitude of combinations and synergies of various attributes will make the assortment seem richer and more diverse (Townsend and Kahn 2014). In contrast, by-attribute processing promotes comparison of each attribute across different product options, leading consumers to ignore the attributes that are identical across options while focusing only on the distinctive ones (Kim et al. 2013; Medin et al. 1993; Tversky 1977). For example, when people compare objects, features that do not vary across objects are not considered, because they are not diagnostic for choosing (Medin et al. 1993). As a result, the lower number of attributes considered subsequently decreases perceived variety within the assortment.

Taking these findings together, we theorize that using visual frames to separate product options in an assortment increases perceived variety of the assortment by eliciting a by-alternative approach while inhibiting the by-attribute approach; and the augmented perception of assortment variety triggered by using the by-alternative (vs. by-attribute) approach subsequently decreases choice deferral, as explained earlier. We offer the following hypotheses:

H_1: Consumers are less likely to defer choice from a product assortment when the products in that assortment are surrounded by visual frames than when they are not.

H_2: The effect of visual product frames on choice deferral is mediated by consumers' greater use of the by-alternative (vs. by-attribute) approach in product comparisons and subsequently their perceptions of assortment variety.

Boundary Conditions

We next consider two boundary conditions for the effect of visual product frames on consumers' decisions for choice deferral.

Category familiarity. If consumers' decision for choice deferral is driven, at least in part, by greater use of the by-alternative approach (and less use of the by-attribute approach) activated by visual product frames, then in situations when the former approach is already activated while the latter is hindered we would expect this effect to be attenuated. In the current research, we suggest that consumers' category familiarity—their prior experience with a given product category (Alba and Hutchinson 1987)—may lead to such situations.

Consumers who are familiar with a category usually possess superior knowledge about existing products and may even have developed a set of expectations such as attribute importance and attribute synergies (Chernev 2003; Mogilner et al. 2008; Sujan and Bettman 1989). Consequently, these consumers can rely on comparing either key product attributes across options or attribute interactions within options, and thus they can freely switch between by-attribute and by-alternative approaches. Conversely, when consumers have limited knowledge about the product category, they are unable to identify which attributes are most important and diagnostic (Maheswaran and Sternthal 1990; McGill and Anand 1989). As a result, they treat all attributes as equally important and consider them simultaneously to form an overall evaluation

for each available option (i.e., a by-alternative approach).

Given that consumers' use of the by-alternative approach enhances their variety perception about an assortment and subsequently boosts their propensity to choose, we predict that the effect of visual product frames on choice deferral will be weakened or dismissed for those consumers who are not sufficiently knowledgeable about a given product category and tend to mainly employ a by-alternative approach (rather than a by-attribute approach) for option comparisons independent of product frames. Putting it formally, we offer the following hypothesis:

H_3: The effect of visual product frames on choice deferral is attenuated or dismissed when consumers are unfamiliar with the given product category.

Assortment size. Our theory suggests that consumers will be less likely to defer a choice from an assortment with (vs. without) visual frames because the frames elicit greater perception of assortment variety, which usually boosts the likelihood of a purchase decision. However, the strength of this effect depends in part on the size of the assortment.

Prior work suggests that assortment size directly influences perceived variety (Kahn and Wansink 2004). Although (as mentioned) the effect of assortment size on consumers' perceptions of variety is often subject to multiple assortment-related factors ranging from assortment structure (Hoch et al. 1999; Kahn and Wansink 2004; Mogilner et al. 2008) to display direction (Deng et al. 2016) and display depiction (Townsend and Kahn 2014), it is apparent that all other things being equal, an increase in assortment size will increase perceived assortment variety, which will in turn decrease choice-deferral rate. Thus, when consumers choose from a large assortment and perceive a high level of variety from this assortment, they will tend to make a choice (for the reasons identified previously) regardless of whether product frames are present or

not. By contrast, for small assortments, visual product frames may create the illusion that there are many distinct options available and in turn nudge choices, whereas an absence of frames decreases the perception variety and hinders choice. We therefore predict that this focal effect should be more evident in a small assortment and will be attenuated in medium or large assortments. Formally, we can state the following hypothesis:

H_4: The effect of visual product frames on choice deferral is attenuated or dismissed as the assortment size increases from small to medium and large.

OVERVIEW OF STUDIES

To test the above hypotheses, we conducted seven preregistered studies. Studies 1A and 1B provide initial evidence for our basic hypothesis (H_1) that visual product frames on an assortment decrease consumers' choice-deferral likelihood. Studies 2A and 2B shed light on the underlying mechanism of this effect (H_2), by demonstrating the effect of visual product frames on consumers' greater use of the by-alternative (vs. by-attribute) approach with eye-tracking data (in Study 2A), and validating perceived assortment variety as the underlying mechanism and rules out several alternative explanations (in Study 2B). We test the boundary conditions proposed (H_3-H_4) in the next two studies. Results show that this effect is attenuated when consumers are not sufficiently knowledgeable about the given product category (Study 3) or when they choose from a medium or large product assortment (Study 4). Study 5 demonstrates the external validity of our findings by showing this effect in a field experiment and examining the impact of visual product frames on incentive-compatible actual purchase behavior.

All studies reported in the current paper were preregistered, and target sample sizes were determined in advance of data collection based on participant availability, study design, and

collection method (Simmons et al. 2011). We report both the preregistered sample size and the collected sample size, and find that analyzing only the lower bound of the preregistered sample size yielded results that did not significantly differ from those based on the entire sample (see Web Appendix B for details). We report all manipulations and all hypothesis-related measures in Appendix or Web Appendix (see Web Appendix D). In Studies 1A, 1B, 2B, 3, and 4, we inserted an attention check. The exclusion of all participants who failed the attention check from our analyses did not change the pattern of the main results significantly (see Web Appendix B for details). Basic demographic measures (such as gender and age) were collected at the end of each experiment, but since they did not have a systematic impact on our results, we will not discuss them further. More details about manipulations, measures, and additional analyses can be found in Web Appendix.

STUDY 1

In Study 1, we obtain initial evidence for the basic hypothesis that separating each product option in an assortment with visual frames decreases consumers' choice deferral, with two preregistered studies. We demonstrate the generalizability of this effect by examining it with both visual (Study 1A) and verbal (Study 1B) product-display formats and for both a material product (i.e., mouse pads; Study 1A) and an experiential one (i.e., resorts; Study 1B).

Study 1A

A total of 200 adult consumers (64.00% female, M_{age} = 30) participated in this preregistered study (https://aspredicted.org/s58s6.pdf) through Credamo (a MTurk-like online survey panel in China) in exchange for a small monetary reward. They were randomly assigned to either the frame condition or the no-frame condition. All participants passed the attention

check (see Web Appendix D) so all were included in the data analyses.

Participants were told to imagine that they wanted to buy a mouse pad and searched product information on a website. They were then shown a webpage containing five equally priced mouse pad options, horizontally displayed in two counter-balanced random orders, each presented with a picture and a short description of product features. In the *frame* condition, each product option was separated by a visual frame, whereas in the *no-frame* condition, no visual frame was used in the product presentation (see Appendix).[2]

Participants evaluated the product options at their own pace and then indicated their decision for whether they would choose one option or none of them on a binary scale (1 = I would not buy either of the mouse pads and would like to look for more alternatives, 0 = I would settle for one mouse pad from the five alternatives), a choice-deferral measurement used frequently in past research (Chernev 2005a; Dhar 1997; Dhar and Nowlis 1999; Levav et al. 2010; Tversky and Shafir 1992). Those who selected "0" then specified which mouse pad they would like to choose. To make the study incentive-compatible, participants were told before making their decision that we would randomly draw several winners among the group, and those winners would receive the product of their choice (if they selected a product option) or an equivalent amount of money (if they chose to defer their choice). After participants completed this study, two of them were randomly chosen. They received either the mouse pad they had selected or an amount of money equivalent to its value.

A chi-square test revealed a significant effect of visual product frames on choice deferral (χ^2 (1) = 7.44, p = .006; φ = .193). Consistent with our expectation, participants in the frame

[2] In this and remaining studies, we conducted several posttests to ensure that the stimuli we used did not significantly differ in several important aspects (including display attractiveness, product attractiveness, perceived interstitial space, and perceived product prestige) between the frame condition and the no-frame condition. Detailed results are reported in Web Appendix C.

condition were significantly less likely to defer their choice (20.79%) than were those in the no-frame condition (38.38%).

Study 1B

A total of 225 adult consumers (61.78% female, M_{age} = 41) took part in this preregistered study (https://aspredicted.org/um7gs.pdf) through MTurk in exchange for a small monetary reward. They were randomly assigned to either the frame condition or the no-frame condition. We measured participants' general attentiveness with one instructional manipulation check (i.e., IMC; Oppenheimer et al. 2009; Paas et al. 2018) at the beginning of the survey in this and other MTurk studies (i.e., Studies 3 and 4). Participants who failed the IMC instructions were not permitted to complete the survey. In addition to the IMC, we included another attention-check question located in the middle of the survey. Six participants failed the attention check (see Web Appendix D), leaving a final sample of 219 (60.73% female; M_{age} = 42).

Participants imagined that they wanted to make a quick getaway to relax in a resort and therefore searched resort information on an online travel agency website. They were then shown a webpage containing six equally priced resort options, presented in three columns and two rows. Four verbal attributes were presented for each option (i.e., resort name, number of swimming pools, view types, and room service). Similar to Study 1A, options in the *frame* condition were separated by semi-closed visual frames, whereas no visual frame was used in the *no-frame* condition (see Appendix).

Participants evaluated the resort options at their own pace and then indicated their decision of whether they would choose one option or none of them on the same scale that was used in Study 1A (1 = I would not choose either of the resort options and would like to look for more alternatives, 0 = I would settle for one resort option from the six alternatives).

Replicating the findings of Study 1A, a chi-square test revealed a significant effect of visual product frames on choice deferral (χ^2 (1) = 4.66, p = .031; φ = .146). As expected, participants in the frame condition were significantly less likely to defer their choice (11.01%) than were those in the no-frame condition (21.82%).

Discussion

The results of Studies 1A and 1B provided convergent evidence that surrounding product options with visual frames reduces consumers' choice deferral. We found that this effect can be generalized to different types of product-display formats (i.e., a visual format in Study 1A and a verbal format in Study 1B) and to different product categories (i.e., a material product in Study 1A and an experiential product in Study 1B).

STUDY 2

We theorize that visual product frames (vs. no frames) facilitate the by-alternative approach while inhibiting the by-attribute approach to the process of examining available options, which in turn increases perceived assortment variety and subsequently alleviates consumers' decision to delay and opt out of choice from that assortment. We test this mechanism using the eye-tracking technique in Study 2A to provide more objective evidence in support of our hypothesis that visual product frames increase consumers' relative use of the by-alternative (vs. by-attribute) approach to information processing.

In Study 2B, we examine the mediating role of perceived assortment variety in the focal effect and meanwhile rule out several alternative explanations. Past research suggests that visual frames could potentially trigger several semantic associations, ranging from a sense of structure and completeness (Cutright 2012; Pinna 2012) to the associations with protection and

confinement (Fajardo et al. 2016; Palinkas 2003). The accessibility of these associations may subsequently affect consumers' purchase intent and decision to defer choice (Fajardo et al. 2016). In addition, visual frames can bring a visual emphasis, thereby attracting consumers' attention to the product options that are surrounded by the frames, which may make those options more concrete and increase perceived feasibility of making a choice from the options (Goodman and Malkoc 2012; Lee et al. 2010). Finally, visual frames have been widely used for aesthetic purposes by UI designers (Schenkman and Jönsson 2000; Wang et al. 2011). Therefore, a product assortment with visual frames may seem more visually attractive than one without frames, and that increased attractiveness may strengthen consumers' confidence in choosing from the assortment (Chernev 2003). We test these alternative possibilities in Study 2B.

Study 2A

A total of 95 students (50.53% female, M_{age} = 20) from a local research university participated in the study (https://aspredicted.org/m7ia6.pdf) for a small monetary reward. They were randomly assigned to the frame condition or the no-frame condition.

Upon arrival, participants were informed that a built-in camera on the computer monitor would record their behavior to ensure that the data collection was high in quality. Therefore, they were told not to move around in the seat and to keep their eyes on the screen once the experiment began. The eye-tracking device was calibrated by asking participants to focus on 9 calibration dots that were presented sequentially on different areas of the computer screen (for the mechanism behind the eye-tracking calibration, see Pfeiffer et al. 2020). Participants were told that this calibration exercise was necessary to ensure a high quality of the video.

After the calibration, study instructions were delivered orally by the experimenter. Participants were asked to imagine that they plan to book a resort for the upcoming holiday and

thus searched resort information on an online travel agency website. They were then shown a webpage containing four equally priced resort options arranged horizontally, with six attributes (including "resort name," "view types," "number of swimming pools," "architectural style," "number of playgrounds," and "distance from airport") for each option placed vertically. Information about the four resort options was presented on a 15-inch computer screen in the form of an option (4) × attribute (6) matrix. Similar to Study 1B, the four resort options were separated by semi-closed visual frames in the *frame* condition, whereas no visual frame was used in the *no-frame* condition (see Appendix).

Participants evaluated the four resort options at their own pace. Their eye movements in the evaluation process were recorded by a Gazepoint GP3 eye tracker with no head or chin gear (Zugal and Pinggera 2014). Eye positions were sampled at 150 hertz with 0.5–1 degree of visual angle accuracy.

Using the eye-tracking device, we recorded participants' eye movements, the amount of time they spent, and their eye fixations. Twenty-four areas of interest (AOI) were specified for the product information, with each AOI defined as one of the 24 cells of the option (4) × attributes (6) matrix.

We calculated two types of eye movements to trace the by-alternative approach versus the by-attribute approach, following a method used in prior literature (e.g., Huang et al. 2019a; McGill and Anand 1989; Sen 1998; Sen and Johnson 1997). The by-alternative approach is measured by the number of transitions from one attribute to the next within the same option, and the by-attribute approach is measured by the number of transitions along the same attribute but across different options. To form a composite index of participants' relative use of the two approaches, we followed the procedure adopted by prior research (e.g., Huang et al. 2019a;

Payne et al. 1988) to use the number of alternative-based transitions minus the number of attribute-based transitions divided by the total number of both transitions. The value of the composite index ranged from -1 to 1, with a more positive value representing a greater proportion of using the by-alternative approach and a more negative value indicating a greater proportion of using the by-attribute approach.

Consistent with our prediction, results from a one-way ANOVA revealed that visual product frames significantly affected participants' relative use of by-alternative versus by-attribute approaches in comparing the available resort options ($F(1, 93) = 8.95$, $p = .004$; $\eta^2_p = .088$). Participants used the by-alternative approach more than the by-attribute approach when the resort options were separated by visual frames ($M = .64$, $SD = .25$) than when they were not ($M = .50$, $SD = .22$). A closer look at the data revealed that such difference may be attributed to a decrease in the use of the by-attribute approach ($M_{frame} = 8.71$, $SD = 6.53$ vs. $M_{no\text{-}frame} = 12.16$, $SD = 7.25$; $F(1, 93) = 5.88$, $p = .017$; $\eta^2_p = .059$) rather than an increase in the use of the by-alternative approach ($M_{frame} = 42.53$, $SD = 25.34$ vs. $M_{no\text{-}frame} = 38.22$, $SD = 24.53$; $F(1, 93) = .71$, $p = .402$). Despite this, these results still support our hypothesis that using visual frames to separate product options increases participants' relative use of the by-alternative (vs. by-attribute) approach.

Additional analysis of the time spent on the 24 AOIs showed that participants spent the same amount of time in processing available options in the frame condition ($M = 20.24$, $SD = 12.34$) and in the no-frame condition ($M = 19.16$, $SD = 11.49$; $F(1, 93) = .20$, $p = .660$). Similarly, analyses of eye fixations in all 24 AOIs showed that participants had a similar number of eye fixations in the frame condition ($M = 80.40$, $SD = 43.49$) and in the no-frame condition ($M = 81.46$, $SD = 42.93$; $F(1, 93) = .01$, $p = .905$). The null results suggested that participants in the

two conditions were equally engaged (i.e., the same amount of time and eye fixations), thus any observed difference in the pattern of eye movements cannot be attributed to varying levels of engagement.

Study 2B

A total of 220 adult consumers (65.91% female, M_{age} = 32) from Credamo took part in this preregistered study (https://aspredicted.org/j4ay2.pdf) for a small monetary reward. They were randomly assigned to either the frame or the no-frame condition. All participants passed the attention check (see Web Appendix D) so all were included in the later data analyses.

Similar to Study 1A, participants imagined that they wanted to buy a bookmark and searched for product information on a website. They were then shown a webpage containing five equally priced bookmark options, presented vertically. As in previous studies, options in the *frame* condition were separated by visual frames, whereas no visual frame was used in the *no-frame* condition (see Appendix).

Participants evaluated the product options at their own pace and then indicated their decision on whether they would choose one option or none on a similar scale as used in the previous studies (1 = I would not buy either of the bookmarks and would like to look for more alternatives, 0 = I would settle for one bookmark from the five alternatives). Then participants evaluated the variety of the product assortment by completing three 7-point items (α = .76; adapted from Townsend and Kahn 2014): 1) How much variety do you think there is in this assortment? (1 = "very little variety," 7 = "very much variety"); 2) How many options do you feel you are offered in this assortment? (1 = "very few," 7 = "a lot"); and 3) This assortment gives me at least one option I like (1 = "strongly disagree," 7 = "strongly agree"). Participants also rated eight other perceptions they had about the product assortment as alternative

mediations, such as (1) perceived structure ("How structured/ordered does the assortment seem to you?"; $r = .52$, $p < .001$; Cutright 2012), (2) perceived completeness ("This assortment brings me a sense of completeness/closure"; $r = .65$, $p < .001$; Yan and Pena-Marin 2017), (3) perceived protection ("How protecting does this assortment seem to you?"; Fajardo et al. 2016), (4) perceived confinement ("How confining does this assortment seem to you?"; Fajardo et al. 2016), (5) perceived concreteness ("How concrete do the options seem to you?"), (6) perceived feasibility ("How feasible is it for you to choose an option from this assortment?"), (7) visual attractiveness ("How attractive does this assortment seem to you?"; Chernev and Hamilton 2009) and (8) choice confidence ("How confident are you in your selection?"; Jia et al. 2014). All were rated on 7-point scales.

Replicating our previous findings, a chi-square test revealed a significant effect of visual frames on choice deferral (χ^2 (1) = 9.03, $p = .003$; φ = .203). Participants in the frame condition were significantly less likely to defer their choices (7.34%) than were those in the no-frame condition (21.62%).

As expected, participants in the frame condition also reported having a higher perception of the assortment variety ($M = 5.91$, $SD = .79$) compared to those in the no-frame condition ($M = 5.41$, $SD = 1.22$; $F(1, 218) = 12.59$, $p < .001$; $\eta_p^2 = .055$). Bootstrapping analyses based on 10,000 resamples (Hayes 2017; Model 4 in PROCESS) confirmed the statistically significant mediating role of perceived assortment variety ($B = -.20$, SE = .07; 95% CI = -.35 to -.09) in the effect of visual frames on choice deferral.

There was no significant effect of visual frames on perceptions of structure ($M_{frame} = 6.21$, $SD = .75$ vs. $M_{no\text{-}frame} = 6.15$, $SD = .70$; $F < 1$, NS), completeness ($M_{frame} = 5.60$, $SD = 1.29$ vs. $M_{no\text{-}frame} = 5.43$, $SD = 1.25$; $F < 1$, NS), protection ($M_{frame} = 4.19$, $SD = 1.89$ vs. $M_{no\text{-}frame} = 4.07$,

SD = 1.62; $F < 1$, NS), confinement (M_{frame} = 2.78, *SD* = 1.65 vs. $M_{no\text{-}frame}$ = 2.99, *SD* = 1.74; $F < 1$, NS), concreteness (M_{frame} = 5.66, *SD* = 1.19 vs. $M_{no\text{-}frame}$ = 5.43, *SD* = 1.34; $F(1, 218) = 1.78$, $p = .183$), choice feasibility (M_{frame} = 6.06, *SD* = .93 vs. $M_{no\text{-}frame}$ = 5.85, *SD* = 1.22; $F(1, 218) = 2.21$, $p = .139$), visual attractiveness (M_{frame} = 5.87, *SD* = 1.12 vs. $M_{no\ frame}$ = 5.76, *SD* = 1.18; $F < 1$, NS), or choice confidence (M_{frame} = 6.39, *SD* = .79 vs. $M_{no\text{-}frame}$ = 6.26, *SD* = .85; $F(1, 218) = 1.25$, $p = .264$), suggesting that our observed effect was not likely to be driven by these alternative mechanisms.

Discussion

Studies 2A and 2B provided convergent evidence for our proposed underlying mechanism. That is, visual product frames (vs. no frames) increased consumers' relative use of the by-alternative (vs. by-attribute) approach and then perceived assortment variety, which subsequently alleviated their decisions to delay or opt out of choice from the assortment. Meanwhile, the results of Study 2B ruled out several alternative processes that might be related to visual frames, such as perceptions of structure, completeness, protection, confinement, concreteness, choice feasibility, visual attractiveness, and choice confidence.

STUDY 3

We reason that the observed effects appear because visual frames induce consumers to adopt a by-alternative (rather than by-attribute) approach that facilitates their recognition of attribute combinations and synergies (and not just the qualities of each individual attribute), which subsequently leads to higher perception of assortment variety. Note that in all our prior studies, consumers are sufficiently knowledgeable about the product categories (i.e., choosing from familiar categories such as mouse pad, hotel, and bookmark). However, when consumers

are unfamiliar with a product category, they are uncertain about what attributes are most important to compare among options. In this case, they may tend to place equal weight on all attributes and consider them all for each option, which triggers the greater use of a by-alternative approach than a by-attribute approach and attenuates the effect of visual product frames on the likelihood of choice deferral. Study 3 tests this possibility.

Method

A total of 423 adult consumers (57.21% female, M_{age} = 43) participated in this preregistered study (https://aspredicted.org/hq4n5.pdf) through MTurk for a small monetary reward. They were randomly assigned to conditions of a 2 (product frame: frame vs. no frame) × 2 (category familiarity: familiar vs. unfamiliar) between-subjects design. Eighteen participants failed the attention check (see Web Appendix D), leaving us a final sample of 405 (58.27% female; M_{age} = 43).

Participants were instructed to imagine that they wanted to buy a soft drink from an online retailer. A webpage was then presented with four equally priced drink options, albeit with different calorie counts and juice contents. Similar to previous studies, options in the *frame* condition were separated by visual frames, whereas no visual frame was used in the *no-frame* condition (see Appendix). Following the same procedure used in prior literature (e.g., Biswas and Sherrell 1993; Zhou and Nakamoto 2007), we identified "soda drink" that was well known to participants as the familiar product category and "relaxation drink" that was less well known as the unfamiliar product category, and accordingly introduced the soft drink either as a type of soda drink (in the *familiar* condition) or as a type of relaxation drink (in the *unfamiliar* condition).

Participants evaluated the product options at their own pace and then indicated their

decision on whether they would choose one option or none of them on a similar scale as used in the previous studies (1 = I would not buy either of the drink options and would like to look for more alternatives, 0 = I would settle for one drink option from the four alternatives). Finally, participants evaluated the variety of the product assortment by responding to the same scale used in Study 2B (α = .74).

Results

To confirm that our manipulation of category familiarity was successful, we conducted a post-test using participants from the same population as in the main study. 189 participants (60.32% female; M_{age} = 46) were randomly assigned to evaluate either the soda drinks (*familiar* condition) or the relaxation drinks (*unfamiliar* condition) concerning their familiarity with the category provided ("How familiar are you with the product category?" 1 = "not at all," 9 = "very much"). As expected, a one-way ANOVA showed that participants were more familiar with the soda drinks (M = 7.78, SD = 1.54) than the relaxation drinks (M = 4.11, SD = 2.55; $F(1, 187)$ = 142.92, $p < .001$; η_p^2 = .433).

A binary logistic regression with product frame (1 = frame, 0 = no frame; mean-centered), category familiarity (1 = familiar, 0 = unfamiliar; mean-centered) and their interaction term as the independent variables, and participants' choice deferral (1 = deferral, 0 = no deferral) as the dependent variable yielded only a significant product frame × category familiarity interaction (β = -.98, SE = .46, $Wald\ \chi^2$ = 4.67, p = .031; Cohen's d = .543). Consistent with our expectation, and replicating our previous results, participants in the frame condition were significantly less likely to defer their choices (22.33%) than were those in the no-frame condition (37.00%; β = -.71, SE = .31, $Wald\ \chi^2$ = 5.16, p = .023; Cohen's d = .394) when the product category was familiar to them. When the product category was unfamiliar, however, the choice-

deferral rates did not significantly vary across conditions (M_{frame} = 26.73% vs. $M_{\text{no-frame}}$ = 21.78%; β = .27, *SE* = .33, *Wald* χ^2 = .67, p = .412). Besides, neither the main effect of product frames (β = -.22, *SE* = .23, *Wald* χ^2 = .96, p = .327) nor that of category familiarity (β = .25, *SE* = .23, *Wald* χ^2 = 1.21, p = .272) was significant.

In addition, a two-way ANOVA analysis of participants' perceived assortment variety as a function of product frame and category familiarity was conducted. The results revealed a significant main effect of category familiarity ($F(1, 401) = 9.79$, p = .002; η_p^2 = .024); that is, participants in the familiar condition perceived a lower level of assortment variety (M = 5.29, SD = 1.54) than did those in the unfamiliar condition (M = 5.74, SD = 1.43). There was also a significant main effect of product frame ($F(1, 401) = 5.38$, p = .021; η_p^2 = .013); that is, participants in the frame condition perceived a higher level of assortment variety (M = 5.68, SD = 1.39) compared to those in the no-frame condition (M = 5.34, SD = 1.60).

More important and consistent with our theory, the results revealed a significant product frame × category familiarity interaction ($F(1, 401) = 6.83$, p = .009; η_p^2 = .017). Decomposing the two-way interaction suggested that when participants were familiar with the product category, they perceived a higher level of assortment variety in the frame condition (M = 5.64, SD = 1.30) than in the no-frame condition (M = 4.92, SD = 1.68; $F(1, 401) = 12.19$, p = .001; η_p^2 = .030). When participants were unfamiliar with the product category, however, there was no significant difference between the frame and no-frame conditions (M_{frame} = 5.72, SD = 1.48 vs. $M_{\text{no-frame}}$ = 5.76, SD = 1.39; $F < 1$).

We predicted that the interaction effect of product frame × category familiarity would lead to different levels of perceived assortment variety, which in turn affect the choice-deferral rates. A moderated mediation analysis (Hayes 2017; Model 8 using 10000 resamples) indicated

that the impact of product frame × category familiarity on the rate of choice deferral was mediated by the perceived variety of the assortment (B = -.93, SE = .39; 95% CI = -1.78 to -.23). The indirect effect of perceived variety excluded 0 and thus was significant in the familiar condition (B = -.88, SE = .29; 95% CI = -1.50 to -.37) but was not significant in the unfamiliar condition, which included 0 (B = .05, SE = .25; 95% CI = -.44 to .57). The results support our proposed process associated with perceived assortment variety.

Discussion

The results of Study 3 demonstrated a boundary condition of the focal effect. We showed that the effect of product frames observed in previous studies was not evident when consumers were unfamiliar with the given product category. In this situation, consumers were uncertain about which attributes were most important and diagnostic, and therefore had to rely on all attributes within a single option (i.e., the by-alternative approach) for option comparisons instead of being able to make comparisons along the most important attributes across different options (i.e., the by-attribute approach). Such a shift to a by-alternative approach as opposed to a by-attribute one enables consumers to easily identify the combinations or synergies between various attributes while avoid overlooking common ones, leading them to perceive a high level of assortment variety independent of product frames, which in turn attenuates the effect of product frames on choice deferral.

STUDY 4

We propose that product-assortment size also plays a role in varying the effect of product frames on choice-deferral likelihood. For assortments with a small number of options, product frames can increase perceived assortment variety so that consumers can appreciate the full extent

of variety in comparison to no frames. But as the assortment size increases, consumers may find that there are many options available either with or without product frames presented. Thus, we predict that the effect of visual product frames on choice deferral will hold only in a small product assortment, but it will be less evident in the medium and large assortments.

Method

A total of 620 adult consumers (63.06% female; M_{age} = 43) participated in this preregistered study (https://aspredicted.org/za5r8.pdf) through MTurk for a small monetary reward. They were randomly assigned to conditions of a 2 (product frame: frame vs. no frame) × 3 (assortment size: small vs. medium vs. large) between-subjects design. Sixteen participants failed the attention check (see Web Appendix D), leaving us a final sample of 604 (63.41% female; M_{age} = 43).

Similar to the previous studies, participants imagined that they wanted to buy a bookmark and searched for product information on an e-commerce website. They were then shown a webpage containing several equally priced bookmark options, each presented with a picture and short description of bookmark features. Assortment size was manipulated by varying the number of options in the assortment (e.g., Chernev 2003; Chernev and Hamilton 2009). In the *small* condition, the assortment consisted of 4 options displayed in a single line; in the *medium* condition, it consisted of 12 options displayed in three lines; and in the *large* condition, the assortment consisted of 20 options displayed in five lines. Similar to previous studies, options in the *frame* condition were separated by visual frames, whereas no visual frame was used in the *no-frame* condition (see Appendix).

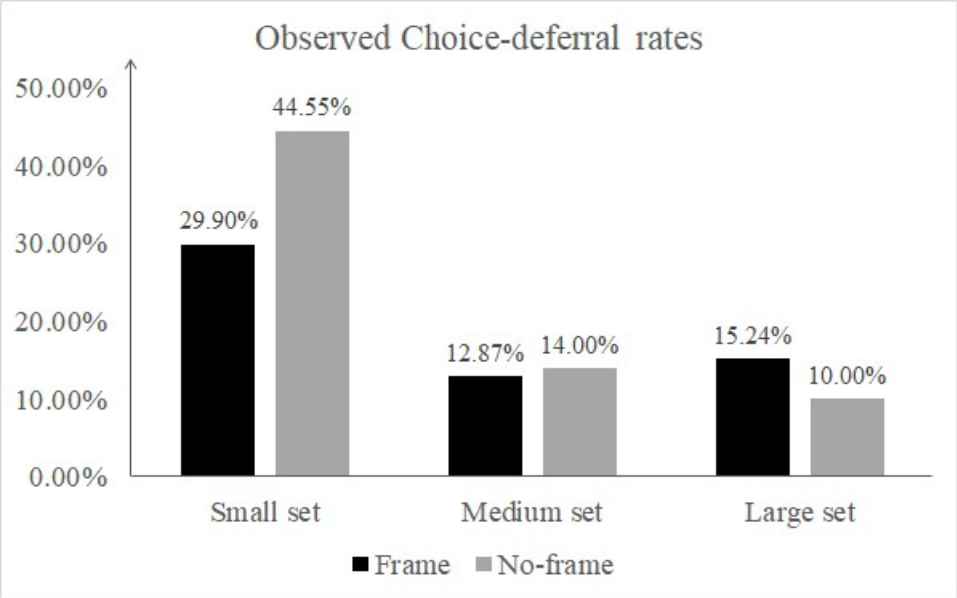
Participants evaluated the product options at their own pace and then indicated their decision on whether they would choose one option or none of them on a similar binary scale as

used in our previous studies (1 = I would not buy either of the bookmarks and would like to look for more alternatives, 0 = I would settle for one bookmark from the assortment).

Results

A binary logistic regression with product frame (1 = frame, 0 = no frame; mean-centered), assortment size (1 = large, 0 = medium, -1 = small; mean-centered), and their interaction term as the independent variable and participants' choice deferral (1 = deferral, 0 = no deferral) as the dependent variable yielded a significant main effect of assortment size (M_{small} = 37.37% vs. M_{medium} = 13.43% vs. M_{large} = 12.68%; β = -.79, SE = .14, *Wald* χ^2 = 33.30, $p < .001$; Cohen's d = .435), qualified by a significant product frame × assortment size interaction (β = .63, SE = .27, *Wald* χ^2 = 5.31, p = .021; Cohen's d = .347). As illustrated in Figure 1, when choosing from a small assortment, participants in the frame condition were significantly less likely to defer their choice (29.90%) than were those in the no-frame condition (44.55%; β = -.67, SE = .29, *Wald* χ^2 = 5.51, p = .019; Cohen's d = .372), replicating our findings in prior studies. When they chose from a medium assortment (M_{frame} = 12.87% vs. $M_{no\text{-}frame}$ = 14.00%; β = -.04, SE = .22, *Wald* χ^2 = .04, p = .844) or a large assortment (M_{frame} = 15.24% vs. $M_{no\text{-}frame}$ = 10.00%; β = .59, SE = .41, *Wald* χ^2 = 2.06, p = .151), however, the choice-deferral rates did not significantly vary across the two frame conditions.

Figure 1. Result of observed choice-deferral rates (Study 4)



Discussion

The results of Study 4 confirmed our hypothesis that the effect of product frames on choice deferral is only evident when participants choose from a small assortment and thus can recognize the value of variety offered by product frames. As the assortment size increases from small to medium and large, this effect became less evident.

STUDY 5

Although we have focused our investigation on the online retailing context, we believe that visual product frames could lead to a similar effect on offline choice deferral, if consumers make purchasing decisions based on the visual display of product information. To examine whether this is the case in a real-world offline setting, we conduct a field experiment at a beverage store by manipulating the presence of visual frames on its in-store poster.

In addition, given that choice deferral is a key barrier to purchase (Chernev 2005b; Grieser 2014; Mourali et al. 2018), a set of past research (e.g., Lichters et al. 2016; Mourali et al. 2018; Valenzuela et al. 2009) used likelihood of purchase to index choice deferral. In line with

this research, we consider likelihood of purchase as a reverse indicator of choice deferral and expect that visual product frames could help increase purchase by mitigating choice deferral in the current study.

Method

We conducted this preregistered field study (https://aspredicted.org/ag6ev.pdf) at a beverage store called "Fang Hua Li" in a major city in Southern China. The store offers a wide variety of beverage categories, including tea drinks (e.g., milk tea, fruit tea, bubble tea, etc.), smoothies, juice, and coffee. This field experiment was conducted daily from 14:00 pm to 20:00 pm (i.e., 6 hours per day) over two consecutive weeks (i.e., from 21 November 2022 to 04 December 2022), during which several new flavors of drinks (i.e., bubble tea) were introduced. There is no electronic menu provided in the shop. Thus, to order drinks, all customers need to look at the menu on the wall behind the counter (presenting information about all existing flavors of drinks) and place their order orally through the shop assistant.

We placed an in-store poster on the left side of the counter, highlighting the new flavors of drinks. On the poster, six new flavors of drinks were presented (see Appendix), each displayed with a small picture along with its ingredients, price, and portion sizes available. The prices of these new drinks were almost similar (ranging from ¥12 to ¥15; approx. US$1.5 to US$2). Two versions of the posters were created. On the *frame* poster, each of the six new drinks was surrounded by a round frame, whereas on the no-frame poster, the six drinks were displayed without any frame.

The store shifted the two posters every two hours. On odd days during the study period (e.g., the first day, the third day, etc.) we displayed the frame poster first, and on the even days (e.g., the second day, the fourth day, etc.) we displayed the no-frame poster first (see Web

Appendix A for the detailed temporal arrangements of the poster displays). Each time a customer came into the store, a trained research assistant (who was blind to our hypothesis) would approach to greet the customer and point to the poster to direct them to view the new drinks. However, customers were free to order either the new drinks (displayed on the poster) or the old ones (displayed on the menu on the wall). To this end, if customers decided to choose none of the new drinks but to look for the old drinks, we considered such behavior as an indicator of choice deferral from the focal assortment consisting of new drinks.

Based on the research assistant's observation, during our study period no customer left the store without purchasing a drink. We therefore analyzed the transaction data retrieved from the store's cashier system (frame conditions were identified based on the transaction time). We coded the customers' purchase decisions as "1" if they purchased at least one of the new drinks presented on the poster, and as "0" if they did not purchase any new drink.

Results

Across the 14 days of this field experiment, 516 customers (266 in the frame condition and 250 in the no-frame condition) purchased drinks from the store. Consistent with our expectations, 84 of the 266 customers in the frame condition purchased at least one of the new drinks presented on the poster (31.58%), but only 40 of the 250 customers in the no-frame condition did so (16.00%; $\chi^2(1) = 17.13$, $p < .001$; $\varphi = .182$). Nine customers purchased multiple drinks, and excluding these customers does not change the results of our data analyses significantly (see Web Appendix B).

To control for the time and date that may result in temporal fluctuations in sales, we created 11 dummy variables (i.e., 5 dummy variables for time and 6 dummy variables for date) and conducted a binary logistic regression as follows:

$$Y = \alpha + \beta \times ProductFrame + \gamma_1 \times TimeOfDay_1 + \gamma_2 \times TimeOfDay_2 + \gamma_3 \times TimeOfDay_3 + \gamma_4 \times TimeOfDay_4 + \gamma_5 \times TimeOfDay_5 + \gamma_6 \times DayOfWeek_1 + \gamma_7 \times DayOfWeek_2 + \gamma_8 \times DayOfWeek_3 + \gamma_9 \times DayOfWeek_4 + \gamma_{10} \times DayOfWeek_5 + \gamma_{11} \times DayOfWeek_6 + \mathcal{E}$$

Y is a categorical variable for whether or not at least one of the six new flavors was purchased (1 = purchased, 0 = not purchased), and ProductFrame is a categorical variable for whether or not the visual product frames were presented on the poster (1 = frame, 0 = no frame). $TimeOfDay_i$ is a group of dummies that flexibly control for purchase trends across time intervals in a day by indicating which hour an observation falls into (e.g., $TimeOfDay_1$ is whether the observation falls in the first time interval, 14:00–14:59, of a day). $DayOfWeek_i$ is also a group of dummies that specify which day a weekly observation falls into (e.g., $DayOfWeek_1$ is whether the observation falls on Monday). $\mathcal{E}$ denotes the error term.

The results of the logistic regression with all variables mean-centered confirmed that visual product frames increased the sales of focal products significantly ($\beta = .97$, SE = .22, $Wald\chi^2 = 18.76$, $p < .001$; Cohen's $d = .535$); that is, the presence of visual product frames increased the likelihood that customers purchase the new drinks presented on the poster.

Discussion

Using a field experiment conducted in a local beverage store, Study 5 showed that customers were more likely to purchase from a focal drink assortment (i.e., less likely to defer their choices) when the drink options were separated by frames than if the options were not. This study not only complements our laboratory studies that focused on choice deferral, but also provides clear evidence supporting our prediction that product frames improve purchases and sales in a real-world offline setting.

GENERAL DISCUSSION

Our research proposes and finds that the presence of visual product frames in an assortment reduces choice deferral via increasing consumers' relative use of a by-alternative (vs. by-attribute) approach to product comparisons and then boosting perceived assortment variety. This effect is more salient when consumers are familiar with the product category, or when they choose from a relatively small assortment. We demonstrate these effects in seven preregistered studies that include one eye-movement study and one field experiment. Our studies document the focal effect in the lab as well as in the field, with material and experiential products, using visual and verbal product stimuli and via frame manipulations that vary in shape (e.g., round and square), color (e.g., more or less visible), and design (e.g., closed and semi-closed).

Our work contributes on several theoretical fronts. First, it augments the literature on choice deferral by identifying visual product frames as a factor that can decrease choice deferral. Prior literature identifies several other relevant factors, ranging from decision contexts (e.g., Chernev et al. 2015; Iyengar and Lepper 2000), assortment complexity (e.g., Dhar 1997; Dhar and Nowlis 1999; Tversky and Shafir 1992), to decision makers' psychological states (e.g., Etkin and Ghosh 2018; Mourali et al. 2018). The present work complements the literature by focusing on a nuanced design feature (frames) of a given assortment, an aspect rarely considered and investigated previously. Further, whereas the prior literature has attributed choice deferral to the decisional conflict or difficulty being experienced (e.g., Dhar 1997; Iyengar and Lepper 2000), the present research extends the literature by uncovering perceived assortment variety as an additional determinant of choice deferral. In doing so, we find that surrounding each product option with a visual frame in an assortment presentation can reduce consumers' choice deferral by eliciting greater perceptions of assortment variety.

The literature on assortment perceptions demonstrates that perceived assortment variety is affected by various factors, including assortment structure (e.g., organization, categorization, etc.; Hoch et al. 1999; Kahn and Wansink 2004; Mogilner et al. 2008), display directions (i.e., horizontal vs. vertical direction; Deng et al. 2016), and depiction styles (i.e., visual vs. verbal; Townsend and Kahn 2014). None of these studies, to our knowledge, considered the impact of the design feature of an assortment display on variety perceptions. Our work thus adds to this stream of research via a novel design feature—the presence versus absence of visual product frames. Relatedly, this stream of literature investigated diverse consequences of assortment variety, ranging from consumers' store choice (Hoch et al. 1999), assortment choice (Townsend and Kahn 2014), and choice satisfaction (Mogilner et al. 2008) to consumption quantity (Kahn and Wansink 2004) and consumption variety (Deng et al. 2016). We further add to this particular body of literature by showing that visual frames can affect consumers' assortment variety perceptions, which in turn affects their propensity to defer choice.

Our research also contributes to the literature on visual marketing. Previous studies have found that visual frames can activate several symbolic associations, such as "structure," "protection," and "confinement" (Cutright 2012; Fajardo et al. 2016). This activation process can shape people's perceptions about the object that is surrounded by the visual frame in a consistent manner, subsequently affecting their evaluations of that object, depending on the specific context (Fajardo et al. 2016). Note that prior work typically used stimuli that featured a single item (e.g., a brand logo) and compared consumers' evaluations to that item, surrounded or not by a visual frame. Neither of these characteristics is applicable to a product assortment, where each option is surrounded by a visual frame, and consumers need to choose one framed option from other similarly framed ones, leading the association account to be relatively silent in predicting their

choice. The current research enriches our understanding of the impact of visual frames by showing that while visual frames may perform the symbolic functions in a single-item setting, they can vary people's relative use of the by-alternative (vs. by-attribute) approach to information processing in a multiple-item setting and then alter people's perceptions of assortment variety.

Finally, the current work advances our knowledge about consumers' choice of distinct comparative approaches (i.e., by-alternative vs. by-attribute). Literature identifies several triggers for their relative use of the two approaches. For example, directly instructing choosers to use mental imagery when processing product information leads to a greater use of the by-alternative approach than the by-attribute approach (McGill and Anand 1989). Moreover, displaying options in an anthropomorphic manner or in visual depictions also facilitates the by-alternative approach while inhibiting the by-attribute approach (Huang et al. 2019a; Townsend and Kahn 2014). Note that these triggers already identified in the literature focus on either choosers or choice options. We propose and identify a novel design feature of an assortment (i.e., product frames) as another trigger for consumers' choice of the by-alternative approach over the by-attribute one.

The limitations of our research should be noted and may suggest potential directions for future research. First, while our findings of Study 3 reveal that the focal effect is attenuated in a relatively unfamiliar product category (i.e., relaxation drinks), Study 5 offers a seemingly contrasting result; that is, the focal effect holds in drinks with new flavors that should be unfamiliar to most consumers. To reconcile this inconsistency, we argue that consumers were quite familiar with the provided drinks in Study 5 even if they were labeled as "new flavors" for two considerations: (1) most participants were returning customers of the beverage store so they should be quite familiar with the specific category of the new drinks (i.e., bubble tea in that

study), and (2) the names of the new drinks indicated the main ingredients so that their tastes can be imagined easily.

Additionally, even if consumers are familiar with a specific product category, their uncertainty about the core attributes in that category (e.g., flavors in the drink category) may as well foster their use of a by-alternative approach (because of their inability to use a by-attribute approach for option comparisons) and subsequently eliminate the focal effect. In an additional study reported in Web Appendix F, we provided an assortment of soda drinks either with concrete and familiar flavors (e.g., apple, berry, etc.) or with abstract and unfamiliar flavors (e.g., rocket, unicorn, etc.) for participants to choose from. The results returned that the focal effect was attenuated and even reversed in the unfamiliar condition. Taking together, we speculate that the focal effect may only hold when consumers are familiar with not only the specific product category but also the core attributes in that category; the lack of either product knowledge may wash out the effect. Future research might nonetheless provide more direct tests for the role of familiarity in our focal effect.

Second, our research focuses on the context where multiple similar product alternatives are displayed, given that manufacturers often offer different versions of the same product with subtle variations in attributes. Consequently, one seemingly trivial yet important methodological consideration of prior studies on choice deferral is that the differences between the offered alternatives were relatively small. One might wonder what would happen if a set of products with large differences is presented. Would surrounding different products with visual frames still inhibit consumers' choice deferral? As previously stated, consumers defer choice due to choice difficulty (Dhar 1997; Iyengar and Lepper 2000). When the differences become either extremely large or extremely small, consumers may find it more difficult to make a choice, therefore

increasing the likelihood of choice deferral. Consequently, large differences among product alternatives may moderate the effect of product visual frames on consumers' choice deferral, making that effect less apparent. This direction is worth future investigations.

Third, the finding of Study 4 revealed that as the assortment size increases, consumers are less likely to defer their choices. This finding may initially seem inconsistent with past literature on choice overload (e.g., Iyengar and Lepper 2000; Shugan 1980), which shows that large (rather than small) assortments are often accompanied by increased choice overload and choice deferral. We speculate that this pattern likely emerges for two reasons. On the one hand, the experimental stimuli we used in Study 4 feature simple products (i.e., bookmarks), which are characterized by only two attributes. Given that one precondition of choice overload is multiple attributes on which products are differentiated (e.g., Chernev et al. 2015), increasing assortment size in our case does not necessarily lead to feelings of cognitive load and consequent choice deferral. On the other hand, with the growth of online shopping platforms, consumers today may be more accustomed to navigating large assortments compared to two decades ago. This increased familiarity may decrease consumers' learning cost and make their processing of a "vast" array of options much easier. However, we believe that choosing from an extremely wide range of options (e.g., 100 and above) can still trigger cognitive load and lead to choice deferral widely observed in past literature. This was beyond the scope of the current work, but future research may consider providing stronger evidence for these speculations.

Although our results support a positive effect of the by-alternative approach on consumer choice (that is, the use of a by-alternative approach reduces choice-deferral rate via increasing perceived assortment variety), prior work on self-customization documents a negative effect of matrix formats (i.e., by-alternative) compared with by-attribute ones on choice likelihood

through the greater difficulty experienced in product customization (Valenzuela et al. 2009). Note that in Valenzuela et al. (2009)'s study, participants are provided with one attribute to choose at a time in the by-attribute condition, whereas they are provided with several alternatives varying on each attribute in the by-alternative condition (i.e., matrix). The by-attribute method obviously simplifies consumers' self-customization procedure by breaking the choice down into several smaller steps and thereby facilitates their choices. In the current work, however, we always display available options in the matrix formats so that the decision difficulty is kept constant independent of which approach participants choose. In this case, consumers' assortment perceptions elicited by one approach rather than decision difficulty may come into play to determine choice likelihood. Future research may consider providing more direct evidence for reconciling these seemingly contrasting findings.

Finally, visual frames can partition an assortment and divide it into several smaller units. As suggested by Cheema and Soman (2008), when consumers encounter a partition, that partition draws more attention toward the consumption decision if there is a small transaction cost, making their decision from automatic to deliberative. As a result, the deliberation leads consumers to stop or postpone further consumption. This rationale may be further applied to understand our findings and suggest a provocative alternative account. The partitions separated by visual frames in an assortment may prevent consumers from further scanning and considering other alternatives, thereby lowering the rate of choice deferral. However, if this is the case, then participants in our studies should be more likely to choose the options on the left/top than those on the right/bottom of the assortment because people normally scan items from left to right and from top to bottom (Lohse 1997). The data from 1A and 2B (in which product options were presented either in a line or in a column) revealed that their choice was randomly distributed

among options at different positions and no consistent pattern was observed across the studies, which was contrasted with this partition account. We thus speculate that the cognitive effort required for scanning beyond visual frames in our paradigm is more trivial than the transaction cost (e.g., opening a fresh bag of popcorn) in Cheema and Soman (2008)' study, thus making it insufficient for the participants to activate a deliberation process and stop the processing. While this question is beyond the scope of this study, empirically testing it would be a fruitful topic for future research.

Our research has important practical implications. Improving conversion rate and lowering choice deferral are primary goals for retailers (Grieser 2014; Mourali et al. 2018). As a result, retailers have employed multiple formats of product presentation in order to increase the utility that consumers can derive from their shopping process and to nudge their purchase. When harnessing the power of digital technologies, for example, retailers can have consumers view products from various angles or virtually experience the different functions of those products (Jiang and Benbasat 2007). They can allow consumers to control the products with mid-air gestures, touchscreen gestures, or mouse movements (Liu et al. 2019). They can also provide a highly interactive mode, a restricted interactive mode, or a non-interactive mode for product presentations (Yi et al. 2015). While some of these presentation formats do facilitate product understanding and maximize utility, retailers are sometimes reluctant to integrate these technologies because of the notable investment required and the difficulty of employing them on a wide scale.

The present research identifies a cost-efficient and easy-to-implement approach to nudge sales that does not require a large investment: the frame design. As described in Study 5, we manipulated the presence of visual frames on a poster menu in a physical store and found that

customers were more likely to make a purchase from the menu if each item was surrounded by a visual frame than if it was not (the purchase likelihood almost doubled). These results suggest that frame design can be widely applied not only to product displays on e-commerce platforms but also in physical contexts, such as displaying options on a menu or presenting discounted products in a store's pamphlet/catalog.

Finally, our findings identify characteristics of the decision context that can attenuate the advantageous effect of product frames. For example, as we found in Study 3, making a choice from an unfamiliar product category can activate the by-alternative approach that facilitates one's identification of attribute interactions and subsequently enhances perceived assortment variety, which then offsets the effect of product frames on choice deferral. Thus, managers should keep in mind that in situations where consumers are unfamiliar with the given product category, such as when they must choose from uncommon or truly innovative products, the frame design may become less effective in improving conversion rate. We also showed in Study 4 that frame design does not matter if consumers choose from a medium to large product assortment. We thus recommend that product managers should not expect to implement the frame design to effectively alleviate choice deferral if they offer an extensive array of options.

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APPENDIX: EXPERIMENTAL STIMULI USED IN STUDIES 1-5

Stimuli used in Study 1A

Frame Condition

No-frame Condition

Stimuli used in Study 1B

Frame Condition

No-frame Condition

Stimuli used in Study 2A

Frame Condition

No-frame Condition

Stimuli used in Study 2B

Frame Condition

No-frame Condition

Field Stimuli used in Study 5

Frame Condition

No-frame Condition

Stimuli used in Study 3

Familiar Frame Condition

Familiar No-frame Condition

Unfamiliar Frame Condition

Unfamiliar No-frame Condition

Stimuli used in Study 4

Small-set Frame Condition

Medium-set Frame Condition

Large-set Frame Condition

Small-set No-frame Condition

Medium-set No-frame Condition

Large-set No-frame Condition