



## Do Colors Change Realities in Online Shopping?

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### Abstract

This study investigates the links among color, price, and patronage intention on the Internet. With regard to the effects of a store website's background colors and product prices, the interactions of background colors and price levels may influence online patronage intention via perceptions of quality, sacrifice, and value. The results reveal that online consumers' reactions to online merchandise prices vary according to website background colors. Participants who view blue or low-brightness backgrounds have high patronage intentions regardless of whether prices are high or low. Participants who view red or high-brightness backgrounds are sensitive to merchandise prices and react significantly negatively to high prices. Further mediation analyses indicate that website background colors can influence how consumers interpret price levels: Blue backgrounds make consumers use high price as a sign of high quality rather than monetary sacrifice, but red or high-brightness backgrounds make consumers use high price as a sign of high monetary sacrifice rather than product quality.

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*Keywords:* Color; Price; Online store atmospherics; Website design

### Introduction

Do colors influence our daily judgments and decisions? Imagine visiting the website of an online store at which a shirt is priced at \$10. Would the website's background colors (e.g., red or blue) influence your purchase value and intention? If the price at another online store is set at \$25, should the background colors of that store's website be the same as those at the \$10 store? Although some researchers have addressed the effects of colors (Bagchi and Cheema 2013; Mehta and Zhu 2009; Puccinelli et al. 2013; Puzakova et al. 2016), the psychological processes of color use have not been fully discussed.

Online consumers are often sensitive to price. Because prior literature has indicated that colors significantly influence consumers' judgments and decision, online businesses can reduce price competition by using color to create atmospheric

differentiation. For example, colors influence consumers' liking of ads (Gorn et al. 1997) and perceived brand personality (Labrecque and Milne 2012; Romaniuk and Nenycz-Thiel 2014). From a business perspective, understanding how color influences consumer judgment can help managers increase their companies' competitive advantages and profits (Labrecque and Milne 2012). Although the role of color in marketing has been abundantly researched, authors have paid surprisingly little attention to the role of color in online environments (Labrecque, Patrick, and Milne 2013), and several knowledge gaps remain.

First, price and color are critical determinants of customer behavior (Baker et al. 2002; Polo, Sese, and Verhoef 2011). Research indicates that product selection, quality, service, store atmospherics, and price relate significantly to store-patronage intentions (Pan and Zinkhan 2006). Although the impacts of color and price have been demonstrated, little is known about the impact of color on price perception (Puccinelli et al. 2013). By understanding how background colors influence consumer perceptions of price, online businesses can better align their website designs with prices.

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Second, color is a multidimensional construct, composed of hue, brightness, and saturation (Gorn et al. 1997). Whereas the dimension of hue (e.g., red or blue) has attracted some study (e.g., Babin, Hardesty, and Suter 2003; Bagchi and Cheema 2013), brightness has received less attention even though the background brightness of retail websites varies. For example, the background brightness of Montblanc's online store (<http://www.montblanc.com/en/home.html>) is low, whereas that of The Gap's online store is high (<http://www.gap.com>). Businesses can differentiate themselves by providing online shopping environments that feature appropriate atmospherics, so we explore the influences of both hue and brightness in online contexts.

Third, research has shown that price has an impact on perceived value through two opposite forces: *price–quality* associations and *price–sacrifice* associations (Bornemann and Homburg 2011; Monroe 2012). In this study, we show how the background hues and brightness levels of websites influence these forces, as well as perceived value and patronage intentions. Online retailers can use our results to design their websites' background colors to appeal to their target segments depending on whether they would target on high-quality or low-sacrifice segments.

## Theoretical Background

### *Color as an Atmospheric Cue of an Online Store*

Kotler (1973/1974) introduced the term *atmospherics* to describe the conscious planning and manipulation of environmental cues that contribute to consumers' propensities to purchase. Atmospheric cues influence both offline and online consumers. Color is an important website design factor; it affects users' aesthetic perceptions (Cai and Xu 2011; Coursaris, Swierenga, and Watrall 2008; Wang, Minor, and Wei 2011), perceptions of download speeds (Gorn et al. 2004), reading of information (e.g., Scharff and Ahumada 2002), willingness to respond to e-mails (Zviran, Te'eni, and Gross 2006), bidders' levels of aggression in auctions (Bagchi and Cheema 2013), and interpretations of negative firm information (Puzakova et al. 2016). Although past studies show that color influences consumers' behavioral intentions in brick-and-mortar environments (e.g., Babin, Hardesty, and Suter 2003; Bellizzi and Hite 1992), evidence still is lacking about the influence of website background colors on online shoppers' patronage intentions. To provide insight, this study varies the combination of background color and price to examine how color can be used to position online stores distinctly.

Color consists of three dimensions: hue, brightness, and saturation (Gorn et al. 1997). Color theorists cite these dimensions as potential influences on viewers' responses; marketing researchers refer to them as the design and ambient factors of service environments (Baker et al. 2002). Table 1 summarizes marketing research on color.

### *Hue*

Hue is the wavelength of light within the visible light spectrum. Short wavelengths tend to be associated with "cool" colors (e.g., blue, purple), and long wavelengths are associated with "warm" colors (e.g., red, orange). Most studies find that

cool-colored shopping environments produce more pleasure than warm-colored environments (Bellizzi and Hite 1992). Research on online environments, however, reports mixed results. Coursaris, Swierenga, and Watrall (2008) find that stronger aesthetic perceptions result from cool rather than warm website colors, whereas Wu, Cheng, and Ye (2008) find that participants report greater pleasure in response to red background colors than blue background colors.

### *Brightness*

Brightness is a continuous dimension, according to which colors high in brightness appear "whitish," like white mixed into a pigment; colors low in brightness appear "darkish," like black mixed into a pigment. Past research shows that the whitish quality of high-brightness color is more pleasant; it produces a calming, relaxing effect (Valdez and Mehrabian 1994). Gorn et al. (2004) find that in online settings, brighter colors elicit greater feelings of relaxation than darker colors.

### *Saturation*

Saturation is the intensity of a color. High-saturation colors have more pigment than low-saturation colors; they are rich, vivid, and striking, whereas low-saturation colors are dull (Gorn et al. 1997). Research consistently reports significant positive relationships between saturation and viewers' perceptions (see Gorn et al. 1997; Valdez and Mehrabian 1994). Colors with high saturation appear even more vivid on a computer screen than colors with low saturation (Gorn et al. 2004). Because low-saturation colors are similar to gray, given these consistent results, we test the effects of the combination of hue and brightness while maintaining a constantly high level of saturation.

Color is an important atmospheric factor; it affects consumers' inferences about quality and store image and contributes to differential advantages (Chebat and Morin 2007). Color can also emphasize or de-emphasize the importance of price (Puccinelli et al. 2013). The influence of color on consumer perception suggests an opportunity for e-retailers to use color designs to influence consumer responses. However, relatively few studies have discussed the relationship between color (hue and brightness) and price, leaving practitioners unsure of how colors influence consumers' perceptions and patronage intentions when the price varies.

### *Effects of Website Background Hue and Price on Perceived Value and Patronage Intention*

There are three points of view that help us understand how color and price influence perceived value and patronage intention: the dual role of price, the effects of color on cognitive tasks, and adaptation-level theory. According to studies of the dual role of price, consumers arrive at their perceptions of value by cognitively trading off the benefits they believe they will receive against the costs they must pay. Thus, price influences perceived value through two mechanisms: as a signal of quality and as an indicator of the required sacrifice for a product (Bornemann and Homburg 2011). When a price increases from low to high, consumers may perceive a change in value by recognizing higher quality (higher

Table 1  
Marketing research on color.

Authors	Color	Context	Result
Babin, Hardesty, and Suter (2003)	Hue (orange vs. blue) and lighting (bright vs. soft)	Offline store	The influences of hue, lights, and price on behavioral intentions were mediated by cognitive and affective reactions.
Bagchi and Cheema (2013)	Hue (red vs. blue)	Online auction	Red (vs. blue) background elicited higher bid jumps and decreased price offers in negotiations.
Bellizzi and Hite (1992)	Hue (blue vs. red)	Offline store	Blue (vs. red) resulted in more simulated purchases.
Chebat and Morrin (2007)	Hue (cool vs. warm)	Offline store	French-Canadians (vs. Anglo-Canadians) had higher perceptions of product quality when the mall exhibited a warm (vs. cool) color decor.
Gorn et al. (1997)	Hue (red vs. blue), brightness, and saturation	Print ads	High brightness produced greater liking for the brand; higher saturation led to higher excitement.
Gorn et al. (2004)	Hue, brightness, and chroma	Web page download speed	Perceived quickness of the download was greater with blue (vs. yellow and red), with a higher-brightness (vs. lower-brightness) color, and with a lower-chroma (vs. higher-chroma) color.
Kaltcheva and Weitz (2006)	Hue (warm vs. cool) and saturation	Online store	Hue and saturation are central to arousal.
Labrecque and Milne (2012)	Hue, brightness, and saturation	Fictitious logos	Hue, brightness, and saturation affect brand personality and purchase intent.
Labrecque, Patrick, and Milne (2013)	Hue, brightness, and chroma	Literature review	Color influences consumers' psychology outcomes and marketing outcomes.
Mandel and Johnson (2002)	Hue (blue vs. green)	Online store	When consumers evaluated a sofa on a blue background with fluffy clouds (vs. a green sofa with dollar signs), they were less likely to identify price as an important attribute.
Mehta and Zhu (2009)	Hue (red vs. blue)	Paper- and computer-based experiment	Red enhanced subjects' performance on a detail-oriented task, and blue enhanced performance on a creative task.
Puccinelli et al. (2013)	Hue (red vs. black) and price	Retail ads	Male consumers perceived greater savings when prices were presented in red (vs. black); women appeared to be naturally inclined toward greater elaboration of the ad.
Puzakova et al. (2016)	Hue (red vs. blue)	News website	Blue (vs. red) cues presented after communications featuring a firm's failure led to more overall recall of firm information and less negative firm evaluations.
Romaniuk and Nenycz-Thiel (2014)	Color on brand	Brand	Color is an effective brand-identity element that helps consumers differentiate a brand from its competitors.

value) and higher sacrifice (lower value) at the same time. Although these two forces work together, the relative influence of price–quality and price–sacrifice associations may vary with the purchase context, because of the ways in which consumers are contextually primed at the time of judgment. Each cue presented may influence how much weight consumers place on their price–quality and price–sacrifice inferences (Monroe 2012). We argue that the background color of a website is a cue that may influence consumers' trade-off of quality with sacrifice to form perceived value.

Studies of the effects of color on cognitive tasks have shown that red and blue have different implications for viewers; they can induce alternative motivations and result in varying cognitive responses. Because blue is usually associated with openness, peace, and tranquility, it should activate an approach motivation, which has been shown to cause people to prefer brands that highlight benefits (Mehta and Zhu 2009). Therefore, consumers who view a blue background are more likely to use high price as an indicator of high quality rather than high monetary sacrifice. In contrast, red backgrounds—associated with danger and mistakes—should activate an avoidance motivation and make people more risk-averse (Mehta and Zhu 2009), leading them to give more weight to price–sacrifice associations and adopt price-minimization strategies (Tellis and Gaeth 1990). Moreover, literature shows that a red background is more likely to heighten

participants' aggression and lead to their unwillingness to pay a high price (Bagchi and Cheema 2013). Therefore, we propose:

**H<sub>1</sub>.** The difference in perceived quality between the low and high-price conditions will be larger with a blue (vs. red) background.

**H<sub>2</sub>.** The difference in perceived monetary sacrifice between the low and high-price conditions will be higher with a red (vs. blue) background.

According to our discussion of price–quality and price–sacrifice associations, when products are presented on a blue background, positive price–quality and non-significant price–sacrifice relationships may lead to a high level of perceived value and patronage intentions even when prices are high. Conversely, for a red background, non-significant price–quality and positive price–sacrifice associations imply that both perceived value and patronage intentions are negatively influenced by price level. We expect a greater decrease in perceived value and patronage intentions from low-price to high-price conditions with a red background than with a blue background. This prediction is consistent with the finding that, compared with red environments, blue environments make shoppers express greater intentions to browse and also higher

propensities to buy the most expensive products (Bellizzi and Hite 1992). We propose:

**H<sub>3</sub>.** The difference in (a) perceived value and (b) patronage intention between the low and high-price conditions will be higher with a red (vs. blue) background.

#### *Effects of Website Background Brightness and Price on Perceived Value and Patronage Intentions*

The brightness of a background color also may influence consumer perceptions because of the association of brightness with store image: Low brightness is related to an upscale image and high brightness is related to a discount-store image. Prestigious stores thus tend to use low-brightness colors (Golden and Zimmerman 1986). In cyber-banking, low-brightness colors invoke greater trustworthiness and elegance (Kim and Moon 1998). Online store websites that use low-brightness backgrounds likely suggest a similar upscale image. Geerts and Veg-Sala (2011) analyze the websites of five luxury brands and find they often use dark background colors to present their products. In line with adaptation-level theory (Helson 1964), which posits that contextual factors shape a person's frame of reference for focal stimuli, shoppers may perceive products to be of higher quality when they purchase them from store websites with low-brightness (vs. high-brightness) backgrounds because the low brightness of the background color is a cue for an upscale store image (Baker, Grewal, and Parasuraman 1994; Gardner and Siomkos 1986).

Price is another consumer cue for assessing product quality: Higher price implies higher quality. Therefore, we must address the integrated effects of multiple cues on perceived quality. Miyazaki, Grewal, and Goodstein (2005) use cue-consistency theory and the cue-integration model to explain the influence of multiple cues on perceived quality; they assert that such cues are likely to have equal effects when the cues are consistent but that negative cues dominate when the cues present contradictory signals. Therefore, when the cues are consistent—that is, when high prices are presented in a store website with a low-brightness background—consumers perceive the store's products to be of high quality. In contrast, when the cues represent inconsistent information, negative cues are more salient. Therefore, quality assessments of conditions with inconsistent cues (i.e., low prices presented in low-brightness conditions or high prices presented in high-brightness conditions) are as low as the quality perceptions in the condition in which both cues are low (i.e., low prices presented in high-brightness conditions).

**H<sub>4</sub>.** The difference in perceived quality between the low and high-price conditions will be higher with a low-brightness (vs. high-brightness) background.

In addition, when a product is positioned in an upscale store, consumers are more willing to pay a high price (Baker et al. 2002) and are less sensitive to price changes (Teodorescu, Pop, and Stăncioiu 2008). For example, Thaler (1985) found that subjects inferred a higher price when purchasing beer in an upscale store rather than in a run-down store. Therefore, we

expect that when products are presented on a low-brightness background, an upscale store image will make consumers' perceived level of monetary sacrifice stay low in both high-price and low-price conditions. In contrast, consumers who view products on a high-brightness background will perceive a discount image and expect relatively low prices, such that their perceived monetary sacrifice is influenced more profoundly by price. Therefore, consumers will respond more negatively to high prices for products presented on bright backgrounds than on dark backgrounds.

**H<sub>5</sub>.** The difference in perceived monetary sacrifice between the low and high-price conditions will be higher with a high-brightness (vs. low-brightness) background.

According to our discussions of how background brightness influences perceived quality and sacrifice, we expect that higher prices on a low-brightness background (implying an upscale image) will lead to consumer perceptions of higher quality rather than higher monetary sacrifice. In contrast, higher prices on a high-brightness background (implying a discount image) will lead to consumer perceptions of higher monetary sacrifice rather than higher quality. Consumers will respond more negatively to high prices on a high-brightness website than on a low-brightness website. Therefore, we expect that the negative influence of price on perceived value and patronage intention is greater for a high-brightness (vs. low-brightness) online background.

**H<sub>6</sub>.** The difference in (a) perceived value and (b) patronage intention between the low and high-price conditions will be higher with a high-brightness (vs. low-brightness) background.

### Study 1

In Study 1, we focus on exploring how background colors and price levels influence customers' patronage intentions. We use a 2 (hue: blue vs. red) × 2 (brightness: low vs. high) × 2 (price: low vs. high) between-subjects design, with the prediction that the difference in patronage intentions between a low-priced and high-priced online store will be higher when the store website's background is red (vs. blue) or bright (vs. dark).

#### *Pretests and Stimuli*

For the experiment, we developed a website for a fictional online retail store that sells casual clothing selected according to the following criteria: (1) the products have a wide price range, such that the categories contain both low- and high-priced products, (2) the products are associated with multiple marketplace cues that consumers can use for product evaluation even without known brand names, and (3) the products often appear in online stores and are used by both men and women.

Using procedures similar to those of Lichtenstein and Bearden (1989), we conducted a pretest with a group of 36 graduate students. We provided the students with low and high prices that they perceived as realistic for items listed on the

experimental website. The pretest website had a gray background to avoid color effects. The average high price was \$NT770 (about \$25USD) and the low price was \$NT290 (about \$9USD). Another 50 students checked for any significant discrepancies between the two price levels, with the following item: “The price of the clothes in the online store is (1: very cheap, 7: very expensive)” ( $M_{\text{low price}} = 3.11$ , standard deviation (SD) = 1.25 vs.  $M_{\text{high price}} = 5.26$ , SD = 1.28;  $F(1, 48) = 35.73$ ;  $p < .001$ ).

Next, we designed the background colors for the same prototype website using the hue, saturation, and brightness (HSB) model that has been widely used by web designers (Gorn et al. 2004). This model measures hue on a color wheel ranging from 0 to 360° (red: 0 and 360; blue: 240). Saturation ranges from 0% (gray) to 100% (fully saturated), and brightness ranges from 0% (black) to 100% (white). For this study, we used blue 240 or red 0, 58% for low-brightness and 100% for high-brightness, and 100% saturation, suitable because these levels were sufficient to manipulate viewers’ responses (Gorn et al. 2004) (see Appendix A). A total of 80 students, whom we randomly assigned to one of the four web page design conditions (hue [blue vs. red] × brightness [high vs. low]), indicated the brightness of the background: “The screen color is (1: extremely bright; 9: extremely dark).” The main effect of brightness was significant, and the means were in the expected directions ( $M_{\text{bright}} = 2.34$ , SD = 1.15 vs.  $M_{\text{dark}} = 6.41$ , SD = 1.45;  $F(1, 76) = 187.96$ ,  $p < .001$ ). Moreover, the main effect of hue and the interaction of hue and brightness were not significant ( $F(1, 76) = .02$  and  $.39$ ).

### Subjects and Design

Consumers often do their online shopping on their own computers, so we examined online shoppers’ behavioral intentions by inviting participants to log in to the experimental web pages from their own computers and asking them to add all items they would like to buy to their shopping carts. In this way, we approximated real shopping behavior.

To ensure that participants had sufficient Internet experience and were familiar with online shopping processes, we posted invitations to our experiment on online forums related to online shopping issues (Penz and Hogg 2011). Without mentioning the precise purpose of the study, we told participants that a foreign e-retailer was conducting research to assess the commercial potential of local markets and assured them they would have a chance to win clothing from the online store in a sweepstake after finishing the questionnaire (Senecal and Nantel 2004). The invitation also included the details of the tasks participants needed to complete. Participants clicked the hyperlink and were randomly assigned to one of eight experimental conditions. This study required participants to go through the shopping procedure up to, but not including, the payment stage (Chen and Dibb 2010). They checked the products and prices on the website and added all items they would like to buy to their shopping carts, then clicked through to the questionnaire page to answer questions about the online store’s design and price levels, for purposes of manipulation

checks and demographics. They recalled the background hue used in the online store and answered two 7-item questions about background brightness of the online store (1: “extremely bright,” 7: “extremely dark”) and price level (1: “extremely expensive,” 7: “extremely cheap”). They had the option to supply their email addresses for the sweepstakes.

After removing participants who did not complete the tasks or who misrecalled the background hue, the final sample consisted of 130 women (59%) and 90 men (41%); 18% were under 19 years old, 36% were between 20 and 29 years, 39% were between ages 30 to 39 years, and 7% were older than 40 years. According to the Taiwan Market Intelligence Center (2012), Taiwanese online shoppers tend to be female and range in age from 25 to 39 years. The sample was therefore consistent with the study context (for a summary of means, standard deviations, and cell sizes, see Appendix B).

### Analysis and Results

#### Manipulation Checks

A full factorial ANOVA on the brightness check item revealed only a main effect for brightness in the expected direction ( $M_{\text{bright}} = 3.12$ , SD = 1.11 vs.  $M_{\text{dark}} = 4.86$ , SD = 1.35;  $F(1, 212) = 106.10$ ;  $p < .001$ ). A similar analysis of the price manipulation check revealed a significant main effect for product price in the expected direction ( $M_{\text{high price}} = 3.02$ , SD = 1.29 vs.  $M_{\text{low price}} = 4.69$ , SD = 1.34;  $F(1, 212) = 88.55$ ;  $p < .001$ ), and a price × hue interaction ( $F(1, 212) = 4.37$ ;  $p < .05$ ).

#### Hypotheses Testing

An ANCOVA model tested the influence of background hue, brightness, and price on the number of clothing items placed in shopping carts. The impact of color on price perception may vary with gender (Puccinelli et al. 2013), so we used gender as a covariate in the analyses. It revealed a significant main effect of price ( $M_{\text{low price}} = 2.20$ , SD = 1.21 vs.  $M_{\text{high price}} = 1.42$ , SD = 1.19,  $F(1, 211) = 23.61$ ,  $p < .001$ ). The influence of price on patronage intention was moderated by the hue and brightness of the websites: hue × price interaction ( $F(1, 211) = 19.56$ ,  $p < .001$ ) and brightness × price interaction ( $F(1, 211) = 5.63$ ,  $p < .05$ ), but the hue × brightness × price three-way interaction was not significant ( $F(1, 211) < 1$ ). There was no significant gender main effect on patronage intentions ( $F(1, 211) = .33$ ).

As Table 2 shows, follow-up contrasts revealed that patronage intentions decreased significantly from the low- to the high-price conditions when the background was red ( $M = 2.42$  vs.  $.95$ ;  $F(1, 211) = 41.47$ ,  $p < .001$ ) rather than blue ( $M = 2.00$  vs.  $1.92$ ;  $F(1, 211) = .10$ ,  $p > .05$ ), in support of  $H_{3b}$ . In addition, the high-brightness background ( $M = 2.35$  vs.  $1.21$ ;  $F(1, 211) = 27.80$ ,  $p < .001$ ) made the patronage intention decrease significantly between the low- and high-price conditions rather than the low-brightness background ( $M = 2.06$  vs.  $1.65$ ;  $F(1, 211) = 2.91$ ,  $p > .05$ ), in support of  $H_{6b}$ . The influences of background color and price on patronage intention are in Fig. 1.

Table 2  
Means, standard deviations, and interactive effects for color × price interactions.

		Low price	High price	F (1, 211)
Patronage intention	Blue	2.00 (.94)	1.92 (1.32)	.10
	Red	2.42 (1.45)	.95 (.80)	41.47***
	Low-brightness	2.06 (1.04)	1.65 (.92)	2.91
	High-brightness	2.35 (1.33)	1.21 (1.37)	27.80***

Note: Standard deviation is shown in parentheses.

\*\*\*  $p < .001$ .

### Study 2

In Study 2, we reexamine the influence of color and price on patronage intention. Study 2 differs from Study 1 in three aspects. First, we analyze perceived quality, perceived monetary sacrifice, and perceived value as mediators. Second, in Study 1, we allowed participants to log in to the experimental web pages from their own computers. Although this procedure simulated a real shopping environment, the differing settings of personal computers raise questions about whether the experimental web page demonstrates accurate colors. For Study 2, we therefore conduct a lab experiment, using carefully calibrated computers and more control of the experimental environment. Third, in Study 2, we take another approach to measure patronage intentions. In Study 1, we asked participants to use their own computers to add items they would like to buy to their shopping carts. By calculating the amounts in shopping carts, we were able to understand more accurately participants’ real buying intentions; however, we were not able to estimate participants’ future intentions. In Study 2, we not only recruit respondents to a computer laboratory with carefully calibrated computer screens; we also intend to know patronage intentions including their future intentions, we therefore adopt another approach to measure patronage intentions by self-administered questions.

### Subjects and Design

In this study, we again used a 2 (hue: blue vs. red) × 2 (brightness: low vs. high) × 2 (price: low vs. high) between-subjects design. To control the appearance of the websites, a computer laboratory with carefully calibrated computer screens

and room lighting was used to collect data. A total of 240 undergraduate and graduate students in northern Taiwan participated in the experiment. The similarities among these participants helped control for occupational and social class factors. We informed participants that we were conducting a market survey for an online casual clothing store that was seeking to learn more about its potential market in a test marketing phase; we told them they would have a chance to win gift certificates in a sweepstakes after completing the questionnaire. We randomly assigned participants to one of eight experimental websites. They clicked a hyperlink to the questionnaire after they had browsed the websites. To eliminate any possible order effect, we counterbalanced the order of the perceived quality, perceived monetary sacrifice, perceived value, and patronage intention measures; manipulation checks appeared at the end of the questionnaire.

After eliminating the responses of those who were color blind and those who misrecalled the background hue (12.5%), our final sample consisted of 117 women (51%) and 111 men (49%). All participants had experience with online shopping.

### Measures

The dependent variables were patronage intentions, perceived value, perceived quality, and perceived monetary sacrifice. The items pertaining to patronage intentions included four 7-point scale statements: “The likelihood that I would shop in this store is very high,” “I would be willing to buy merchandise at this store,” “I would be willing to recommend this store to my friends,” and “In the future, my shopping at this store will be possible” (“1: strongly disagree, 7: strongly agree;”  $\alpha = .80$ ) (Baker et al. 2002; Wakefield and Baker 1998). The measure of perceived value added the items, “The price offered to consumers is fair,” “The offers are of good value,” and “Overall, I think the items are worth the money” ( $\alpha = .83$ ) (Baker et al. 2002). The items for perceived quality indicated, “The workmanship of the products would be (1: very low, 7: very high)” and “The products should be of (1: poor quality, 7: good quality)” ( $\alpha = .88$ ). For perceived monetary sacrifice, we used, “The price is (1: very low, 7: very high)” and “The products are expensive (1: strongly disagree, 7: strongly agree)” ( $\alpha = .90$ ) (Bomemann and Homburg 2011). After responding to the statements, participants completed

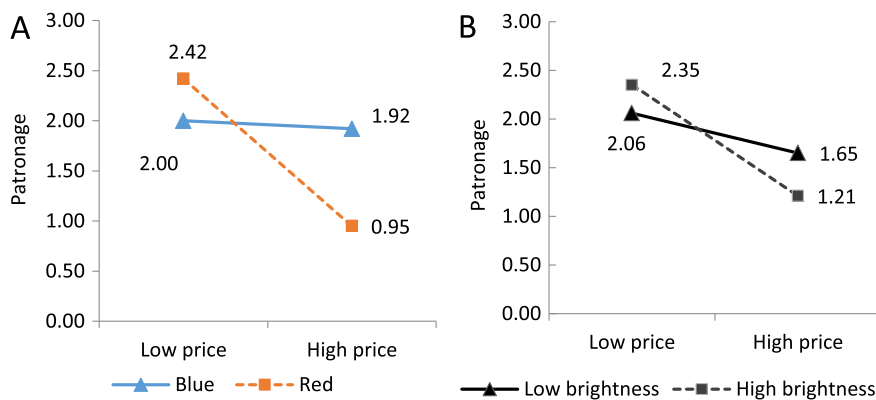


Fig. 1. Interaction effects of color × price on purchase quantity.

manipulation check items by recalling the background hue, answering a question about the brightness (“1: extremely bright, 7: extremely dark”) of the background, and completing a test for color blindness.

Because we measured the dependent variable and mediators using self-reports, common method bias could have been a threat. To limit the likelihood that common method variance (CMV) affected the relationships among the constructs of interest, we took the steps proposed by Podsakoff et al. (2003) and Malhotra, Schaller, and Patil (2017). First, we incorporated some procedural remedies. We pretested the measurement items for clarity. To avoid the social desirability effect, we assured participants on the introduction page that their responses were anonymous and that there were no right or wrong answers in the experiments. In addition, to create some separation, we showed the items of various constructs on different web pages. Second, we employed the marker variable technique proposed by Lindell and Whitney (2001). We used overall attitudes toward the participants’ schools—theoretically unrelated to the focal constructs—to serve as the marker variable. We partialled out the lowest correlation between the marker variable and the focal variable (patronage intention,  $r = .07$ ) from the initial correlations among focal variables. None of the previously significant correlations lost significance after the CMV correction. Therefore, common method bias is unlikely to be a concern in this study.

To test construct validity, we conducted a confirmatory factor analysis; the fit statistics ( $\chi^2 = 55.25$ , d.f. = 38, CFI = .99; NFI = .98, AGFI = .93, RMSEA = .045) corresponded reasonably well. In addition, the loadings on the factors were significant ( $p < .05$ ), and the average variances extracted (AVE) were .64, .59, .65 and .66, respectively. The chi-square difference test indicated that the largest correlation between perceived value and patronage intentions was significantly different from unity ( $\Delta\chi^2 = 171.89 > \Delta\chi^2_{(.05,1)} = 3.84$ ), thereby indicating reasonable convergent and discriminant validity.

## Analysis and Results

### Manipulation Checks

A full-factorial ANOVA on the brightness check item indicated significant variation in the expected direction ( $M_{\text{bright}} = 3.17$ ,  $SD = 1.05$  vs.  $M_{\text{dark}} = 4.97$ ,  $SD = 1.21$ ;  $F(1, 220) = 142.32$ ;  $p < .001$ ); no other significant effects emerged. We used the perceived sacrifice items as a manipulation check for price levels, and the result showed significant variation in the expected direction ( $M_{\text{low price}} = 3.60$ ,  $SD = 1.25$  vs.  $M_{\text{high price}} = 4.27$ ,  $SD = 1.25$ ,  $F(1, 220) = 18.10$ ,  $p < .001$ ). The main effects of hue ( $F(1, 220) = 9.87$ ,  $p < .01$ ) and brightness ( $F(1, 220) = 5.86$ ,  $p < .05$ ) and the price  $\times$  hue interaction ( $F(1, 220) = 8.83$ ,  $p < .001$ ) were also significant.

### Effects of Background Colors and Price on Perceived Quality

As Table 3 shows, a full-factorial ANCOVA model related to the influence of background hues, brightness, and price on perceived quality with gender as a covariate revealed significant main effects of hue, brightness, and price, as well as interactions of hue  $\times$  price, brightness  $\times$  price, hue  $\times$  brightness, and hue  $\times$

brightness  $\times$  price. Analyses of contrasts showed that the difference in perceived quality between the low-price and high-price levels was more pronounced when the online store had a blue background ( $M = 3.86$ , vs. 4.99;  $F(1, 219) = 22.33$ ,  $p < .001$ ) than a red background ( $M = 3.32$  vs. 3.71;  $F(1, 219) = 3.13$ ,  $p > .05$ ) (see Table 4 and Fig. 2A), in support of  $H_1$ . In addition, the difference was more pronounced when the online store had a dark background ( $M = 3.82$  vs. 5.11;  $F(1, 219) = 28.14$ ,  $p < .001$ ) than a bright background ( $M = 3.36$  vs. 3.64;  $F(1, 219) = 1.35$ ,  $p > .05$ ) (see Table 4 and Fig. 2B), in support of  $H_4$ .

The results also revealed a three-way hue  $\times$  brightness  $\times$  price interaction on perceived quality. Simple effects by hue showed that the price  $\times$  brightness interaction was not significant for the blue-hue condition ( $F(1, 110) = .31$ ,  $p > .05$ ) but was significant for the red-hue condition ( $F(1, 108) = 14.47$ ,  $p < .01$ ). Further analysis showed that participants in the blue-hue condition perceived higher quality when the price was high (vs. low), regardless of whether the background brightness was low or high (dark:  $F(1, 219) = 14.14$ ,  $p < .001$ ; bright:  $F(1, 219) = 8.67$ ,  $p < .01$ ) (see Appendix B and Fig. 3A). Analysis of the red-hue condition showed that the difference in perceived quality between the high and low price levels was significant when the website’s background was dark ( $F(1, 219) = 14.04$ ,  $p < .001$ ), but the perceived quality stayed at similarly low levels when the background was bright color ( $F(1, 219) = 1.97$ ,  $p > .05$ ) (see Appendix B and Fig. 3B).

### Effects of Background Colors and Price on Perceived Monetary Sacrifice

The results for perceived monetary sacrifice revealed significant main effects of hue, brightness, and price, as well as the hue  $\times$  price interaction (see Table 3). The contrasts showed that the perceived monetary sacrifice was significantly lower in the low-price (vs. high-price) condition when the store website had a red background ( $M = 3.62$  vs. 4.77;  $F(1, 219) = 25.68$ ,  $p < .001$ ), but this difference was not significant when it had a blue background ( $M = 3.57$  vs. 3.79;  $F(1, 219) = .72$ ) (see Table 4 and Fig. 4A), thereby supporting  $H_2$ . However, in contrast with our expectation in  $H_5$ , the effects of price  $\times$  brightness ( $F(1, 219) = .02$ ) were not significant. Perceived monetary sacrifice was positively influenced by price level in both low-brightness and high-brightness conditions ( $F(1, 219) = 8.53$  and 9.06,  $ps < .01$ ) (see Table 4 and Fig. 4B).

### Effects of Background Colors and Price on Perceived Value

The results for perceived value revealed significant main effects of hue, brightness, and price, as well as significant hue  $\times$  price and brightness  $\times$  price, and hue  $\times$  brightness  $\times$  price interactions (see Table 3). The contrasts showed that when the website’s background was blue, perceived value was not significantly different between the low- and high-price conditions ( $M = 4.64$  vs. 4.67;  $F(1, 219) = .06$ ). However, when the background was red, perceived value decreased significantly ( $M = 5.03$  vs. 3.34;  $F(1, 219) = 58.79$ ,  $p < .001$ ) (see Table 4 and Fig. 5A), in line with  $H_{3a}$ . In addition, when the background brightness was low, the difference of perceived value between the

Table 3  
ANOVA results for perceived quality, monetary sacrifice, value, and patronage intention.

	Perceived quality		Monetary sacrifice		Perceived value		Patronage intention	
	F	Significance	F	Significance	F	Significance	F	Significance
<i>Main effects</i>								
Hue	25.54	.00	8.94	.00	8.16	.00	10.36	.00
Brightness	29.86	.00	5.44	.02	16.11	.00	14.62	.00
Price	21.00	.00	17.57	.00	31.55	.00	19.35	.00
Gender	.19	.67	1.85	.18	.01	.94	1.35	.25
<i>Two-way interactions</i>								
Hue × Price	4.29	.04	9.02	.00	27.78	.00	11.91	.00
Brightness × Price	8.70	.00	.02	.96	11.27	.00	3.80	.05
Hue × Brightness	6.90	.01	.37	.54	.23	.63	.25	.62
<i>Three-way interaction</i>								
Hue × Brightness × Price	5.26	.02	.05	.83	6.98	.01	3.22	.07

price levels was less profound ( $M = 4.89$  vs.  $4.61$ ;  $F(1, 219) = 2.54$ ,  $p > .05$ ) than when the background brightness was high ( $M = 4.81$  vs.  $3.41$ ;  $F(1, 219) = 40.60$ ,  $p < .001$ ) (see Table 4 and Fig. 5B), supporting  $H_{6a}$ .

Furthermore, the simple effects analysis of the three-way price × hue × brightness interaction on perceived value showed that the price × brightness interaction was significant for the blue-hue condition ( $F(1, 110) = 21.57$ ,  $p < .001$ ) but not for the red-hue condition, ( $F(1, 108) = .21$ ,  $p > .1$ ). For the blue-hue condition, perceived value was positively influenced by price level when the background brightness was low ( $F(1, 219) = 8.43$ ,  $p < .01$ ) (see Appendix B) but negatively influenced by price level when background brightness was high ( $F(1, 219) = 9.70$ ,  $p < .01$ ). However, the analysis of the red-hue condition showed that perceived value was negatively influenced by price level for both low- and high-brightness conditions ( $F(1, 219) = 24.16$  and  $35.59$ ,  $ps < .001$ ) (see Appendix B).

Table 4  
Means, standard deviations, and interactive effects for color × price interactions.

		Low price	High price	F(1, 219)
Perceived quality	Blue	3.86 (1.38)	4.99 (1.26)	22.33 ***
	Red	3.32 (1.37)	3.71 (1.62)	3.13
	Low brightness	3.82 (1.49)	5.11 (1.10)	28.14 ***
	High brightness	3.36 (1.27)	3.64 (1.64)	1.35
Monetary sacrifice	Blue	3.57 (1.08)	3.79 (1.11)	.72
	Red	3.62 (1.41)	4.77 (1.20)	25.68 ***
	Low brightness	3.41 (1.23)	4.05 (1.31)	8.53 **
	High brightness	3.79 (1.25)	4.48 (1.16)	9.06 **
Perceived value	Blue	4.64 (1.23)	4.67 (1.15)	.06
	Red	5.03 (1.33)	3.34 (1.27)	58.79 ***
	Low brightness	4.89 (1.32)	4.61 (1.46)	2.54
	High brightness	4.81 (1.20)	3.41 (1.06)	40.60 ***
Patronage intention	Blue	4.42 (1.06)	4.29 (1.13)	.46
	Red	4.41 (1.04)	3.36 (.98)	30.57 ***
	Low brightness	4.54 (1.09)	4.25 (1.14)	2.98
	High brightness	4.29 (.99)	3.42 (1.02)	20.33 ***

Note: Standard deviation is shown in parentheses.

\*\*\*  $p < .001$ .

\*\*  $p < .01$ .

#### Effects of Perceived Value on Patronage Intention

For patronage intention, we find significant main effects of hue, brightness, and price, as well as a significant hue × price interaction. Moreover, the brightness × price and three-way hue × brightness × price interactions were significant at  $p < .1$  (see Table 3). As Table 4 and Fig. 6A show, price level did not exert a significant influence on patronage intention when the background hue was blue ( $M = 4.42$  vs.  $4.29$ ;  $F(1, 219) = .46$ ); however, when the background hue was red, price level negatively influenced patronage intention ( $M = 4.41$  vs.  $3.36$ ;  $F(1, 219) = 30.57$ ,  $p < .001$ ), in support of  $H_{3b}$ . The difference in patronage intentions between price levels was less profound when the background brightness was low ( $M = 4.54$  vs.  $4.25$ ;  $F(1, 219) = 2.98$ ,  $p > .05$ ) rather than high ( $M = 4.29$  vs.  $3.42$ ;  $F(1, 219) = 20.33$ ,  $p < .001$ ) (see Table 4 and Fig. 6B), supporting  $H_{5b}$ .

The price × hue × brightness three-way interaction on patronage intentions was significant at  $p < .1$ . The price × brightness interaction was significant for the blue-hue condition ( $F(1, 110) = 6.77$ ,  $p < .05$ ) but not significant for the red-hue condition, ( $F(1, 108) = .01$ ,  $p > .1$ ). For the blue-hue condition, patronage intention was not influenced by price level when background brightness was low ( $F(1, 219) = 2.06$ ,  $p > .05$ ), but it was negatively influenced by price level when background brightness was high ( $F(1, 219) = 5.31$ ,  $p < .05$ ) (see Appendix B and Fig. 7A). The analysis of the red-hue condition showed that patronage intention was negatively influenced by price level for both low- and high-brightness conditions ( $F(1, 219) = 13.83$  and  $16.94$ ,  $ps < .001$ ) (see Appendix B and Fig. 7B).

#### Mediating Effects of Perceived Quality and Sacrifice

A regression indicated significant positive effects of perceived value on patronage ( $\beta = .51$ ;  $t = 10.55$ ,  $p < .001$ ). To understand how price level affects patronage intention through quality, sacrifice, and value perceptions, we tested the serial mediation models using the PROCESS macro for SPSS (bootstrapping method with 5,000 resamples) (Hayes 2013). When the background was blue, price level positively influenced patronage intentions via quality and value perceptions (indirect effect =  $.18$ , 95% confidence interval [CI] =  $[.0512, .4359]$ ) rather than monetary sacrifice and value perceptions (indirect effect =  $-.00$ ,



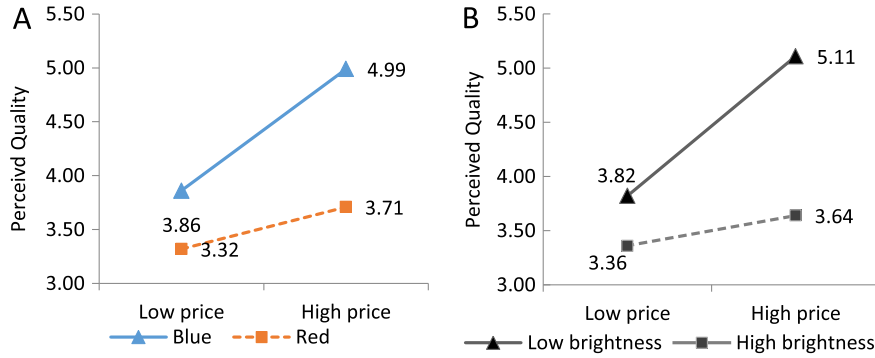


Fig. 2. Interaction effects of color × price on perceived quality.

95% CI = [-.0685, .0641]). Conversely, when the background was red, price level negatively influenced patronage intention through monetary sacrifice and value perceptions (indirect effect = -.21, 95% CI = [-.4399, -.0737]) rather than through quality and value perceptions (indirect effect = .01, 95% CI = [-.0026, .0643]). With regard to brightness, when the background brightness was high, price level negatively influenced patronage intentions via monetary sacrifice and value perceptions (indirect effect = -.19, 95% CI = [-.4255, -.0363]) rather than quality and value perceptions (indirect effect = .01, 95% CI = [-.0057, .0578]). When the background brightness was low, the two opposite forces of price significantly and simultaneously affected value perceptions: Price level significantly influenced patronage intentions through both quality and value perceptions (indirect effect = .15, 95% CI = [.0564, .3509]) and monetary sacrifice and value perceptions (indirect effect = -.05, 95% CI = [-.1787, -.0011]).

**Discussion of Study 2**

Consumers regard price simultaneously as the monetary sacrifice for purchasing a product and as a signal of quality (Dodds, Monroe, and Grewal 1991). To understand whether consumers respond positively or negatively to prices in various shopping environments, it is crucial to explicitly differentiate the components of perceived value, perceived quality, and perceived sacrifice (Völckner 2008). In Study 2, we examined

the underlying process by which price and color affect perceived value, through perceived quality and sacrifice, by focusing on the impacts of price–quality relative to price–sacrifice when the background color varies.

When we investigated the influence of price on perceived quality, we found that—consistent with our expectations—participants in the blue (vs. red) background condition perceived higher quality, and the difference in perceived quality between blue and red was even greater when the price level increased. Moreover, the positive price–quality association was significant no matter whether the background was dark blue or bright blue. For the red condition, however, the positive price–quality association was significant only when the background was dark red, not when it was bright red.

With regard to the influence of price on perceived monetary sacrifice, we found that consistent with our expectations—participants in the red (vs. blue) condition responded more profoundly to price changes. However, in contrast with our prediction about monetary sacrifices, participants were not influenced by the price level in the low-brightness (upscale store image) condition; perceived monetary sacrifice increased significantly with price level in both low- and high-brightness conditions. This result may be attributed to the low cost of an Internet search. Online consumers are sensitive to price even at the higher end of the market. For example, some retailers in upscale markets have modified their price structures and included low-price segments to attract price-sensitive customers (Fritz and

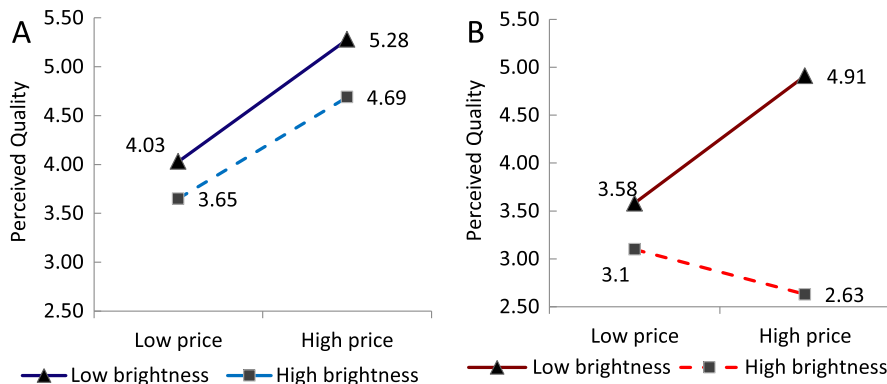


Fig. 3. Interaction effects of hue × brightness × price on perceived quality.

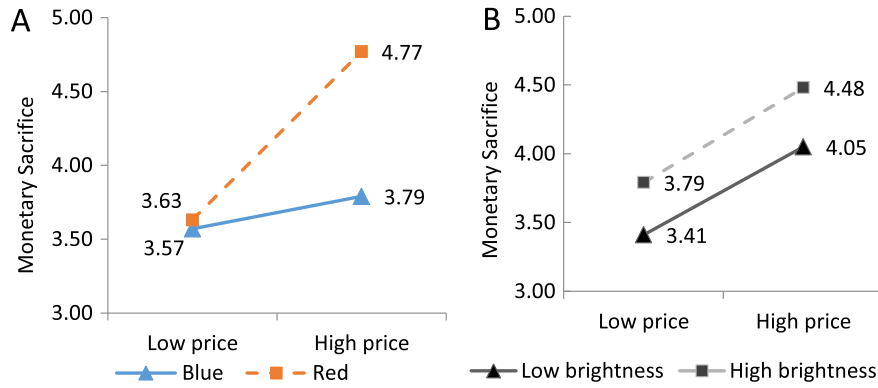


Fig. 4. Interaction effects of color × price on perceived sacrifice.

Gülow 2013; Rao, Bergen, and Davis 2000). Therefore, dark colors do not mitigate the influence of price on perceived sacrifice.

Overall, price increases from low to high, a blue or dark background keeps participants’ perceived value and patronage intention at similar levels. For red or bright backgrounds, however, higher prices lead to lower perceived value and patronage intentions because the influence of price on perceived monetary sacrifice is more pronounced than the influence of price on perceived quality.

### General Discussion and Implications

Our studies focus on how online buyers use price and atmospheric color to form judgments about the values of offers and make purchase decisions. Many online consumers cite low price as their dominant motivation for purchasing online; consumers who patronize stores with low prices often report higher behavior intentions than those who patronize stores with high prices (Forman, Ghose, and Goldfarb 2009). The results of our first study reveal that e-retailers can use appropriate website background colors to alleviate the negative relationship between price and patronage; when price varies, consumers’ patronage intentions are more stable when designers use blue or dark (i.e., low-brightness) backgrounds. In contrast, when online stores are designed with red or bright (i.e., high-brightness) backgrounds, price level may significantly influence patronage. These findings

suggest that blue hues and low brightness are harmless background-color dimensions, but e-retailers who use red hues or bright backgrounds should be careful when pricing their products.

Our second study reveals that quality, monetary sacrifice, and value perceptions mediate the influence of color and price on patronage intentions. People exhibit different patronage intentions because they perceive different values from products when the background colors of online stores vary. By comparing perceived quality and sacrifice, we find that participants in blue-hue conditions perceive higher value than those in red-hue conditions if prices are high because they likely focus on the positive role of price as an indicator of quality, not on the negative role of price as an outlay of economic resources. However, when the background color of a website is red, people are more likely to focus on the role of price as a sacrifice, and their perceived value is negatively influenced by price levels. These results reveal that website background hues influence consumers’ interpretations of price information.

Our study also complements color research by revealing how the brightness of color influences human behavior. Although brightness as a color dimension has received little prior research attention, our results show that price influences consumers’ quality and sacrifice perceptions differently, depending on the background brightness of online stores. Low brightness heightens consumers’ price–quality and price–sacrifice associations simultaneously;

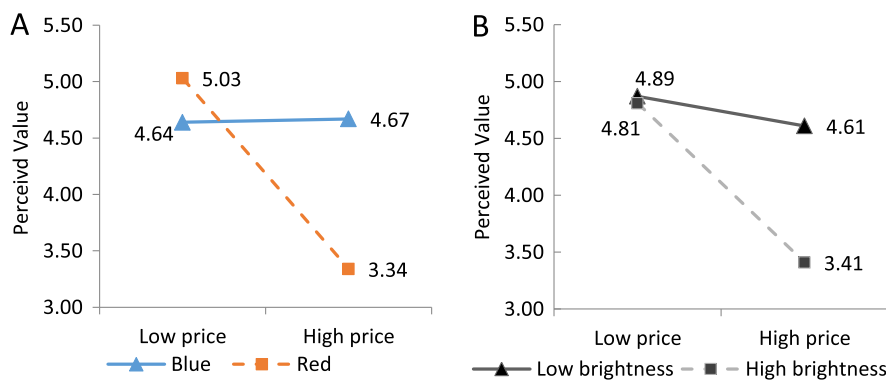


Fig. 5. Interaction effects of color × price on perceived value.

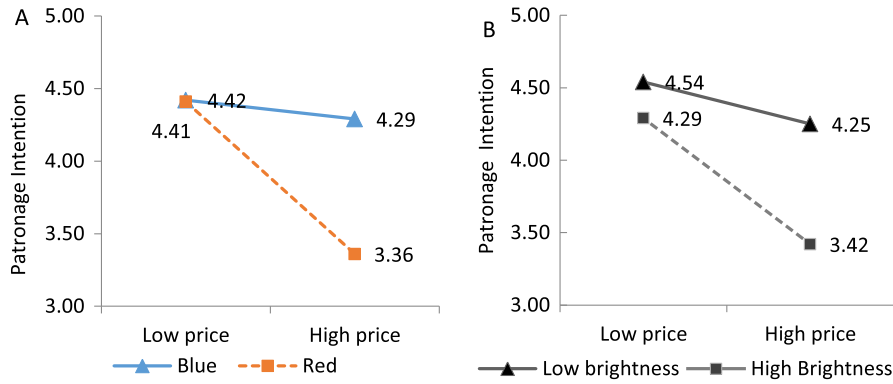


Fig. 6. Interaction effects of color × price on patronage intention.

high brightness increases their price–sacrifice associations but not their price–quality associations. As a result, perceived value declines more profoundly when prices increase at bright (vs. dark) store websites. These results help clarify how color brightness works.

*Managerial Implications*

The findings also provide managerial insights. First, consumers use available marketing cues, such as price level and atmospherics, to form judgments about perceived value and to establish their patronage intentions. Because online users easily can rely on software agents to compare prices across different retailers, price now plays a more important role in consumer shopping decisions. However, marketers can use context cues to alleviate the influence of price (Sevilla and Townsend 2016). According to our findings, website background colors—which are easy to change—can be effective context cues. Our results also reveal that background hues and levels of brightness are more influential when product prices are high rather than low. Thus, e-marketers should design their backgrounds carefully, especially if they sell high-priced products.

Second, though consumers are implicitly mindful of perceived quality and sacrifice, the more salient these perceptions, the more they affect value perceptions and purchases (Monroe 2012). Our study suggests that depending on their strategies, e-retailers can use blue or dark backgrounds to lead buyers to place more weight

on the quality inferences that high prices convey, or they can use red or bright backgrounds to lead buyers to place relatively more weight on the saving perceptions that low prices convey. The results resonate with a recent study by Deval et al. (2013), who found that when participants were reminded of quality, they evaluated a focal wine more favorably when it was described as high-priced (vs. low-priced); however, when they were reminded of the value of money, they rated the focal wine more favorably when it was offered at a low (vs. high) price. Therefore, businesses need to develop atmospherics that align with their positioning—an issue that marketing research does not examine sufficiently with regard to online stores. Sites for upscale brands appear to exemplify this approach though: Both Montblanc and Cartier (<http://www.cartier.com>) adopt low brightness in their background colors. If e-tailers adopt high-brightness backgrounds, they should price their products at lower levels to elicit greater perceived value and higher intention, as The Gap and Giordano (<http://www.giordano.com/hk>) have done. Price and store image can augment brand effects when they are presented consistently to consumers (Dodds, Monroe, and Grewal 1991).

Third, we examine the effect of contradicting cues. High store image (dark background) and low price did not produce significantly higher value perception and patronage intention because low price contradicts positive store image. This finding is consistent with the results of our first study, which indicates that negative cues exert higher influence among conflicting quality cues (Miyazaki, Grewal, and Goodstein 2005). Recent

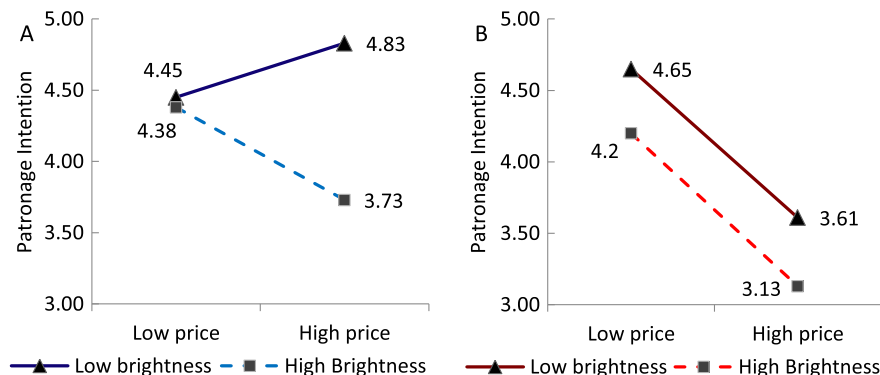


Fig. 7. Interaction effects of hue × brightness × price on patronage intention.

price–quality research shows that a combination of high quality and low price produces patronage intention at levels similar to high-quality-only and low-price-only appeals (Shirai 2015). Therefore, e-tailers should position themselves clearly in either upscale or discount markets, rather than seek a high-image–low-price positioning.

*Limitations and Future Directions*

We acknowledge several limitations of this study. First, both our experiments employed a casual clothing e-retailing context and therefore can be generalized to other merchandise (e.g., durables, groceries) or service categories only with great care. Second, we acknowledge the issue of external validity, or the extent to which these results generalize outside the Taiwanese

consumer segments that this research includes. For example, Chebat and Morin (2007) find different effects of decor schemes across consumer subculture segments. Although the patterns of the patronage intentions variables in Studies 1 and 2 were slightly different, H1–H6 generally received support in both studies. Further research should extend this study to different cultures and contexts. Third, additional research could address other website elements (e.g., music, graphics) in combination with background color, because consumers react to environments holistically (Baker et al. 2002). An appropriate combination of music and colors may produce more positive reactions (Keller 2010). Fourth, research should examine how the characteristics of different types of consumers moderate these relationships. For example, sensation seekers are more sensitive to environmental stimuli.

**Appendix A. Experimental Web Page (Blue Hue (H = 240), Low Brightness (B = 58%), High Saturation (S = 100%), Low Price)**



**Appendix B. Means, Standard Deviations, Cell Sizes, and Three-way Interactions of Two Studies**

	Blue						Red					
	Dark			Bright			Dark			Bright		
	Low price	High price		Low price	High price		Low price	High price		Low price	High price	
Study1 Patronage	n = 33 1.85 (1.00)	n = 23 2.09 (.85)	F (1, 211) –	n = 34 2.15 (.86)	n = 25 1.75 (1.64)	F (1, 211) –	n = 24 2.25 (1.07)	n = 24 1.21 (1.37)	F (1, 211) –	n = 32 2.56 (1.68)	n = 25 .68 (.75)	F (1, 211) –
Study 2 Quality	n = 30 4.03 (1.56)	n = 30 5.28 (1.16)	F (1, 219) 14.14 ***	n = 26 3.65 (1.13)	n = 29 4.69 (1.31)	F (1, 219) 8.67 **	n = 26 3.58 (1.39)	n = 27 4.91 (1.02)	F (1, 219) 14.04 ***	n = 30 3.10 (1.35)	n = 30 2.63 (1.27)	F (1, 219) 1.97
Sacrifice	3.35 (1.16)	3.57 (1.16)	–	3.83 (.93)	4.02 (1.02)	–	3.48 (1.33)	4.59 (1.28)	–	3.75 (1.48)	4.93 (1.11)	–
Value	4.49 (1.19)	5.37 (1.00)	8.43 **	4.87 (1.08)	3.88 (.98)	9.70 **	5.35 (1.32)	3.77 (1.45)	24.16 ***	4.76 (1.30)	2.96 (.94)	35.59 ***
Patronage	4.45 (1.14)	4.83 (.97)	2.06	4.38 (.98)	3.73 (.97)	5.31 *	4.65 (1.04)	3.61 (.91)	13.83 ***	4.20 (1.01)	3.13 (1.01)	16.94 ***

Note: Standard deviations reported in parentheses; –: no significant three-way interaction.

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

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