The Halo Effect of Product Color Lightness on Hedonic Food Consumption

ADRIANA V. MADZHAROV, SURESH RAMANATHAN, AND LAUREN G. BLOCK

ABSTRACT The authors present evidence that light-colored hedonic foods, that is, foods generally considered to be vices and relatively unhealthy, are consumed in greater quantity than the same foods that are darker in color. Greater consumption was demonstrated for lighter-colored chocolate candies and pudding (vs. darker) across a variety of colors. This halo effect of color lightness arises for vice foods because they are consumed for the hedonic experience itself; indeed, the present results indicated that greater consumption was driven by an increased pleasurable experience in the form of a more favorable in-the-moment emotional response and higher taste evaluations. By contrast, the halo effect of color lightness was attenuated for healthy, often called virtue, foods that are consumed for more utilitarian consequences. Findings have practical implications for consumer welfare by contributing to an understanding of what may drive overconsumption of high-calorie foods and for marketers interested in encouraging responsible consumption.

Ever since the seventeenth century when the Dutch created the orange carrot in order to boost their national pride in the midst of an independence war from Spain, color in food has been used as a tool to increase positive emotions and enjoyment of food. In modern days, more and more foods are created in unconventional colors (e.g., Gatorade Blue Raspberry drink and neon orange and purple Goldfish crackers; *Food Business Review* 2010) or in colors that have little relation to flavor (e.g., the exterior color of M&Ms is independent of the chocolate flavor; Shankar et al. 2009) simply to alter the hedonic experience of consumption. Advances in food coloring technology have made it possible for food companies to use color in innovative ways in order to differentiate their products, add variety to their assortments, and ultimately bring more pleasure and excitement to the food experience (e.g., blue- and purple-colored bacon [Black 2010] or Burger King's all black, white, and red burgers [Nuga 2014; Wohl 2016]). Despite a dramatic increase in the variations and shades of colors and the corresponding increase in consumers' interest in such products (Judkis 2016; Wohl 2016), scant attention has been paid to the topic of food color as a hedonic cue in food consumption beyond flavor perceptions (Labrecque, Patrick, and Milne 2013).

In the present research we explore the effect of color lightness, defined as the degree of darkness or lightness of the color relative to a neutral scale that extends from pure black to pure white (also called "value"; Gorn et al. 1997), on consumption of hedonic foods. Color lightness is the third main property of color, along with hue (the color pigment, e.g., blue, red) and saturation (the degree of pigment, e.g., dull vs. rich red; Gorn et al. 1997). While much of the consumer behavior research on color has looked at the effects of specific hues or hue categories (e.g., red vs. blue [Bagchi and Cheema 2013] or warm vs. cool colors [Gorn et al. 2004]), the other two important properties of color, lightness and saturation, have all but been neglected (Labrecque et al. 2013). However, extant research from psychology has established that lightness and saturation can have an equally important or even greater influence on perceptions and behavior compared to color hues (Valdez and Mehrabian 1994; Labrecque et al. 2013). We specifically focus on color lightness because, across hues, color lightness has been shown to have a considerably stronger and independent effect on pleasure than saturation (Valdez and Mehrabian 1994).

Over a series of four studies, we present evidence that the color lightness of hedonic food influences the quantity

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of food consumed. We began with two experiments (studies 1A and 1B) in which we first demonstrated that people consumed more light-colored hedonic foods than dark-colored hedonic foods (e.g., M&Ms candy and pudding). In study 2, we provided preliminary evidence for the process underlying this effect by showing that light-colored hedonic food elicited more positive hedonic evaluations and as a result was consumed more than dark-colored food. However, this effect was attenuated for healthy foods. Finally, in study 3, we provided in-depth process evidence for the effect of light colors on pleasure by examining the moment-to-moment trajectories of experienced emotions during consumption of light- and dark-colored hedonic food. We demonstrated that light-colored (vs. dark-colored) hedonic foods led to more favorable emotional responses and higher hedonic evaluations, which together led to increased volume of consumption.

CONCEPTUAL FRAMEWORK

Extant research has suggested that much of consumer behavior is the result of exposure to subtle cues in the environment that activate cognitive and affective processes without awareness or intent (Bargh 2002; Sela and Shiv 2009). Specifically, research has established that visual cues in the consumer environment are particularly important in shaping perceptions and triggering behavior (for a review, see Wedel and Pieters [2012]). This is not surprising given the fact that one-third of the cortex in the brain is devoted to visual perception (Grady 1993). Visual perception is a form of sensory reasoning that provides people with the ability to interpret the world around them almost immediately (Grady 1993). Importantly, every visual stimulus processed by the human perceptual system contains color information (Elliot and Maier 2007). Research suggests that perception of lightness plays a fundamental role in visual perception and stimulus interpretation (Grady 1993; Woods and Wilcox 2006). For example, although at birth infants have poor visual acuity and color vision, their visual system can detect color lightness information (but not color hue information) that can be very helpful for identifying shapes (Woods and Wilcox 2006). In addition, studies have suggested that even for adults with fully developed visual systems, color lightness is essential for the processing of depth and movement information (independent of other properties of color, such as hue; Grady 1993). Thus, color information, and in particular color lightness, play an integral role in many aspects of stimulus interpretation.

One such aspect of stimulus interpretation is categorization, which is particularly relevant to evaluation and choice of products in a marketing context. Research suggests that any to-be-perceived object acquires its meaning from being categorized (Bruner 1957). Stimulus properties, like color, serve as cues to the membership of the objects in one or more categories (Bruner 1957). Fiske and Pavelchak (1986) proposed that the process of perceptual categorization extends to the activation of an evaluative tag such that the act of perception leads not only to automatic categorization but also to automatic retrieval of positive or negative evaluations that have been attached to the properties of the stimulus. In consumer research, perception-behavior effects through evaluative activation have been demonstrated in the context of food consumption. Specifically, the good/bad categorization of food into pre-existing natural or goal-derived categories based on marketing stimuli or product attributes is often labeled a "halo." Well-documented "health halos" include the effect of brand names and category names on evaluations of taste, healthfulness, caloric content, and satiety (Raghunathan, Naylor, and Hoyer 2006; Chandon 2013; Suher, Raghunathan, and Hoyer 2016). For example, a study by Raghunathan and colleagues demonstrated that food labeled as "unhealthy" is automatically evaluated as more "tasty" and is enjoyed more when consumed (Raghunathan et al. 2006). In the present article, we extend this line of research by identifying a new food halo, namely, the effect of color lightness as a perceptual cue that influences the consumer's emotional experience and hedonic evaluations, ultimately increasing the enjoyment and volume of food consumption.

The Positive Halo of Light Colors on Pleasurable Consumption

Numerous studies demonstrate that lighter colors carry more positive meaning and elicit more positive associations than darker colors (Valdez and Mehrabian 1994; Meier, Robinson, and Clore 2004; Meier et al. 2007). These findings are supported by the fact that very strong associations of lightness with good and darkness with bad are present in religion, ancient traditions, and popular culture (Meier et al. 2004). For example, in ancient Greek philosophy, darkness is linked to imprisonment and ignorance, and lightness to freedom and knowledge; in Christianity, Hinduism, and Buddhism, light is equated with truth and life, and dark with delusion and death (Meier et al. 2004). Numerous empirical studies confirm the lightness-valence association (i.e., light = positive, dark = negative; Meier et al. 2004; Sherman

and Clore 2009) and demonstrate that even across cultures people view light colors as good and dark colors as bad (Adams and Osgood 1973). The findings that cultures around the world associate lightness with positivity and darkness with negativity are explained with a general evolutionary predisposition of diurnal creatures, for whom daytime provides better opportunities for living and survival (Meier et al. 2007; Lakens et al. 2013).

Lightness Halo on Evaluations. Studies have shown that metaphors related to lightness are also used to form perceptual judgments and affective responses. For instance, Song and colleagues (2012) show that faces of smiling versus frowning people were judged to be lighter in color. Another study by Banerjee, Chatterjee, and Sinha (2012) shows that recalling positive (ethical) behavior led people to believe that the room had more light. More relevant to the present work are the studies that suggest that the lightness-valence metaphor can bias affective reactions to stimuli. In general, lighter colors elicit more pleasure than darker colors (Valdez and Mehrabian 1994). More recent findings demonstrate that pictures of stimuli and products are evaluated more positively when they are lighter versus darker in color (Lakens et al. 2013; Kareklas, Brunel, and Coulter 2014). In sum, the literature points to a lightness-valence response such that lighter colors generally evoke greater positivity than do darker colors. In the context of food consumption, positivity is reflected by a greater enjoyment experienced during consumption, and one source of such enjoyment and pleasure are sensory qualities of the food such as its taste (Alba and Williams 2013). Thus, based on the lightness-valence evidence presented above, we expected that light-colored foods would be evaluated more positively than dark-colored foods specifically on the hedonic dimensions of the food qualities (e.g., tasty, appetizing). In addition, positivity and pleasure during the food consumption experience could be reflected in a more positive emotional experience while eating (Ramanathan and Williams 2007). Research on color lightness and emotions (albeit limited; Valdez and Mehrabian 1994) suggests that light colors can lead to more pleasure through elicited emotional response.

Lightness Halo on Emotional Experience. Most of the research on the effects of color on emotions has focused on specific hues and discrete emotions (Gorn et al. 2004; Bagchi and Cheema 2013). Specifically, studies have examined how color as an environmental factor leads to contextual emotions, which in turn affect behavior (e.g., website background on online bidding; Bagchi and Cheema 2013). In the food domain, extant research has explored how contextual emotions elicited by factors other than the food itself affect subsequent food choice (Gardner et al. 2014). Unlike prior research, in the present article we examine how the food itself, and specifically its color lightness, affects people's emotional and evaluative response during consumption. We build on research that posits that perceptual stimuli are likely to evoke dynamic affective responses, where the appraisals can change moment by moment (Gawronski and Bodenhausen 2006; McConnell et al. 2011) as people interpret the qualities of the stimulus and try to mobilize positive affect to overcome any negative affect (Quirin, Bode, and Kuhl 2011) or to minimize the negative affect (Taylor 1991). For hedonic foods in particular, emotion trajectories are an important determinant of pleasure, as people hold simultaneous emotions of happiness and guilt. Indeed, prior research by Ramanathan and Williams (2007) has shown that the temporal dynamics or the rates of increase or decrease of positive and negative emotions are an important predictor of food choice. Specifically, people showing stable or increasing positive hedonic emotions, such as happiness, and decreasing negative emotions, such as guilt, are more likely to choose hedonic snacks over healthy ones (Ramanathan and Williams 2007). This suggests that any differences in emotion trajectories elicited by the color lightness of a food may also lead to differences in food evaluation and consumption. Thus, building on prior work suggesting color lightness leads to a more pleasurable emotional response (Valdez and Mehrabian 1994), we expected that light-colored food would elicit a more positive in-the-moment emotional response, which in turn would lead to stronger hedonic evaluations of the food, ultimately biasing consumption volume. However, as we discuss next, we expected the more pleasurable experience and increased consumption evoked by light colors to be moderated by the motivational relevance of hedonic gratification.

The Moderating Role of Motivational Relevance

The interpretation and judgment of perceptual stimuli and consequent reactions to them are contingent on motivational relevance (Eitam and Higgins 2010). We drew from two streams of research to suggest that color lightness is more motivationally relevant to the consumption of hedonic foods as compared to utilitarian foods. First, we called upon the food decision-making literature that shows that people typically categorize foods into dichotomous catego-

ries, such as "good/bad" and "vice/virtue" (Irmak, Vallen, and Robinson 2011). Vice foods, or those that are generally considered unhealthy, are consumed for hedonic rewards (e.g., taste; Raghunathan et al. 2006). Specifically, hedonic gratification is derived from the product's innate affective and sensory attributes; the hedonic experience is rewarding in and of itself, with no further goal or consequence necessary for satisfaction (Botti and McGill 2011). By contrast, healthy foods—virtues—are consumed for more utilitarian consequences, such as being better for one's diet (lower in calories) or promoting better nutritional health; utilitarian consumption is more extrinsically motivated because it is not the reward in and of itself but rather an intermediate step toward achieving a higher-end goal (see Botti and McGill [2011] for a review of hedonic and utilitarian consumption motivation). Consistent with this view, Labbe et al. (2015) show that even the same food (or beverage, i.e., coffee) is considered to be a hedonic good when satisfaction from the consumption episode is related to its multisensory experience and considered to be a utilitarian good when consumers expect a consequence after consumption (Labbe et al. 2015). In line with this literature, we suggested that the greater hedonic evaluations that light-colored foods evoke would have a stronger influence in the context of hedonic (vs. utilitarian) consumption.

In addition to this, we drew upon research on construct accessibility and applicability (Higgins and Brendl 1995) to suggest that the association between darker colors and healthy foods acts as a countervailing force that attenuates any naturally evoked lightness halo in the context of utilitarian consumption. Indeed, many dark-colored foods that appear in nature (e.g., fruits, vegetables, grains, rice and beans) are better for health than light-colored foods because of the presence of dark color pigments called anthocyanins, which are important phytonutrients and sources of antioxidants (Matlack 2013). Doctors and nutritionists often advise their patients or clients to consume dark-colored foods such as blueberries, spinach, brown rice, or whole wheat bread, while they regard light-colored foods such as white potatoes and white bread as less healthy. Thus, consumers may have learned the association that dark-colored foods are better and healthier than light-colored foods. However, we contend that these positive associations with dark colors are learned specifically in the context of healthy or natural foods but not in the context of hedonic foods, in which consumers have come to expect artificial coloring (e.g., candy, ice cream; we discuss a notable exception—dark chocolate vs. milk chocolate—in "General Discussion"). Consequently, the recently learned positive associations for dark color will be more applicable, or motivationally relevant, to the evaluation of healthy foods. Support for the relevance of learned associations acting as a countervailing force can be found in nonfood domains. For example, research using advertisements featuring Caucasian American versus African American spokespersons has shown that the strong effect of the automatic positive associations with light colors can be attenuated when other learned positive associations with the dark colors are present (Kareklas et al. 2014). This is also in line with the activation rules for chronic and temporary accessibility proposed by Higgins and Brendl (1995), whereby chronic sources of accessibility to a particular construct have an attenuated effect when an alternative construct is more applicable to the target. In a similar vein, we proposed that the positive learned association with healthy foods and dark colors would introduce a tension that could attenuate the positive halo of light colors when evaluating healthy foods.

Taken together, we expected that light-colored foods would lead to a more pleasurable experience and increased consumption when people eat hedonic foods. However, this effect would be attenuated during the consumption of healthy foods. Formally stated:

H1: Consumption of light-colored hedonic foods will be greater compared to consumption of dark-colored hedonic foods.

H2: The effect of color lightness on consumption of hedonic foods will be mediated by the pleasure evoked by the light color.

We began by testing hypothesis 1 in studies 1A and 1B, where we showed greater consumption of light-colored (vs. dark-colored) hedonic foods (M&Ms candy and pudding). In study 2, we provided preliminary evidence that evoked pleasure was the process underlying this effect by showing that light-colored hedonic food elicited more positive hedonic evaluations and as a result was consumed more than dark-colored hedonic food. However, this effect was attenuated for healthy foods consumed for utilitarian motivations. Finally, in study 3, we provided in-depth process evidence for the effect of light colors on pleasure by examining the people's emotional experience as they consume light- and dark-colored hedonic food. We demonstrated that light-colored (vs. dark-colored) hedonic foods led to a more favorable emotional experience, as well as to more

positive hedonic evaluations, which in turn led to an increased volume of consumption.

STUDY 1A

We tested our hypothesis that people would consume a greater quantity of light-colored (vs. dark-colored) hedonic foods by providing M&M candy to study participants. We began by testing our theory on two colors of M&Ms, black and white, which vary in lightness but not on the other two properties of color, namely, hue and saturation. By using the achromatic colors white and black, we controlled for hue and saturation to the greatest possible extent. In addition, we used gray as the neutral color that falls between black and white on the lightness dimension. Note that a pretest confirmed that the three M&M colors were evaluated equally on the dimensions of product knowledge, experience, and novelty (see the appendix, available online for details of the pretest and images of the M&M colors).

Method

Ninety-three undergraduate business students (ages 18–35; 50% female) from Baruch College participated in the study for course credit. Participants were told that they would be asked to evaluate M&M candy, and they completed a paper-and-pencil questionnaire. All participants were given individual transparent zip-lock bags with exactly 50 M&M candies inside and were randomly assigned to one of three conditions (product color: light = white [$n = 32$] vs. neutral = gray [$n = 32$] vs. dark = black [$n = 29$]). First, in order to control for potential individual differences, participants were instructed to rate their general liking of M&Ms, ("In general, how much do you like M&Ms?"; 1 = not at all, 7 = very much). Next, participants were given the M&Ms and were invited to eat as much as they wished while completing a filler task for 15 minutes, which gave them enough time to consume the M&Ms. Next, participants were asked to count and record how many M&Ms were left in their bags. Since snack consumption can depend on participant's hunger and dieting behavior, participants completed 7-point scales (1 = not at all, 7 = very much) on hunger ("How hungry were you at the beginning of the survey?") and dieting ("I am generally very health conscious," "I usually eat whatever I want," "I am currently dieting to lose weight," "I monitor what I eat in order to stay healthy"; Cronbach's $\alpha = .65$).

Results and Discussion

The analysis was conducted with color of the candy as the independent factor, and dieting behavior, hunger, and general liking of M&Ms as covariates. As the number of M&Ms consumed was a count variable, and since our data were overdispersed (variance greater than the mean), we used the negative binomial approach (see Coxe, West, and Aiken [2009] for a discussion of the appropriate conditions to use ANOVA, Poisson, or negative binomial regression for count measures).

Confirming our theorizing, and in support of hypothesis 1, the regression showed a main effect of color, indicating that participants consumed more from the light-colored candies than from the dark-colored or neutral-colored ones (Wald $\chi^2(2) = 6.91$, $p < .05$). Specifically, planned contrasts showed that study participants who were given the white M&Ms consumed significantly more M&Ms than participants who were given the gray M&Ms ($M_{\text{light}} = 19.40$ vs. $M_{\text{neutral}} = 11.67$; $z = 1.93$, $p = .053$) or the black M&Ms ($M_{\text{light}} = 19.40$ vs. $M_{\text{dark}} = 10.72$; $z = 2.26$, $p < .05$). Consumption was not significantly different between the dark color and the neutral color conditions ($p > .10$). However, the linear contrast was significant, suggesting that consumption progressively increased with color lightness (Wald $\chi^2(1) = 5.11$, $p < .05$). None of the covariates were significant ($p > .10$), except for liking of the M&Ms, such that people who indicated they liked M&Ms also consumed more of the candy (Wald $\chi^2(1) = 10.24$, $p = .001$). However, follow-up analysis (ANOVA) showed that reported liking of M&Ms did not differ across conditions ($M_{\text{light}} = 5.16$ vs. $M_{\text{neutral}} = 5.06$ vs. $M_{\text{dark}} = 4.90$; $F(2, 90) = .19$, $p = .83$). In addition, the effect of color on consumption remained significant (Wald $\chi^2(2) = 7.43$, $p < .05$) even when the covariates were removed from the analysis.

Study 1A provided initial evidence that product color lightness biased the volume of hedonic food consumption such that people consumed more from light-colored versus dark-colored hedonic food. The results from this study also suggested that consumption progressively increased as the color of the food got lighter (from black to gray to white). However, the results also showed that consumption of the neutral color significantly differed from the light but not from the dark color. These results could be due to the fact that the increase in color lightness was slightly disproportional between the white and the gray, and the gray and the black colors (lightness ratio from black to gray to white was 0% vs. 33% vs. 100%, hue = 320°, saturation = 0%; HSL system). Thus, the gray color was slightly darker than it should have been to reach the ideal middle level between white and black (i.e., lightness level of 50%). A different gray color of the product was not commercially available.

We addressed this limitation in the next study by examining four different degrees of color lightness that differ by an equal percentage change. In addition, we replicated the effect of increased consumption for the light-colored (vs. dark-colored) hedonic food, but this time with a different food product and by using chromatic (e.g., green color) rather than achromatic colors (such as white, gray, and black).

STUDY 1B

Method

Ninety-two undergraduate business students (97% ages 18–32; 53% female) from Baruch College participated for course credit. The study was run as a four-condition (product color: lightest [$n = 24$] vs. lighter [$n = 23$] vs. darker [$n = 21$] vs. darkest [$n = 24$]) between-subjects design. All participants were given individual 9.2-oounce transparent plastic cups with vanilla pudding and were randomly assigned to one of the four conditions. The vanilla pudding was the same in all conditions and only differed in color lightness. We used McCormick's food dye to color the pudding in four different degrees of lightness of the same color hue green, thus controlling for hue. Lightness ranged from 50% in the darkest color condition to 80% in the lightest color condition; the two conditions in the middle had lightness of 60% (darker) and 70% (lighter), respectively; that way lightness was consistently increased by the same degree (by 10%; the images are presented in the appendix). As in study 1A, a separate color test on the four green colors showed no differences on product knowledge, experience, and novelty (see the appendix for details of the color test).

The procedure for the main study was identical to the one in study 1A with two exceptions: in this study the participants filled out the survey on computers and consumption was recorded by the experimenter rather than self-reported. The weight of each participant's cup was measured before and after consumption, and the difference served as the measure of consumption in ounces.

Results and Discussion

An ANCOVA with color of the pudding as the independent factor and dieting behavior, hunger, and general liking of pudding as covariates revealed a main effect of color indicating that participants consumed more from the light-colored pudding than from the dark-colored pudding ($F(3, 85) = 2.98$, $p < .05$). Importantly, the linear contrast test was significant and revealed that consumption progressively increased with color lightness ($F(1, 85) = 8.82$, $p < .01$). Consumption in ounces, from the darkest to the lightest color condition, was $M_{\text{darkest}} = 1.74$, $M_{\text{darker}} = 2.10$, $M_{\text{lighter}} = 2.69$, and $M_{\text{lightest}} = 3.39$, respectively. Planned contrasts showed that study participants who were given the lightest color consumed twice as much pudding as did participants who were given the darkest color ($M_{\text{lightest}} = 3.39$ vs. $M_{\text{darkest}} = 1.74$; $p < .01$). Consumption was significantly different between the lightest color and the darker color conditions ($M_{\text{lightest}} = 3.39$ vs. $M_{\text{darker}} = 2.10$; $p < .05$). Contrast effects between the lightest and the lighter color condition, between the lighter and the darker color condition, between the lighter and the darkest color conditions, or between the darker and the darkest condition were not significant ($p > .10$). None of the covariates were significant ($p > .10$), except for hunger, such that people who indicated they were hungrier in the beginning also consumed more of the pudding ($F(3, 85) = 12.27$, $p < .001$). However, reported hunger, diet, or general liking of pudding did not differ across conditions ($F < 1$). After taking the covariates out of the analysis, the overall effect was marginally significant ($F(3, 88) = 2.20$, $p = .09$); however, the linear contrast was significant ($F(1, 88) = 6.50$, $p = .01$), and the planned contrast between the lightest colior and and the darkest color was also significant ($p < .05$).

The results from studies 1A and 1B demonstrated that consumption of hedonic food progressively increased as the color of food became lighter. We have thus far confirmed hypothesis 1 with two different products (M&Ms and pudding), using both achromatic and chromatic colors and incorporating several degrees of lightness.

In our next study (study 2), we replicated the effect of color lightness on hedonic food consumption with a different color hue (blue). Importantly, we tested hypothesis 2, or the premise that light-colored hedonic foods are consumed more because of the pleasure evoked by the color lightness. Specifically, pleasure from the consumption experience was measured by the hedonic evaluations of the food, and we expected that these hedonic evaluations would be more positive for light-colored versus dark-colored foods. Furthermore, we theorized earlier that pleasure during consumption and hedonic evaluations are relevant and applicable to hedonic food consumption but less so for healthy food consumption. Thus, in this study we aimed to show that the effect of color lightness would be strong for hedonic foods but that it would be attenuated for healthy foods.

STUDY 2

Method

The procedure for the main study was identical to the one in study 1B with the exception that all participants read a

description of the pudding before they started the survey. In the hedonic frame condition, it was stressed that the pudding is a delicious snack and can be eaten for an indulgent treat. In the healthy frame condition, it was stressed that the pudding is a healthy snack and can be eaten for a healthy alternative. A separate test of the frame descriptions confirmed that the pudding was evaluated as more hedonic and less healthy in the hedonic frame condition than in the healthy frame condition (details on this test are presented in the appendix).

After reading the description, participants completed a filler task, which gave them enough time to consume the pudding. Next, participants evaluated the pudding's hedonic qualities ("Please evaluate the pudding on the following . . ."; two 7-point bipolar scales: tasteless/tasty, unappetizing/appetizing). The two items were combined into a composite measure of hedonic evaluations ($r = .65$, $p = .000$). Consistent with prior studies on food consumption (Irmak et al. 2011; Belei et al. 2012), we administered the food evaluation questions after participants had spent some time consuming the food; that way we minimized the chance that evaluations might impact volume of consumption.

Results and Discussion

An ANOVA was conducted with product color and product type frame as between-subjects factors. Results again confirm hypothesis 1, such that study participants who were given the light color consumed significantly more pudding than did participants who were given the dark color ($M_{light} = 2.93$ vs. $M_{dark} = 1.89$; $F(1, 90) = 5.61$, $p < .05$). Importantly, results support our theorizing: the analysis revealed a significant interaction effect of product color and product type frame on consumption ($F(1, 90) = 5.86$, $p < .05$; see fig. 1). As theorized, study participants who read the hedonic description of the pudding consumed more of it in the light color condition than those in the dark color condition ($M_{light} = 3.39$ vs. $M_{dark} = 1.35$; $p < .001$). Consumption by study participants in the healthy frame condition did not differ significantly in the light color and the dark color conditions ($M_{light} = 2.44$ vs. $M_{dark} = 2.46$; $p > .10$). The difference in consumption in the dark color condition between healthy and hedonic frame participants was marginally significant ($M_{healthy} = 2.46$ vs. $M_{hedonic} = 1.35$; $p = .08$). No other effects were significant.

We performed another ANOVA to examine the effect of product color and product type frame on hedonic evaluations. The analysis revealed a significant interaction effect ($F(1, 90) = 3.94$, $p = .05$), such that study participants who read the hedonic description of the pudding evaluated the pudding as more hedonic in the light color condition than those in the dark color condition ($M_{light} = 5.06$ vs. $M_{dark} = 4.15$; $p < .05$). Hedonic evaluations by study participants in the healthy frame condition did not differ significantly in the light color and the dark color conditions ($M_{light} = 4.31$ vs. $M_{dark} = 4.59$; $p > .10$). No other effects were significant.

Next, we tested whether these hedonic evaluations were driving the effect of product color and product type frame on consumption. We conducted a test for moderated mediation (5,000 bootstrap sample procedure, model 8; Hayes 2013) with product color as an independent variable (light = 0, dark = 1), product type frame as a moderator (healthy = 0, hedonic = 1), and hedonic evaluation as a mediator. The results showed that in the hedonic frame condition, the indirect effect of hedonic evaluations on consumption had a 95% CI of −1.44 to −.06 with an estimate of −.65. However,

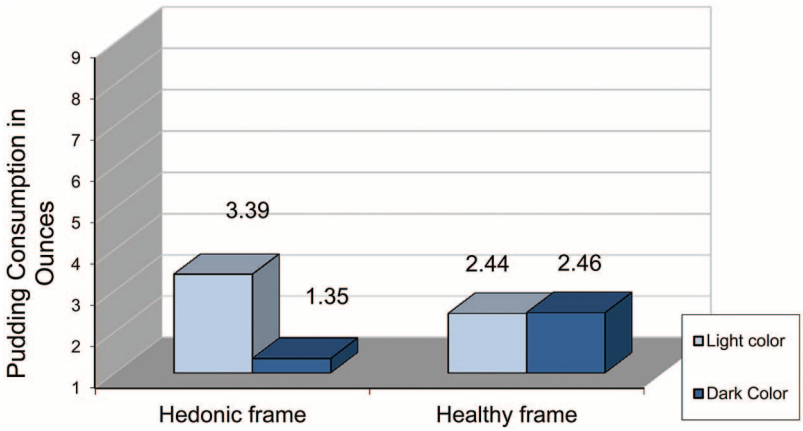

Figure 1. Study 2: Effect of color lightness and product type frame on consumption.

in the healthy frame condition, the indirect effect of hedonic evaluations on consumption had a 95% CI of −.38 to .84 with an estimate of .20. These results indicated that hedonic evaluations mediated the effect of product color on consumption in the hedonic frame condition but that hedonic evaluations did not mediate the effect of product color on consumption in the healthy frame condition.

In study 2 we once again confirmed that people consume more from light-colored than dark-colored hedonic food, this time using a different color hue. Importantly, the results showed that this increase in consumption for light-colored foods was mediated by the more positive hedonic evaluations of the light-colored food relative to the dark-colored food. In addition, consistent with our theorizing, these effects held true only when the product was described as hedonic and not as healthy. In order to further support our theorizing, we performed a follow-up study where the food was an objectively healthy product, yogurt. We used plain yogurt dyed in two different shades of red hue (light and dark; see appendix for details on this study). The results showed that the yogurt was not consumed differently whether it was in light or dark color. Therefore, with this additional study and study 2, we provided additional evidence that color lightness leads to a more pleasurable consumption experience and increased volume of consumption for hedonic foods but not for healthy foods.

Our next study (study 3) was designed to provide a more thorough examination of the underlying affective processes guiding the hedonic evaluations and consumption observed in studies 1A, 1B, and 2. We used a modified version of the Evaluative Space Grid (ESG; Larsen et al. 2009) to examine the differences in emotions evoked by the color lightness during hedonic food consumption. An important goal of this study was to capture the effect of color lightness on momentary felt emotions by examining how emotions evolve while participants consume the food and how these affective reactions translate into explicit evaluations of the food's taste—a main source of pleasure and enjoyment for hedonic food consumption.

STUDY 3

Method

One hundred and forty-nine undergraduate business students from Baruch College participated in a study that was run as a two-condition (product color: light vs. dark) between-subjects design. All participants were first seated in front of individual computers and were administered an emotion response task using a customized computer version of the ESG (Larsen et al. 2009). Participants first worked on a practice task, where they were shown the grid along with a picture and were asked to indicate how positive/negative they felt toward what was shown in the picture by moving the mouse cursor within the grid. Participants repeated this procedure four times, where, in a random order, they were shown pictures of items that elicit neutral (a pencil), positive (a $20 dollar bill), negative (hemorrhoidal medicine), and mixed (a Hummer automobile) emotions (Ramanathan and Hofmann 2015). Each picture was presented on the screen for 30 seconds, during which time participants were asked to move the mouse continuously within the grid. This dynamic measure of feelings enabled us to collect fine-grained data about the changes in emotions and their trajectories. The grid measured the intensity of positive emotions toward the product in the picture at the very instant (1 = none at all, 10 = a lot) along the *x*-axis and the intensity of negative emotions felt at the very instant on the same scale along the *y*-axis. The program transformed these measures into a continuous score between 0 and 300. Each picture was presented on the screen for 30 seconds. Mouse movements were sampled every 100 milliseconds, thus yielding *x*- and *y*-coordinate information over 300 time points. These practice rounds were used to calibrate the emotion grid for each individual. One participant failed to follow instructions on the use of the grid and was excluded from further analysis. Details of the calibration are presented in the appendix.

Following this practice task, all participants were given individual zip-lock bags with exactly 50 M&M candies inside and were randomly assigned to one of two color conditions: white or black. All participants were invited to "take one or more M&Ms out of the bag and taste it." Immediately after that, the emotion grid appeared on the screen, where participants were asked to continue tasting the M&Ms and to evaluate how much negative/positive emotions they felt towards the M&Ms. Participants were invited to eat as many M&Ms as they liked while they completed some filler questions for 15 minutes. Next, we measured the hedonic evaluations of the M&Ms with the items: appetizing, delicious, satisfying, and indulgent ("Please, evaluate the M&Ms on the following"; 7-point scales, 1 = not at all, 7 = very; Cronbach's $\alpha = .88$). Participants answered questions on general liking of M&Ms and hunger (same as in study 1A) and color preferences ("How much do you like the color black/white?; 7-point scales, 1 = not at all, 7 = very much). Finally, participants counted how many M&Ms were left in their bags. After some time, while completing

an unrelated survey, participants filled out the retrained eating subscale of the Dutch Eating Behavior Questionnaire (DEBQ; Van Strien et al. 1986). The Restraint Eating Scale assesses people's restraint eating behavior (ten-item, 5-point scale; 1 = never; 5 = very often); example items are: "Do you watch exactly what you eat?" "How often in the evening do you try not to eat because you are watching your weight?" Reliability for the scale using Cronbach's alpha was .92.

Results

Effects of Color on Consumption and Hedonic Evaluations. As in study 1A, we used the negative binomial approach for this count measure. Results were consistent with our previous studies: controlling for general liking, hunger, diet status, and color preferences, participants in the light color condition consumed more M&Ms than participants in the dark color condition ($M_{light} = 20.28$ vs. $M_{dark} = 16.16$; Wald $\chi^2 = 3.65$, $p = .056$). The measures of diet and color preferences were not significant as dependent measures or as covariates in the analysis; therefore, they were excluded from the above analysis. Hunger was a significant covariate ($b = .09$, Wald $\chi^2 = 10.93$, $p < .001$).

Consistent with study 2, a one-way ANOVA on hedonic evaluations (appetizing, delicious, satisfying, and indulgent) showed a significant effect of color such that light-colored M&M's were rated as more hedonic compared to dark-colored ones ($M_{light} = 4.88$ vs. $M_{dark} = 4.39$; $F(1, 147) = 3.86$, $p = .051$).

Effects of Color on Emotional Experience. We computed a moving average of participants' emotions using a window of 45 time points and a shift of 30 time points across windows. That is, each moving average score consisted of the average of 45 data points and each window overlapped the other to the extent of 15 data points. This overlap was necessary to ensure smoothness of the moving averages. This yielded 10 moving averages per emotion per individual. Our interest was in the temporal trajectories of these emotions across product color condition, specifically to examine whether light colors resulted in a more pleasurable emotional experience.

Using a methodology developed by Muthén and Muthén (2000), we first estimated a growth model to derive parameter estimates for the intercept and slope for positive and negative emotions. The analysis revealed that light- and dark-colored M&Ms did not differ in the initial levels of positive emotions ($M_{dark} = 214.13$, $M_{light} = 216.55$, $t < 1$), or in those of negative emotions ($M_{dark} = 69.41$, $M_{light} = 56.24$, $t(141) = 1.36$, $p = .171$). Importantly, however, the temporal emotional trajectory indicates that over time there was a significantly more pleasurable emotional experience for the light-colored M&Ms compared to dark colored ones ($b = 1.90$, $t(141) = 2.02$, $p = .042$). As discussed next, the emotional trajectories (i.e., slopes for positive and negative emotions) were used to test the mediational role of evoked pleasure as specified by hypothesis 2.

Pleasure Evoked by the Light Color Mediates Consumption. In order to test whether differences in consumption of light versus dark-colored M&Ms were mediated by the evoked pleasure of eating as indicated by the emotion trajectories and hedonic evaluations, we fitted a structural equation model to the data. The intercepts and slopes for positive and negative emotions were treated as proximal mediators, which then predicted hedonic evaluations (distal mediator), which in turn predicted consumption. Results showed that the only significant pathway for the entire causal chain featured the slope for positive emotions. That is, light colored (relative to dark colored) foods evoked faster increases in positive emotions ($b = 1.90$, $t(141) = 2.02$, $p = .042$), which in turn caused more positive hedonic evaluations ($b = .055$, $t(141) = 3.06$, $p = .002$), and finally led to greater consumption of the M&Ms ($b = .22$, $t(141) = 4.81$, $p < .001$). The indirect effect for the entire path was marginally significant ($b = .02$, $t(141) = 1.85$, $p = .067$). None of the other indirect effects were significant, $p > .500$. Figure 2 shows the path model.

In summary, these results provided evidence for our hypothesis 2 that product color lightness contributed to a more pleasurable consumption experience. Specifically, color lightness affected the immediate emotional experience and the food's hedonic evaluations, which in turn influenced the amount consumed.

GENERAL DISCUSSION

Four studies provided converging evidence that the color lightness of food served as an evaluative cue that led to a more pleasurable consumption experience and increased consumption. Across various products and color hues, we showed that people consumed more light-colored versus dark-colored foods. In addition, by applying various degrees of lightness, we demonstrated that the color lightness effect on consumption increased progressively as the color of the food got lighter (studies 1A and 1B). Our findings supported our theorizing that evoked pleasure during the consumption episode, as evidenced by more positive hedonic

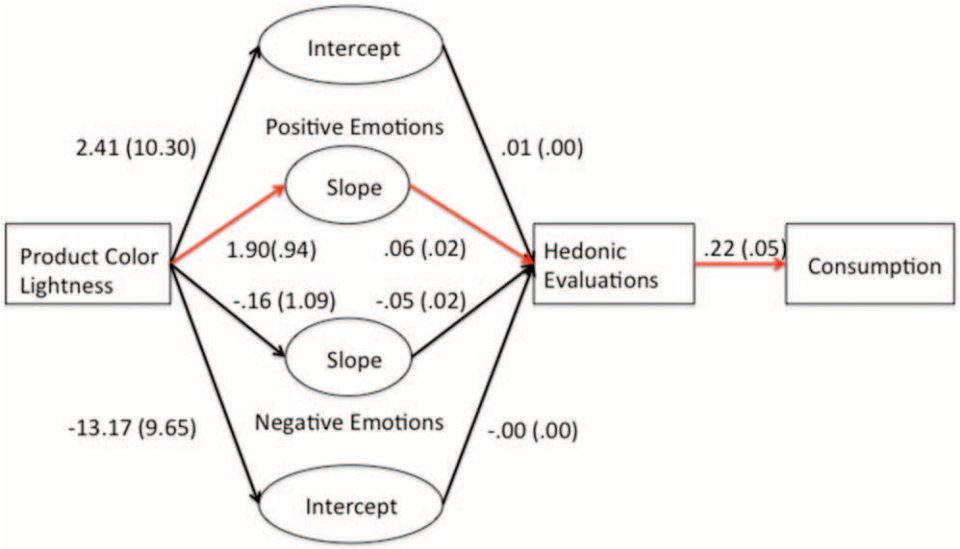

Figure 2. Study 3: Path model of the effect of color lightness on consumption via emotions and hedonic evaluations. Note: Paths in red were significant at $p < .05$.

evaluations of the food, mediated consumption volume (study 2). In addition, results supported our theorizing that this effect was obtained for hedonic food consumption (i.e., when the motivation for consumption is pleasure) but was attenuated when food was consumed for utilitarian motivations, such as was the case with healthy foods (study 2). Further, in study 3 we demonstrated that color lightness contributed to a more favorable emotional response, which then resulted in more positive hedonic evaluations of the lightcolored (vs. dark-colored) food and that in turn increased the volume of light colored food consumption.

Together, these results make several important contributions to the literatures on the processing of colors and affective processing. Our findings add to the understanding of how color functions as a perceptual cue, implicating evaluative processes as a route to influencing behavior. Previous studies on color have largely focused on specific hues. For example, Elliot et al. (2007) showed that the evaluative responses evoked by certain colors could influence approach or avoidance behavior; the color red was associated with threat and activated avoidance motivations, impairing intellectual performance relative to green and gray colors. The associations with red as an avoidance color and green as an approach color is pertinent to the food domain, notably the "traffic light labels" used for nutrition labeling. This front-of-pack labeling format, mimicking the red-stop and green-go perceptual color cues in a traffic light, provides a clear evaluative signal to consumers that the red products are the most unhealthy and the green the healthiest. Consequently, this traffic light nutrition labeling is preferred by most European consumer associations (Grunert, Bolton, and Raats 2011). Our results extend this literature on color signaling by demonstrating that it is not only specific color hues but also the more general lightness of a color that carries evaluative signals that lead to either approach- or avoidance-related consumption behavior. Our findings also add to the literature on affective processing. In particular, lighter-colored hedonic foods lead to a more favorable in-the-moment emotional response. This emotional response is particularly interesting because it shows that people not only metaphorically encode light and dark colors as positive or negative, respectively, as suggested by Meier, Robinson, and Clore (2004), but also transfer this encoding to their conscious and dynamic emotional experience.

Our studies also contribute, both theoretically and practically, to the understanding of what drives food consumption quantity. Overconsumption is one factor that has led to extremely high obesity levels, and the obesity crisis is a global issue with numerous health and cost implications (Chandon and Wansink 2011). In an effort to help understand why obesity, and correspondingly consumption quantity, has increased over the last few decades, many consumer researchers are studying the subtle and often unconscious influencers of consumption. Indeed, there is an extensive literature accumulating on these drivers of food consumption (see Chandon and Wansink [2011] for a review). Only a handful of studies, though, have focused on the effect of color on food quantity consumption. For example, Van Ittersum

and Wansink (2012) manipulated the color contrast between the dinnerware and that of its background to show that the corresponding visual perceptual biases influence the amount of food people served themselves. The current research is the first to demonstrate that the color lightness—within one color hue—of the food itself is a driver of consumption quantity. This has implications for practical food marketing. Recently, there is a dramatic increase in the variations and shades of colors of products, including in colors of food products (Labrecque et al. 2013). Color is used by food marketers as a positioning strategy (e.g., bright blues and reds in children's yogurt), a reinvigorating or gimmick strategy (e.g., Heinz EZ Squirt Ketchup in colors as green, purple, and teal), and of course as a communication strategy (e.g., Crystal Pepsi). Our findings suggest that color can achieve more than the increased sales that food introductions in unusual colors generate. Lighter food color during hedonic consumption can communicate to consumers the product's hedonic benefits and contribute to a more pleasurable consumption experience overall. When candy manufacturers offer seasonal or holiday-themed color variations, for example, pastel-colored (which are also lighter) M&Ms during the Easter season, consumer hedonic experiences might rise along with sales. In the current research, participants were offered only a one- colored product. However, consumers can often purchase hedonic foods in a variety of colors within one pack. M&Ms even offers two shades within one color hue, pink, for their seasonal breast cancer awareness packages. One can speculate that the lighter shade of pink mixed with the darker in one package will increase consumption compared to a pack with only darker pink candies. Analogous support for this might be found in the work by Chernev and Gal (2010), who demonstrate an averaging bias in the food domain, such that adding a virtue to a vice actually increases the perceived healthiness (lower calories) of the vice. Might an analogous averaging of the virtues of light-colored food with the vices of dark-colored foods likewise result in a systematic bias in the resulting hedonic experience? Empirical work that explores this speculation and potential theoretical extension is warranted.

Likewise, there is a need for empirical work to explore the effect of color on consumption and hedonic experiences when the color implies a change in other attributes, such as flavor. Although not reported in this article, the current authors have preliminary evidence that suggests that the consumption results found in this research are replicated even in that context. For example, in a study with Mini Oreo cookies that differed on color lightness (Golden vs. Original), when participants were given a bag with 15 mini Oreos, those who got the Golden Oreos (light colored, vanilla flavored) consumed, on average, seven cookies versus four cookies for those who were given the original Oreos (dark colored, chocolate flavored), despite initial taste evaluations that indicated that participants thought the original Oreos taste better (authors can be contacted for details of the study). While we call for more empirical work to confirm this, these results, together with the findings of the current study, suggest that the creative application of coloring to consumer hedonic foods might simultaneously increase profits and waistlines.

We recognize that within the hedonic foods category, there is one notable exception to our argument on the positivity of light colors: dark chocolate, for which consumers have a strong, recently learned association that dark chocolate is healthier than milk chocolate. We ran an additional study in which we manipulated color lightness within milk and dark chocolate [lightness (lighter/darker) $\times$ type of chocolate (milk/dark) between subjects design] and measured perceived taste and health of the chocolate. The results supported a light = good halo on taste: milk chocolate was evaluated as tastier than dark chocolate. The results also supported the presence of a learned association: dark chocolate was evaluated as healthier than milk chocolate. Interestingly, there was no main effect of lightness, nor an interaction effect of lightness by type of chocolate on health or taste ratings, supporting our learned association account and its applicability for products with health benefits. In other words, it was not the darker shade of brown within chocolate type (for which there are no learned associations), but rather the type of chocolate (for which there is a learned association) that drove evaluations. These findings are particularly interesting and relevant in the context of consumers' constructed preferences. Our results suggest that the halo effect of color lightness is strongest for hedonic products for which consumers have no prior specific associations with color lightness.

Finally, the herein-documented halo effect of color lightness has important implications from a consumer welfare perspective. An understanding of the potential to overeat light-colored hedonic foods (relative to dark) might help consumers curb some unnecessary calories. Recent food trends attest to the creative and bold use of the color spectrum, with such creations as neon-rainbow-colored bagels, tie-dyed waffles, and cakes in the spectrum of the rainbow hitting the shelves (Judkis 2016). It seems as if bold and novel color combinations are grabbing consumers, perhaps

to the detriment of their weight and consumption goals. One of the most intriguing implications of our findings is that color lightness, which is but one property of color, can singularly drive consumption quantity. It is possible that the other two main properties of color, hue and saturation, can in isolation or in combination with each other or with lightness also systematically bias consumption quantity. Future research should extend the present inquiry to explore the full extent of the influence of color properties and patterns on hedonic food consumption. Such an understanding might one day provide guidance to consumers seeking to maintain or reduce their weight by alerting them to the potential perceptual biases engendered by color while encouraging responsible consumption of colored hedonic foods in smaller portions so as to maintain pleasure.

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