Monochrome Forests and Colorful Trees:

The Effect of Black-and-White versus Color Imagery on Construal Level

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Research suggests that whereas black-and-white (bw) imagery enhances perception of essential form, color imagery enhances perception of specific detail. Drawing from construal level theory, the present research extends this work by proposing and demonstrating that the focus on form (vs. detail) prompted by bw (vs. color) imagery promotes a tendency to construe or represent the depicted objects in an abstract, high-level (vs. concrete, low-level) manner. Three experiments examine the impact of bw versus color imagery on construal level, as assessed by action identification (Experiment1), sensitivity to essential vs. superficial features (Experiment 2), and behavior segmentation (Experiment 3). Two additional experiments explore the consequences of this basic effect on product feature evaluation (Experiment 4) and product choice (Experiment 5). We discuss how this work advances construal level theory and visual perception research, and explore practical implications for marketing.

Color has become mainstream in all forms of media in the 21st century, making it rare to observe any content presented in black and white format. Yet, media producers can choose to present visual material in either format, leading marketing and advertising researchers to ask which might be better for various marketing communications (e.g., television and magazine advertising, package design). Research generally suggests that color leads consumers to judge ad content as more attractive, interesting, exciting, and powerful (Bohle and Garcia 1986; Click and Stempel 1976; Schindler 1986), attracts viewers' attention (Gronhaug, Kvitastein and Gronmo 1991; Hornik 1980; Lohse 1997), and promotes favorable attitudes (Berdie 1992; Fernandez and Rosen 2000; Meyers-Levy and Perrachio 1995; Pallak 1983; Percy and Rossiter 1983). Extensive work also suggests that people remember color images more accurately or for longer time than black-and-white (bw) images (Gardner and Cohen 1964; Homa and Viera 1988; Suzuki and Takahashi 1997; VanderMeer 1954; Wichmann, Sharpe, and Gegenfurtner 2002). Findings like this may explain why color tends to be more common than bw imagery in most media advertisements.

Whereas past work has focused on which form of imagery, bw vs. color, promotes greater attention, memory, favorable attitudes, etc., the present work adopts a different perspective. That is, we focus on the impact of bw vs. color imagery on how people process information, and how this change in information processing influences feature evaluation and choice. We propose that bw vs. color imagery directs attention to different types of information and product attributes, which in turn systematically affects preferences. One implication of our approach is that there may be conditions under which bw (vs. color) imagery can lead to more favorable consumer responses.

Drawing from construal level theory (CLT; Liberman and Trope 2008; Liberman, Trope, and Stephan 2007; Trope and Liberman 2010; Trope, Liberman, and Wakslak 2007), we propose the novel hypothesis that whereas bw imagery promotes high-level construal, color imagery promotes low-level construal. We first present the theoretical argument as to why bw (vs. color) imagery should be associated with high-level (vs. low-level) construal. We then empirically test this hypothesis by assessing research participants' construal level following exposure to bw vs. color imagery (Experiments 1-3). We then examine the consequences of bw vs. color imagery on feature evaluation and choice in consumer behavior contexts (Experiments 4-5). We end the paper with a discussion of how this work contributes to our understanding of color perception, construal, and practices in marketing.

THEORETICAL BACKGROUND

Construal Level Theory

CLT provides a theoretical framework for understanding how people consider objects and events that are removed from direct experience, i.e., those that are psychologically distant. Psychological distance is ego-centric and anchored in the one's experience of "me" in the "here-and-now." Objects and events that are farther (vs. nearer) to this reference point are psychologically distant (vs. proximal). For example, an event that is to occur a year from now is psychologically distant relative to one that is to occur tomorrow. Beyond temporal distance, research has identified physical space (here vs. there), social distance (me vs. you, us vs. them), and hypotheticality (likely vs. unlikely, real vs. imagined) as dimensions of psychological distance.

When events are directly experienced (i.e., are psychologically proximal), people can use their perceptual systems to construct rich and detailed representations of events. When events extend beyond the scope of direct perception, however, people must instead engage in construal, constructing representations from the knowledge they have. Detailed specifics about distant events, however, are often unavailable and subject to change. In response to this challenge, CLT proposes that people engage in high-level construal – constructing representations that focus on the abstract, essential, and defining features of an event. As events become proximal, people engage in low-level construal – incorporating the incidental details that become increasingly available and reliable to create more concrete and idiosyncratic representations of specific events. This is a functional response to the epistemic challenges of psychological distance because the essential and most defining features of events are less likely to change across different contexts (e.g., here versus there; now versus later) whereas concrete and incidental details are more variable and dependent on the particular situation.

An extensive literature supports the assertion that people engage in high-level (vs. low-level) construal when thinking about psychologically distant (vs. proximal) events (Liberman and Trope 2008; Liberman et al. 2007; Trope and Liberman 2010; Trope et al. 2007). For example, people are more likely to identify behaviors in terms of the abstract ends they achieve ("why" one does something), rather than the concrete means by which to achieve them ("how" one does something) when they are situated in the distant rather than near future (Liberman and Trope 1998). Similar findings have been reported with manipulations of other distance dimensions, including space (Fujita, Henderson, Eng, Trope, and Liberman 2006), social distance (Smith and Trope 2006), and hypotheticality (Wakslak, Trope, Liberman, and Alony 2006). People are also more likely to organize and segment behavior associated with

psychologically distant vs. near events into larger, broader units, suggesting more abstract rather than concrete processing (Henderson, Fujita, Trope, and Liberman 2006; Wakslak et al. 2006).

More importantly, research suggests that distance-dependent construal systematically impacts evaluation, judgment, and choice. For example, research suggests that the focus on "why" (vs. "how") that high-level (vs. low-level) construal promotes leads people to weight desirability (vs. feasibility) considerations in consumer choice (Fujita, Eyal, Chaiken, Trope, and Liberman 2008; Liberman and Trope 1998; Sagristano, Trope, and Liberman 2002; Todorov, Goren, and Trope 2007). The focus on abstract and essential properties that high-level construal promotes also leads people to prefer decision options that maximize the primary and central aspects of a choice rather than the secondary and superficial features (Eyal, Sagristano, Trope, Liberman, and Chaiken 2009; Fujita et al. 2008; Fujita, Trope, Liberman, and Levin-Sagi 2006; Torelli and Kaikati 2009; Trope and Liberman 2000). In one study, for example, Trope and Liberman (2000) asked participants to select a radio for listening to music in the near vs. distant future. One radio had excellent sound (primary feature) but a mediocre clock display (secondary feature), whereas the alternative had mediocre sound but an excellent clock. Those selecting a radio for purchase in the distant future were more likely to pick the radio with superior primary (rather than secondary) features – i.e., the radio with excellent sound but poor clock display. Research also suggests that people are more likely to make behavioral intentions and act in line with their abstract goals, principles, and values (vs. what is situational pragmatic) when engaged in high-level (vs. low-level) construal (Eyal et al. 2009; Fujita et al. 2006; Fujita et al. 2008; Kivetz and Tyler 2007; Torelli and Kaikati 2009). Thus, extensive work highlights the central role of construal level in consumer judgment and decision making.

Black-and-White versus Color Imagery and Construal Level

One reason to expect that perception of bw vs. color imagery might be related to construal level stems from people's tendency to associate bw vs. color media with the distant vs. near past, respectively. Given that color in pictures and video is a more recent technological development, people may view color imagery as something temporally proximal and bw imagery as something temporally distant. CLT would suggest that the temporal distance (vs. proximity) of bw (vs. color) imagery in turn should evoke high-level (vs. low-level) construal.

We propose, however, that the relationship between the perception of bw vs. color imagery and high-level vs. low-level construal may be more fundamental than a mere association with temporal distance. Consider, for example, people's direct experience of their environments. The human eye is unusually advanced in its perception of color. The three cones within the human eye (which perceive red, green, and blue, respectively) work together to allow perception of the entire rainbow spectrum (Gegenfurtner and Sharpe 2001; Kaplan, Lee, and Shapley 1990; Stockman and Sharpe 1999). Thus, people's direct experience of their environments, at least with respect to vision, is in color. By extension, the experience of bw imagery is psychologically removed, reflecting an experience that deviates from the colorful experience of "me" in the "here-and-now." Extending beyond temporal distance, then, the perception of bw (vs. color) imagery may reflect a more general psychologically distant experience, which CLT suggests should therefore promote high-level (vs. low-level) construal.

Beyond psychological distance, there are other reasons why bw imagery might be associated with high-level construal, and color imagery with low-level construal. Specifically, we argue that the cognitive operations entailed in the perception of bw vs. color imagery are highly similar to those entailed in high-level vs. low-level construal, respectively, and this

overlap may lead them to become associated with one another. Research suggests that relative to color imagery, bw imagery directs people's attention to global shape and form. With bw imagery, limited surface information, such as hue and texture, reduces the contrast between various image components, rendering smaller details less salient and distinctive (Davidoff 1991; Itti and Koch 2001; Janiszewski 1998). Despite the absence of color, however, bw images clearly depict contour and boundary information, which highlight form and shape (Arnheim 1957, 1974; Nojima 2003). For example, in a bw image of a chair, the wood color and texture of the chair may not be noticeable, but the shape of the chair is still easily perceived. By contrast, vivid colors accentuate different hues and textures, drawing attention to specific detail (Brockmann 1991; Dooley and Harkin 1970; Katzman and Nyenhuis 1972). This attention to detail when presented with color imagery is evident even when those details are not relevant to essential information of imagery. Thus, whereas bw imagery directs attention to global form and shape, color directs attention to constituent detail.

There are at least two ways in which the focus on form (vs. detail) prompted by bw imagery is akin to high-level (vs. low-level) construal. First, form is generally more resistant to environmental variation relative to color (Arnheim 1974; Nojima 2003). Perception of color is sensitive to changes in the angle from which a viewer perceives them as well as by the brightness of the environment. Shape and form, by contrast, are less affected by such situational variation. Thus, the focus on context-specifics associated with color detail in visual perception parallels the contextual sensitivity associated with low-level construal in mental distance travel. Similarly, the focus on context-independent constants associated with form parallels the sensitivity to essential invariances associated with high-level construal.

Second, form more so than color detail provides information about the essential nature of depicted objects (Arnheim 1974). Perception research indicates that people use the global shapes of objects to identify and understand their meaning and functions (Arnheim 1974; Biederman 1987; Biederman and Ju 1988; Lowe 1984; Mapelli and Behrmann 1997). Although there may be times in which color can be critical for identification – such as when the color of a tomato (green vs. red) signals its palatability (less edible vs. more edible, respectively) – generally speaking, color relative to form is less informative about the essential nature of objects and is treated as redundant or unnecessary information (Brockmann 1991; Dooley and Harkins 1970; Rossiter 1982). To illustrate, consider a chair as an example. Changes in the global form of a chair can alter its perceived essential functions (e.g., removing the back of a chair may make it appear to be a small table) whereas changes in color detail rarely do (e.g., a chair is still a chair whether it is brown or black). That changes in shape impacts meaning to a greater degree than changes in color suggests that shape represents an essential feature highlighted by high-level construal, whereas color represents a secondary feature highlighted by low-level construal.

The Present Research

Present research is designed to test the hypothesis that bw vs. color imagery promotes high-level vs. low-level construal, respectively. Preliminary support for this hypothesis comes from prior research examining the impact of bw vs. color on learning and memory. For example, Katzman and Nyenhuis (1972) found that people were more likely to recall story-irrelevant information when scenes from a comic book were presented in color rather than bw. Similarly, Dooley and Harkins (1970) presented bw vs. color bar charts to participants, and found that those exposed to color charts spent more time looking at irrelevant graphic stimuli. Although this past

work provides some initial support for our hypothesis, they were not designed to test the construal level framework specifically and did not explore this research question systematically. The present research is designed to extend this past work and not only demonstrate the effect of bw vs. color imagery on construal level, but to examine also implications for consumer behavior. In the first three experiments, we examine the impact of bw vs. color imagery on construal level, assessing the latter by action identification (Experiment 1), sensitivity to essential vs. superficial features (Experiment 2), and behavior segmentation (Experiment 3). Experiments 4 and 5 then explore the implications of this relationship between imagery and construal by examining the impact of bw vs. color imagery on evaluations of essential vs. superficial product features (Experiment 4) and product choice (Experiment 5).

EXPERIMENT 1: ACTION IDENTIFICATION

Experiment 1 investigates our proposition that bw (vs. color) imagery evokes high-level (vs. low-level) construal. We presented participants with bw vs. color pictures and asked them to describe the behaviors depicted in the picture using one sentence. We predicted that those presented with bw relative to color pictures would be more likely to identify behaviors in terms of the abstract, superordinate ends they achieve ("why" one does something), rather than the concrete, subordinate means by which to achieve them ("how" one does something). Past research indicates that whereas identifying actions in terms of abstract ends suggests high-level construal, identifying actions in terms of concrete means suggests low-level construal (Liberman and Trope 1998; Vallacher and Wegner 1987).

Method

Experiment 1 implemented a one-factor (bw vs. color) between-subjects design. We recruited 181 undergraduate students from an introductory marketing class, who participated in this computer-based study in exchange for course credit. We presented participants with two pictures: 1) a boy reading a book and 2) a woman painting a room (see Figure 1). Critically, we manipulated whether the picture was presented in bw vs. color, and randomized participants to one of these two conditions. The computer program presented each target picture sequentially, and asked participants to describe the behaviors depicted in one sentence. Our main interest was whether participants identified the action depicted in terms of its abstract ends (high-level construal) or concrete means (low-level construal).

Insert figure 1 about here

Results and Discussion

Two independent coders, who were blind to condition, analyzed the open-ended responses to the target pictures as reflecting high-level construal, low-level construal, neither, or both. Following Liberman and Trope (1998), descriptions that fit the structure "[description] by [activity]" were coded as high-level construal, whereas descriptions that fit the structure "[activity] by [description]" were coded as low-level construal. For example, describing a boy reading a book as "studying" reflects a higher level description than an activity "reading" because it makes more sense to say that "one studies by reading" than "one reads by studying." Examples of descriptions and their respective coding are presented in Table 1. Interrater

agreement was high (95.58% for reading, 94.48% for painting) and disagreements were resolved by a third judge. Collectively, only 4.97% of responses did not fit either structure or fit both.

Insert table 1 about here

As expected, presenting pictures in bw vs. color appeared to promote high-level construal. In response to the first picture of a boy reading a book, participants in the bw vs. color condition generated more high-level descriptions (41.94% vs. 29.55%, respectively) and fewer low-level descriptions (53.76% vs. 67.05%, respectively). The percentage of descriptions that did not fit either structure or fit both was more or less the same across the two conditions (4.30% vs. 3.41%, respectively). A similar pattern was evident when examining responses to the second picture of a woman painting. Specifically, participants in the bw vs. color condition generated more high-level descriptions (40.86% vs. 31.82%, respectively) and fewer low-level descriptions (52.69% vs. 64.77%, respectively). The percentage of description that did not fit either structure or fit both was similar (6.45% vs. 3.41%, respectively).

To conduct a more refined analysis of these data, we followed procedures used by Liberman and Trope (1998) in coding responses reflecting low-level construal with the value of -1 and responses reflecting high-level construal with the value 1. Responses that did not fit either structure, or fit both, were given the value of 0. We summed these response values and created an abstraction index ranging from -2 to 2, with higher scores indicating greater high-level construal. As predicted, the abstraction index was higher when participants were exposed to bw pictures (M_{bw} = -.24) than when exposed to color pictures (M_{co} = -.70; $t(179) = 2.09$, $p < .05$). These data thus provide preliminary support for the hypothesis that bw relative to color imagery is more likely to promote high-level construal.

EXPERIMENT 2: SENSITIVITY TO PRIMARY VS. SECONDARY FEATURES

As noted earlier, CLT research indicates that high-level relative to low-level construal enhances sensitivity to the primary and essential features rather than the secondary and surface-level features of objects and events (Eyal et al. 2009; Fujita et al. 2008; Fujita et al. 2006; Torelli and Kaikati 2009; Trope and Liberman 2000). Drawing from these findings, we reasoned that to the extent that bw (vs. color) pictures evoke high-level (vs. low-level) construal, the former should lead people to become more sensitive to the primary and essential (vs. secondary and surface-level) features of consumer products. We tested this hypothesis in Experiment 2. Specifically, we presented products to participants and asked them to sort them into categories. The products shared similarities as to what function they serve vs. what aesthetic design features they had. We assumed that whereas function represents a primary feature, aesthetic design represents a secondary feature. As such, we predicted that people are more likely to attend to functional aspects (rather than design) of products and to use them as a basis of categorization when they are presented in bw vs. color.

Method

Experiment 2 implemented a one-factor (bw vs. color) between-subjects design. We recruited 175 undergraduate students from an introductory marketing class, who participated in this computer-mediated study in exchange for course credit. After a brief instruction that explained that the aim of the study was to understand how people categorize various consumer products, we presented participants with a set of four products (see Figure 2) and asked them to

sort the products into two categories of two products each. Each product was labeled with a letter (A, B, C, and D). Participants indicated their groupings by writing down the letter corresponding to each product into one of two boxes, with each box representing a category grouping.

Insert figure 2 about here

Four pairs of boots formed the target stimulus. Two pairs (A & B) were rain boots while the other two pairs (C & D) were snow boots. Thus, from a functional perspective, boots A (leopard rain boots) & B (plain rain boots) fell into one category while boots C (leopard snow boots) & D (plain snow boots) fell into another. In addition, boots A & C had leopard-spot designs on them while boots B & D were plain. Thus, from an aesthetic design perspective, A (leopard rain boots) & C (leopard snow boots) fell into one category while B (plain rain boots) & D (plain snow boots) fell into another. Critically, we manipulated whether the four boots were presented in bw or in color, and randomized participants to one of these two conditions. We predicted that people exposed to bw (relative to color) pictures of the boots would be more likely to categorize the boots on the basis of their function rather than design.

Result and Discussion

Among the 175 participants, 142 categorized the products on the basis of function, whereas 29 categorized the products on the basis of design. Four participants formed A&D and B&C groups. We excluded them from our analysis because their categorization was based on neither function nor design.

That participants in general were more likely to categorize the boots in terms of function over design provides support for our assumption that function represents a primary feature

whereas design represents a secondary feature. What we were interested in, however, was the percentage of participants who categorized the boots based on their function vs. design as a function of bw vs. color imagery. Our analyses indicated that a greater percentage of participants categorized boots based on their function (vs. design) in the bw condition than in the color condition (Function$_{bw}$ = 90.00% vs. Function$_{co}$ = 76.92%; $X^2(1, N=171) = 5.17, p < .05$). These data support our prediction that bw (vs. color) presentation of products enhances high-level construal, drawing greater attention to primary and essential aspects of objects and events rather than their secondary and surface-level aspects.

EXPERIMENT 3: BEHAVIOR SEGMENTATION AND ACTION IDENTIFICATION

We designed Experiment 3 to achieve two goals. First, we wanted to test whether the effect of bw vs. color imagery extended beyond pictures to videos. We expected bw vs. color imagery to have the same effect on construal level irrespective of whether these images were presented in picture or video format. To assess people's construal of video content, we used a classic assessment of abstract, schematic processing: how perceivers segment or "chunk" continuous streams of behavior (Newtson 1973; Newtson and Engquist 1976). Those who engage in more abstract, schematic information processing tend to ignore incidental details and instead focus on broader patterns of behavior, leading to behavior segmentation that emphasizes fewer, larger units (Markus, Smith, and Moreland 1985). Indeed, past research demonstrates that those engaged in high-level relative to low-level construal segment behavior depicted in videos into fewer, broader units (Henderson et al. 2006; Wakslak et al. 2006). Thus, we expect that bw

(relative to color) imagery to produce parallel effects, identifying fewer, broader units of meaningful behavior when presented with video presentations of ongoing behaviors.

A second goal of Experiment 3 was to test the possibility that bw vs. color imagery can promote high-level vs. low-level construal as a procedural mindset. Past CLT research indicates that inducing participants to construe an event in higher- vs. lower-level terms can promote a tendency to construe subsequent unrelated events in a similar fashion (Freitas, Gollwitzer, and Trope 2004; Förster, Friedman, and Liberman 2004; Fujita et al. 2006). To test this, after participants completed the behavior segmentation task, we assessed their construal of behaviors unrelated to those depicted in the segmentation task. To the extent that bw vs. color videos can induce high-level and low-level construal as procedural mindsets, we might expect that those exposed to bw (vs. color) videos would construe subsequent unrelated behaviors in higher-level (vs. lower-level) terms.

Method

Experiment 3 implemented a one-factor (bw vs. color) between-subjects. We recruited 40 undergraduate students taking summer courses to participate in this computer-based study in exchange for course credit. Critically, we manipulated whether videos were presented in bw or in color, and randomized participants to one of these two conditions. We asked participants to imagine that they had secured a new position in a film production company and had been asked to view three short videos that were currently in production, with following instructions (Henderson et al. 2006; Wakslak et al. 2006):

The assignment your boss gave you is to watch three videos and to segment what you see into actions that seem natural and meaningful to you. While watching these videos, you will be asked to click a button when, in your judgment, one meaningful action ends and another begins. There is no right or wrong way to do this; it's up to you to decide whether or not an action seems natural and meaningful to you.

We then presented three videos in the same sequence to all participants. Participants first watched the classic Heider and Simmel's (1944) animated film of shapes moving around a rectangular object (90 seconds long). Henderson and colleagues (2006) used this video in a behavior segmentation task to assess changes in construal level. Following their lead, we told participants that the moving shapes in the video symbolically represented an event that took place during a camping trip for young teenagers. Participants then watched a stop motion animation video (103 seconds long) that presented a sequence of what appear to be unrelated actions (e.g., washing a knife, measuring and sawing a board, using a screwdriver, cooking a lobster and vegetables). Finally, participants watched an animated film (216 seconds long) depicting an elderly man selling noodles on a street for his living despite his shaking hands (e.g., receiving order, cooking noodles, serving noodles, changing a light bulb). We selected these three videos to vary in content and format. While watching each video, participants were instructed to press a key each time they perceived that a meaningful action had ended and another had begun. The number of meaningful behavioral segments served as the measure of construal level, with fewer segments suggesting enhanced high-level construal.

To examine whether any change in construal level induced by the videos would "carry over" to subsequent unrelated contexts as a procedural mindset, we asked participants to

complete an additional task after the behavior segmentation task. In this second task, we used items from the Behavioral Identification Form (BIF; Vallacher and Wegner 1989). The BIF presents participants with target behaviors (e.g., making a list) and asks them to choose which of two re-descriptions of this behavior they prefer. One description emphasizes the abstract ends achieved by the behavior ("why" one engages in the behavior: e.g., getting organized) whereas the other emphasizes the concrete means by which to achieve the behavior ("how" one engages in the behavior: e.g., writing things down). We presented only eight of the original BIF items for the sake of time. To ensure that any effect was not dependent on the frequency or commonality of a given behavior, we selected four items that reflected what we intuited would be more common for undergraduate students, and four items that were less common (see Table 3). We coded responses such that preferences for the concrete, low-level identification were given the value of 0, and preferences for the abstract, high-level identification were given the value of 1. We summed these item scores and created an abstraction index ranging from 0 to 4 for both common and uncommon behaviors, with higher scores indicating greater high-level construal. We expected that the effect of color vs. bw on construal level would drive differences in BIF scores, irrespective of video content.

Results and Discussion

We analyzed the data from the behavior segmentation task using a 2 (presentation format: bw vs. color) X 3 (video clip: video 1 vs. video 2 vs. video 3) repeated measure ANOVA with presentation format as a between-subjects factor and video as a within-subjects factor. Because the distribution of behavioral segments was positively skewed, we transformed the data using a logarithmic function and conducted our analysis on this transformed variable (for ease of

interpretation, we present all *M* and *SD* in their original format in all reported analyses and Table 2). As predicted, our analysis revealed a significant main effect of presentation format ($F(1, 38) = 6.36$, $p < .05$). More specifically, participants who watched bw videos segmented the behaviors into fewer units ($M_{bw} = 2.21$) than did those who watched color videos ($M_{co} = 2.67$). Neither the main effect of video ($F(2, 76) = 1.03$, $p = .36$), nor the interaction between presentation format and video ($F(2, 76) = 2.00$, $p = .14$) was statistically significant. These data suggest that watching bw (vs. color) videos promotes high-level (vs. low-level) construal. Not only do they conceptually replicate Experiment 1 and 2, they also suggest that the effect of bw (vs. color) imagery on construal level is not limited to pictures, but may also extend to videos.

Insert table 2 about here

We next analyzed the abstraction index calculated from participants' responses to eight BIF items using a 2 (presentation format: bw vs. color) X 2 (commonality: high vs. low) repeated measure ANOVA with presentation format as a between-subjects factor and commonality as a within-subjects factor. The interaction between presentation format and commonality was not statistically significant ($F(1, 38) = .03$, $p = .87$), but the main effect of commonality was significant ($F(1, 38) = 11.65$, $p < .01$). The latter revealed that participants generally preferred to describe common relative to uncommon behaviors ($M_{common} = 2.85$ vs. $M_{uncommon} = 2.33$) in more abstract, high-level terms. More importantly, however, as predicted, participants who watched the bw videos tended to prefer more abstract re-descriptions of behaviors ($M_{bw} = 3.03$) than those who watched color videos ($M_{co} = 2.15$; $F(1, 38) = 13.67$, $p < .001$). Table 3 describes the choice probability for each of the eight items as a function of condition. One can observe that although not every item produced a statistically significant effect of bw vs. color, the direction of effect

was consistent with predictions across all items. Collectively, these findings suggest that not only can bw vs. color imagery impact construal of the focal objects and events, it can also impact people's construal of subsequent unrelated stimuli by inducing construal level mindsets.

Insert figure 3 about here

EXPERIMENT 4: PRODUCT ATTRIBUTE EVALUATION

Experiments 1-3 support our main proposition that exposure to bw relative to color imagery promotes high-level construal. Experiment 4 and 5 were designed to investigate the implications of these findings for common consumer decisions. To the extent that high-level relative to low-level construal makes people more sensitive to primary vs. secondary features of objects and events, it should promote preferences and decisions that give weight to these primary vs. secondary attributes (Eyal et al. 2009; Fujita et al. 2008; Fujita, Trope, et al. 2006; Torelli and Kaikati 2009; Trope and Liberman 2000). Thus, we predict that bw vs. color presentation of products should increase the perceived importance of the primary, goal-related attributes of the product relative to the secondary, goal-irrelevant attributes. We tested this hypothesis in Experiment 4.

Method

Experiment 4 implemented a 2 (presentation format: bw vs. color) x 2 (attribute: primary vs. secondary) mixed factorial design, with imagery as a between-subjects factor and attribute as a within-subjects factor. We recruited 125 undergraduate students from an introductory

marketing class, who participated in this computer-mediated study in exchange for course credit. We introduced our study to participants as an experiment designed to develop advertising tag lines for a camping radio. Participants read the following information before they saw a bw vs. color picture of the target product, manipulated between-subjects:

> This radio is targeted at people who go on camping trips. Many camp locations in the U.S. have poor reception and most radios don't work as well. A recent study showed that over 80% of the popular camping sites in the U.S. received an acceptable signal from only one radio station nearby. Yet, many people like to take a radio on their camping trips because it makes them feel like they are still part of the 'civilization' even though they are away from people. This radio puts out nice sound and is rugged enough to be used for camping trips. Many campers rent this type of a radio from camp offices across the country.

We reasoned that informing participants that the radio is to be used on camping trips would lead them to understand that physical attributes such as size and weight are goal-relevant and primary features, as the radio would have to be carried and transported. At the same time, since camping sites can only tune to one radio station, station-related features, such as "multi-station presets" (a feature which allows users to quickly tune to their favorite radio stations) and "high precision tuner" (which allows the radio to distinguish two stations that share similar radio frequencies), are less useful and thus secondary. To provide empirical support for these assumptions, we conducted a pilot study ($N = 55$). Participants were presented with the scenario above, and asked to rate how important each of the four attributes was using a 9-point Likert scale (1 = Not at all important, 9 = Very important). Results confirmed that participants

considered the two physical attributes to be more important and thus primary ($M_{\text{size}} = 6.33$; $M_{\text{weight}} = 6.35$) than the two station-related attributes ($M_{\text{presets}} = 5.53$; $M_{\text{tuner}} = 5.13$). Specifically, the average of the two primary attributes ($M_{primary} = 6.34$) was significantly higher than the average of the two secondary attributes ($M_{secondary} = 5.33$; $F(1, 54) = 21.41$, $p < .001$).

Consistent with the cover story, participants in Experiment 4 generated taglines for the target product. Afterwards, they rated the importance of four attributes of the radio (primary attributes: size and weight; secondary attributes: multi-station presets and high-precision tuner) on a 9-point scale (1 = Not at all important, 9 = Very important). Critically, we presented the picture of the radio either in bw vs. color when participants read the scenario and rate the importance of attributes (see Figure 3). Our interest was whether or not bw vs. color presentations of the radio would influence the relative weighting of these primary and secondary attributes. If bw (vs. color) presentation enhances high-level (vs. low-level) construal, we would expect that participants would perceive the physical attributes to be more important relative to the station-related attributes in bw condition relative to color condition.

Insert figure 3 about here

Result and Discussion

Ratings within attribute type (primary vs. secondary) were averaged to create a single index for each general attribute. We then analyzed these data using a 2 (presentation format: bw vs. color) x 2 (attribute: primary vs. secondary) repeated-measure ANOVA with presentation format as a between-subjects factor and attribute as a within-subject factor. Results revealed a significant main effects of attribute ($F(1, 123) = 28.58$, $p < .0001$). This effect of attribute

replicates our pilot data, and supports our assumption that the physical attributes of the radio

($M_{primary}$ = 6.47) were more goal-relevant and primary to the station-related attributes ($M_{secondary}$ =

5.58) in the consumer product evaluation scenario that we presented to participants. Results also

indicated a significant effect of presentation format. Color (M_{co} = 6.28) relative to bw (M_{bw} =

5.77) pictures increased the perceived importance of the all of radio attributes ($F(1, 123) = 7.07$, p

$< .01$). Critically, as predicted, the interaction between attribute and presentation format was

marginally significant ($F(1, 123) = 3.58$, $p = .06$). More specifically, as depicted in Figure 4,

participants tended to weight the primary over secondary attributes to a greater extent when

exposed to bw ($M_{primary}$ = 6.38 vs. $M_{secondary}$ = 5.16; $F(1, 55) = 21.68$, $p < .0001$) as compared to

color imagery ($M_{primary}$ = 6.57 vs. $M_{secondary}$ = 5.99; $F(1, 68) = 7.21$, $p = .01$). Looked at another

way, whereas presentation format did not impact the consideration of primary features (M_{bw} =

6.38 vs. M_{co} = 6.57; $F(1,123) = .59$, $p = .44$), those presented with bw imagery were significantly

less likely to give consideration of secondary features as compared to those exposed to color

imagery (M_{bw} = 5.16 vs. M_{co} = 5.99; $F(1,123) = 10.55$, $p < .01$). These results support our

prediction that bw (vs. color) imagery increases the perceived importance of the primary, goal-

related attributes of the product relative to the secondary, goal-irrelevant attributes.

Insert figure 4 about here

EXPERIMENT 5: PRODUCT CHOICE

In Experiment 4, we showed that bw (vs. color) imagery can influence how people

weight primary vs. secondary features in the consideration of consumer products. Experiment 5

examines the implications of these changes in feature weighting for consumer choice. That is, can bw (vs. color) imagery enhance preferences for consumer products that are superior on primary (vs. secondary) features?

Method

Experiment 5 implemented a one-factor (bw vs. color) between-subjects design. We recruited 94 undergraduate students from an introductory marketing class, who participated in this computer-mediated study in exchange for course credit. To facilitate introduction of consumer products that differed in superiority of primary vs. secondary features, we presented participants with a scenario similar to the one used in Experiment 4:

> Imagine you went camping with your close friends. There would be no electricity in the camping site. But you and your friends are hoping to enjoy some music while camping. You don't have a portable radio with you, and are looking for something that can play music and give decent sound. Fortunately, the campsite manager is able to rent a radio which operates without electricity. The manager told you that because the camp location is remote, you can play only one station.

Given this camping scenario, we assumed that participants would understand that rental price, in addition to physical characteristics (e.g., weight), represents primary attributes for evaluation and choice. By contrast, we assumed that they would understand that aesthetically pleasing design (e.g., a nice display) and station-related features (e.g., multiple station pre-sets) represent secondary attributes. To provide empirical support for these assumptions, we

conducted a pilot study ($N = 84$) in which participants read the scenario and rated how important each of the four attributes was using a 9-point Likert scale (1 = Not at all important, 9 = Very important). Results confirmed that participants considered the two primary attributes to be more important ($M_{price} = 6.17$; $M_{physical} = 4.44$) than the two secondary attributes ($M_{station} = 3.24$; $M_{display} = 3.57$). Specifically, the average of the two primary attributes ($M_{primary} = 5.30$) was significantly higher than the average of the two secondary attributes, ($M_{secondary} = 3.40$; F (1, 83) $= 62.16$, $p < .0001$).

Drawing from these pilot data, we presented participants in Experiment 5 with information and pictures of two radios (see Figure 5), and asked them which one they preferred. One radio (Option A) was superior on the basis of the two primary attributes whereas the other (Option B) was superior on the basis of the secondary attributes. Specifically, both radios were described as having equally good sound quality, as indicated by their star ratings. However, Option A had lower rental price ($10 per day) and appeared lighter. By contrast, Option B provided more attractive digital display design and multi-station presets buttons, but had a higher rental price ($18 per day) and appeared heavier. If bw (vs. color) presentation enhances high-level (vs. low-level) construal, we would expect that participants prefer Option A over Option B in the bw relative to color condition.

Insert figure 5 about here

Result and Discussion

Among the 94 participants, 58 choose Option A and 36 chose Option B. That participants were generally more likely to choose Option A over Option B, together with our pilot data,

supports our assumption that the former was viewed as the choice option with superior primary (relative to secondary) features. More critically, as expected, a chi-square test revealed that those presented with bw pictures of the two radios were significantly more likely to choose Option A over Option B (73.91%), compared to those presented with color pictures (50.00%; $X^2(1, N = 94) = 5.68, p < .05$). These results support our prediction that bw (vs. color) presentations of products can increase the choice probability of the option with superior primary, but inferior secondary, attributes. In other words, in this particular study, participants in the color condition showed a greater willingness to spend more money for the choice option that contained unnecessary secondary features. This suggests that at times, by emphasizing secondary features, color relative to bw imagery may lead to sub-optimal consumer decisions.

GENERAL DISCUSSION

In this research, we attempted to provide evidence for the novel hypothesis that bw (vs. color) imagery can evoke high-level (vs. low-level) construal. Experiments 1-3 sought to demonstrate this by manipulating exposure to bw vs. color imagery and assessing construal level using three distinct measures (action identification, behavior segmentation, and essential vs. superficial feature sensitivity). Not only did the effect of bw vs. color imagery replicate across measures, it also replicated across media, evident with both pictures (Experiments 1 and 2) and videos (Experiment 3). The results of Experiment 3 also suggested that the bw vs. color imagery not only influences the construal of the depicted objects and events, it may also induce procedural mindsets that impact the construal of subsequent unrelated material. Experiments 4 and 5 explored the implications of this effect for consumer behavior, examining the impact of bw

vs. color imagery on construal-dependent consumer product feature weighting (Experiment 4) and product choice (Experiment 5). As predicted, bw vs. color imagery enhanced sensitivity to primary vs. secondary product features, and led participants to prefer products with superior primary relative to secondary features. Collectively, these findings support our assertion that bw vs. color imagery promotes high-level vs. low-level construal, respectively.

On Emotionality as a Potential Confound

Some (Elliot and Maier 2013; Singh 2006; Ward 2004) may argue that color imagery is more emotional than bw imagery, and that it is the emotionality of the stimuli (and not the presence or absence of color per se) that leads the former to promote low-level construal relative to the latter. This suggestion, however, would appear inconsistent with the intuitions of artists, who strategically use bw imagery to convey a wide variety of emotional content (Schindler 1986; Nojima 2003; Zettl 2014). Empirical research, moreover, on the impact of bw vs. color imagery on emotions appears mixed (Detenber, Simons, and Reiss 2000; Perse, Pavitt, and Burggraf 1991). Research by Detenber and colleagues (2000), for example, suggests that while participants self-report stronger emotional reactions to color rather than bw imagery, there are no detectable differences in physiological assessments of these emotions. Thus, it is unclear whether color images are indeed more emotional than bw images.

There are also reasons to question the assertion that low-level construal is more emotional than high-level construal. CLT proposes that emotionality and construal level are conceptually distinct. Rather than suggesting that one level of construal is more emotional than the other, CLT instead suggests that people experience different types of emotions at each level of construal. Some emotions represent acute responses to specific, unique features of the here-

and-now, whereas other emotions result from a broader understanding. Research suggests, for example, that whereas low-level construal promotes the experience of lust, high-level construal promotes the experience of love (Epstude and Förster 2011). Research also suggests that low-level construal is associated with the experience of primary emotions such as happiness, high-level construal is associated with the experience of self-conscious emotions such as pride (Eyal and Fishbach 2010; Fishbach, Eyal, and Finkelstein 2010; Katzir, Eyal, Meiran, and Kessler 2010). Thus, it is not that high-level and low-level construals differ on emotionality; rather, they may differ on the type of emotions experienced. Thus, assuming low-level construal is more emotional than the high-level construal is conceptually problematic.

Implications for CLT

The present findings extend the existing CLT literature in a number of ways. Theoretically, this work is the first that we are aware of to demonstrate that a basic component of visual imagery (presence or absence of color) can be an important antecedent variable that determines level of construal. It adds to a growing literature examining factors that lead people to construe events in higher vs. lower-level terms beyond psychological distance, such as temperature (Ijzerman and Semin 2010), darkness (Steidle, Werth, and Hanke 2011), visual perspective (Libby, Shaeffer, and Eibach 2009), novelty (Förster, Liberman, and Shapira 2009), fluency (Alter and Oppenheimer 2008), confidence (Wan and Rucker 2013), measurement unit size (Maglio and Trope 2011), regulatory resource depletion (Agrawal and Wan 2009; Bruyneel and DeWitte 2012; Schmeichel and Vohs 2009; Wan and Agrawal 2011) and mood (Beukeboom and Semin 2006; Gasper and Clore 2002; Labroo and Patrick 2009). Such factors are important to understand given the central role of construal level in consumer information processing,

evaluation, and decision-making (Trope et al. 2007). Understanding the antecedents to construal level may facilitate our understanding of how people represent and interpret objects and events, which may in turn help us understand and potentially influence their subsequent judgments and decisions.

The present work may also lead to the development of new experimental methodologies with which to manipulate level of construal. Researchers looking to manipulating construal level could capitalize on the tendency for bw vs. color imagery to promote high-level and low-level construal, respectively. Results from Experiment 3 suggest that exposure to bw vs. color videos led people to construe subsequent unrelated materials in higher-level vs. lower-level terms. This indicates the possibility of developing materials that use bw vs. color stimulus to induce differences in construal level as procedural mindsets. We encourage future research to pursue this possibility to expand the "toolbox" of procedures with which researchers can use to investigate further the role of construal level in consumer judgment and decision-making.

The present findings may, in addition, have implications for understanding how people visualize various events in their "mind's eye." To the degree that the processing of bw vs. color imagery and construal level are associated, we should not only expect that bw (vs. color) imagery promotes high-level (vs. low-level) construal, but we might also expect the reverse. That is, whereas high-level construal may promote visualization of objects and events in black-and-white, low-level construal may promote visualization of objects and events in color. To the extent that this is true, we might also predict that people will use black-and-white to visualize psychologically distant events, and use color to visualize psychologically proximal events. This suggests, for example, that people may picture the distant future in black-and-white, and the near future in color. These possibilities may provide insight into the subjective experience of high-

level and low-level construal, an insight largely lacking in the current CLT literature. We are

currently conducting experiments in the lab testing these possibilities.

Implications for Marketing and Consumer Behavior

Marketing research on the effects of bw vs. color imagery has generally focused on

whether the high cost of using color in marketing can be justified by any positive effects (e.g.,

which attracts greater attention? Which is remembered better? Which promotes positive

evaluations of products?). Fewer studies have examined more nuanced predictions, such as the

possibility that bw vs. color imagery directs attention to distinct aspects of ads and products.

Research that has addressed this issue has largely been conducted in isolation and has lacked an

integrative theoretical framework (Bohle and Garcia 1987; Katzman and Nyenhuis 1972;

Kumata 1960). In the present work, we have attempted to present a theoretical framework that

not only accounts for these past findings, but also generates new predictions. Not only do these

studies explore how bw vs. color imagery impacts representation or construal of consumer

products, but they are also among the first to explore directly the consumer behavior implications

of such differences in attention and information processing.

Future research might explore the implications of the effect of bw vs. color imagery for

consumer judgment and decision-making beyond those that we have examined in the present

work. Research has demonstrated, for example, that high-level (vs. low-level) construal can

enhance self-control (Fujita 2008; Fujita and Carnevale 2012). Other work has suggested that

high-level (vs. low-level) construal can enhance the likelihood of finding more integrative win-

win agreements in negotiation (Henderson and Trope 2009; Henderson, Trope, and Carnevale

2006), promote use of base-rates (Henderson et al. 2006; Ledgerwood, Wakslak, and Wang

2010), and facilitate decision-making under information overload (Fukukura, Ferguson, and

Fujita 2012), among many other judgment and decision-making phenomena (Trope et al. 2007).

In all these cases, we should expect bw vs. color imagery to have similar effects. Marketers

seeking to leverage these effects may thus consider using bw vs. color imagery as a

psychological "nudge" (Thaler and Sunstein 2008).

One key implication of our theoretical perspective is that it questions the assertion that

color is always superior to bw in advertisement. Although color may have positive effects, such

as promoting attention, memory, and general positive evaluations (Fernandez and Rosen 2000;

Gardner and Cohen 1964; Gronhaug et al. 1991; Hornik 1980; Lohse 1997; Pallak 1983; Percy

and Rossiter 1983), the present findings also suggest that by highlighting secondary and

incidental aspects, color ads may also distract consumers from attending to the more essential

and primary features of the advertisement and advertised product. For marketers, the present

work provides profitable opportunities by suggesting the need to consider carefully whether to

use bw vs. color imagery in advertisements. If a product is superior on a primary feature, for

example, marketers should consider using bw imagery to draw attention to these positive features.

By contrast, if a product is superior on a secondary feature, markers should consider using color

imagery. Thus the decision to use bw vs. color imagery may be an important one when tailoring

messages to consumers. Our findings also ring the alarm to consumers and guide wiser

consumption. As suggested in Experiment 5, color can re-direct our attention from primary to

secondary attributes of consumer products and leading to a greater willingness to pay premiums

for products with unnecessary and superfluous features.

Knowing that bw vs. color imagery impacts construal level may also have important

implications for matching effects in persuasive advertisements. Research suggests that a match in

construal level between consumer and advertisement enhances persuasion (Fujita et al. 2008;

Kim, Rao, and Lee 2009; Tsai and Thomas 2011). Similar effects should emerge with a match

between bw vs. color and whether consumers are engaged in high-level vs. low-level construal.

Thus, a persuasive appeal concerning a temporally distant vs. near event (which should evoke

high-level vs. low-level construal among consumers, respectively; Trope et al. 2007) should be

more persuasive if accompanied by a bw vs. color image, respectively. Matching, however, may

also be important to consider within aspects of the persuasive appeal itself. A persuasive appeal

that highlights high-level, "why" arguments vs. low-level, "how" arguments should be more

persuasive when accompanied by bw vs. color imagery, respectively. Ongoing work in our lab is

currently testing these predictions.

Coda

Artists have anecdotally noted that bw relative to color imagery conveys messages that

are timeless and enduring, revealing the deeper meaning of the depicted content (Bray 2011;

Rowse 2007; Zettl 2014). Such intuitions are supported empirically by the present research. By

evoking high-level (rather than low-level) construal, bw imagery may allow people to transcend

the particulars of the moment and focus on bigger and broader generalities. We find the notion

both intriguing and exciting that such a simple change in the visual presentation of a stimulus has

such a fundamental effect on people's psychology. We encourage and look forward to further

scientific inquiry addressing this issue.

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TABLE 1

Coding Scheme for Open-Ended Responses in Study 1

	Picture (1)	Picture (2)
High-Level (+1)	-Study -A little boy is learning -A child learning the words -A little boy learning how to read -A boy concentrating on study -A boy improving his reading skills -The boy is obtaining knowledge -Children absorb knowledge from the book	-Decorating home -Young lady making home improvements -Improving the appearance of her house -This is a homeowner painting her house -A girl is doing home projects -A girl is making the room looks better -Painting gives off a new look in a room -A woman decorating her house by repainting
Neither or Both (0)	-A boy is reading and studying -Young boy reading/doing his homework -The kid is studying carefully and the subject may not seem familiar to him -Boy practicing reading -A kid doing his homework	-Painting, Home Improvement -the girl cannot paint, unprepared -A girl is painting a room in her house
Low-Level (-1)	-Reading -A boy is reading -A kid trying to read -A young child reading a book by himself -A child is reading a book word by word -A boy is trying to figure out a word -A little boy is carefully reading a book using his fingers pointing the words	-Painting -A woman is brushing -Girl is painting -The woman is doing some painting -Painting a wall -A woman is using brush cleaning the wall -A woman finishing wood -An attractive woman is staining wood

TABLE 2

Mean Number of Behavior Segments in Study 2

	BW Mean (S.D.)	Color Mean (S.D.)
Video 1	12.75 (6.96)	15.85 (8.61)
Video 2	12.05 (8.34)	15.40 (14.53)
Video 3	10.95 (6.64)	18.55 (6.06)
Mean	11.92 (5.48)	16.60 (8.81)

Note: Actual *M* and *SD* (Non log-transformed)

TABLE 3

Preference for High-Level Re-Descriptions of Behaviors in Study 3

| Behavior Commonality		Preference for high-level BW vs.Color	Chi-Square
Common	1. Making a list **Getting organized** *vs. Writing things down*	85% vs.60%	X^2(1, N=40)=3.13, *p*=.08
	2. Reading **Gaining knowledge** *vs. Following lines of print*	95% vs.70%	X^2(1, N=40)=4.33, *p* =.04
	3. Washing clothes **Removing orders from clothes** *vs. Putting clothes into the machines*	75% vs.45%	X^2(1, N=40)=3.75, *p* =.05
	4. Eating **Getting nutrition** *vs. Chewing and swallowing*	75% vs.65%	X^2(1, N=40)=0.48, *p* =.49
Uncommon	5. Painting a room **Making the rooms look nice** *vs. Applying brush strokes*	95% vs.75%	X^2(1, N=40)=3.14, *p* =.08
	6. Chopping down a tree **Getting firewood** *vs. Wielding an axe*	65% vs.30%	X^2(1, N=40)=4.91, *p* =.03
	7. Caring for houseplants **Making the room look nice** *vs. Watering plants*	25% vs.10%	X^2(1, N=40)=1.56, *p* =.21
	8. Measuring a room for carpeting **Getting ready to remodel vs.** *Using a yardstick*	90% vs.75%	X^2(1, N=40)=1.56. *p* =.21

FIGURE 1

Study 1 Stimuli
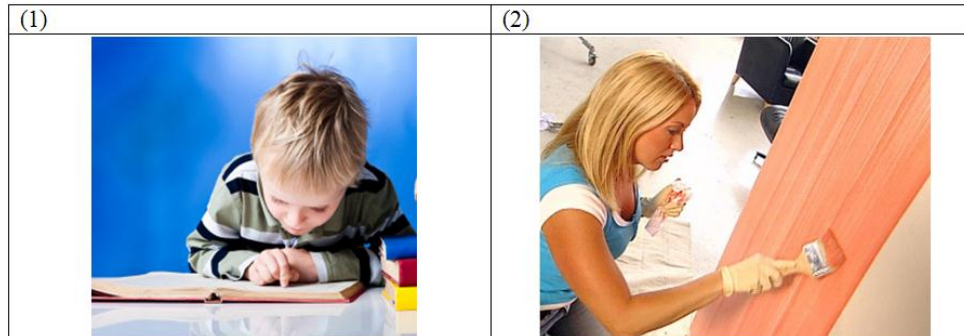
FIGURE 2

Study 2 Stimuli

FIGURE 3

Study 4 Stimuli

FIGURE 4

Study 4: Black-and white (vs. color) imagery increases the perceived importance of the primary

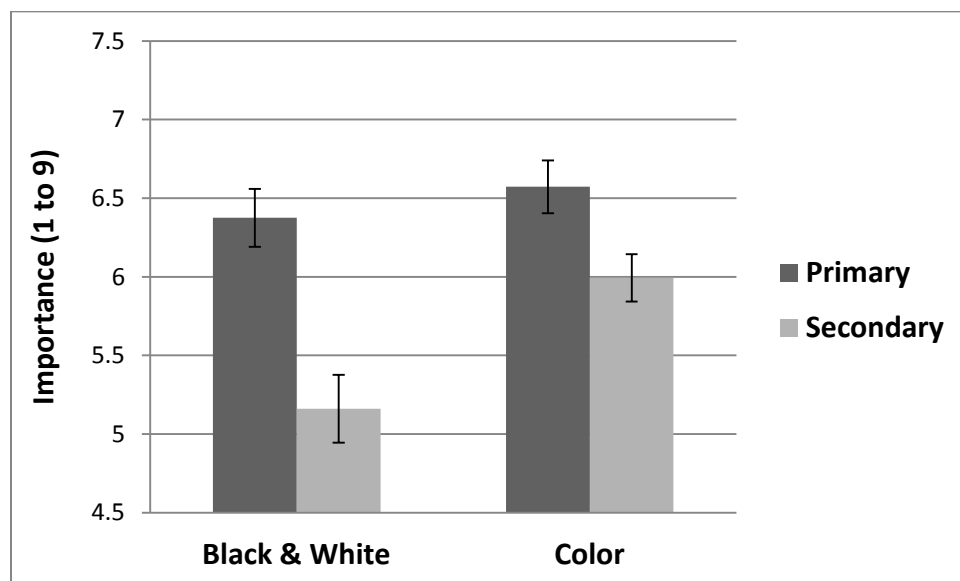attributes of the product relative to the secondary attributes.

FIGURE 5

Study 5 Stimuli

Option A   Option B

Rental Price : $ 10 /day
Sound quality : ★★★★☆

Rental Price : $ 18 /day
Sound quality : ★★★★☆