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The Two-Dimensional Impact of Color on Shopping

AYN E. CROWLEY*
College of Business and Economics, Washington State University, Pullman, WA 99164-4730

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Abstract

Prior research has typically grouped color effects into a single class of effects and has ignored situational aspects of consumer responses to color. In the present study, color effects are shown to exhibit different patterns depending on the type of response examined. Further, these effects are described as a function of color wavelength. Evaluative effects are most positive at the short wavelength (blue) end of the visible spectrum, while the activation response engendered by color exhibits a U-shaped pattern across wavelengths. Results of the study support the existence of these two distinct dimensions, and potential applications of the findings are discussed.

Color is such a pervasive part of everyday life that one tends to take it for granted. Yet, differential effects (both physiological and psychological) for various colors have been found repeatedly across decades of research in psychology. Since many forms of marketing communication, such as packages, products, advertisements, and store environments, are presented to consumers in color, these color effects are bound to be operative in a variety of consumer behavior contexts. While the psychological effects of color have received some attention in the consumer behavior literature (e.g., Bellizzi, Crowley, and Hasty, 1983; Middelstadt, 1990), our knowledge of these effects is limited at best. Almost uniformly, psychological responses to color have been conceptualized as a single effect rather than a multidimensional response.

Different effects and associations engendered by various colors of stimuli have been found consistently in psychological research. In the present paper, color effects are hypothesized to have a situational dimension, and different patterns of effects are found depending on the type of effect or reaction to color that is measured.

Specifically, some colors are more activating (stimulating brain wave activity, skin conductance, etc.) while other colors tend to be more deactivating. Thus, one dimension of consumer response to color is hypothesized to reflect activation-related behaviors. A separate color effect deals with evaluative or affective ("liking") responses to color. Colors that enhance consumers' liking of a stimulus are not necessarily those colors that consumers find activating (or deactivating). In this article, these two dimensions of consumer response to color are shown to

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have different patterns across the visible spectrum. This conceptualization is consistent with Mehrabian and Russell's (1974; see also Russell and Pratt, 1980) contention that these two dimensions are useful in describing emotional reactions to physical environments.

In the brief literature review that follows, prior research on color effects has been dichotomized into studies with an activation *or* an evaluation focus. It should be noted that this dichotomization is not generally recognized in the color research literature. Rather, color effects have been viewed as a single class of effects. After describing the rationale for a "two-dimensional" view of consumer response to color in more depth, an experiment that tests the two-dimensional hypothesis is presented. Finally, the implications of the study and suggestions for future research are discussed.

1. Literature review

1.1. Mapping consumer responses to color onto the visible spectrum

Any search for patterns in human response to color must begin by mapping colors onto some continuum. The visible spectrum, with colors ordered based on the wavelength of visible light associated with each color, serves as such a continuum for the present conceptualization. When viewed as wavelengths of visible light, colors can be ordered from long to short wavelengths as follows: red, orange, yelow, green, blue, violet (see figure 1). This visible spectrum is but a small part of the total spectrum of wavelengths. As noted by Wilson (1966), wavelengths slightly longer than visible red are infrared, or heat-producing wavelengths. At the opposite end of the spectrum, beyond the blue/violet visible wavelengths, are ultraviolet or sunburn-producing wavelengths (Pavey, 1980).

By using wavelength and the visible spectrum to map colors, the color spectrum can be viewed as a ratio scale (see Stevens, 1946). Yet, many color researchers have implicitly assumed that color represented a nominal variable with no natural ordering (e.g., Jacobs and Suess, 1975; Bjerstedt, 1960; Sallis and Buckalew, 1984). Color has even been used as an example of a nominal variable in statistics texts (see Armore, 1973).

1.2. Arousal effects

Prior research has examined both arousal perceptions (i.e., how active a stimulus is perceived to be), as well as the actual physiological arousal engendered by exposure to various colors. Studies using both approaches have found that certain colors, especially red, are more physiologically and psychologically activating than other colors. For example, Nakshian (1964) found that the color red caused significantly greater hand tremor than green. Similarly, Clynes and Kohn (1968)

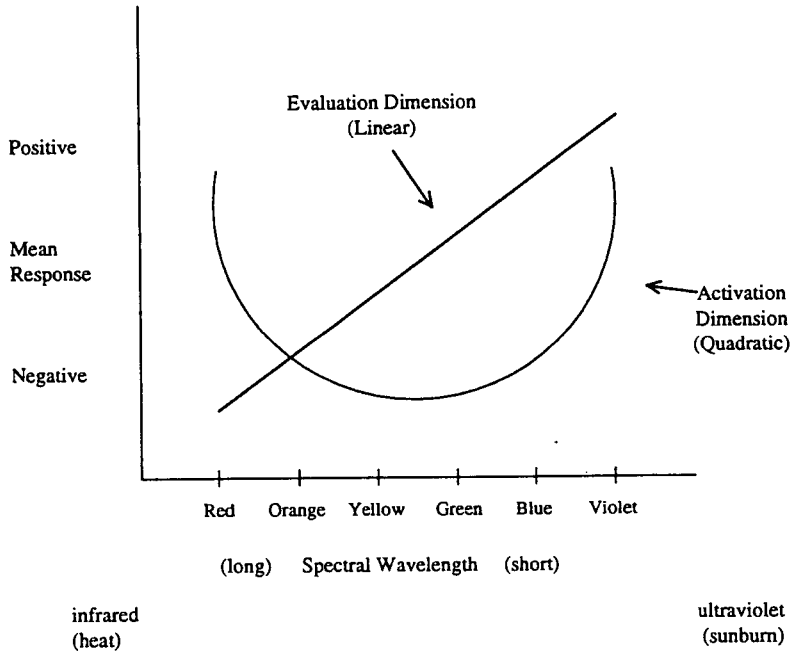

Figure 1. "Two dimensions" hypothesis regarding consumer response to color.

found that brain function (measured by electrical responses) was more affected by red than by other colors of equal intensity.

In pharmacy research using placebo drugs, Sallis and Buckalew (1984) found red and black capsules were ranked as strongest and white as weakest. Along the same lines, Jacobs and Nordan (1979) found that subjects were most likely to classify a red placebo as a stimulant (rather than a depressant).

Among those investigators who have examined color effects on arousal, Wilson (1966) was the first to suggest a possible relationship between arousal reactions and a color's wavelength. Wilson (1966) found red to be significantly more arousing than green based on both absolute skin conductance measures and conductance change (galvanic skin response) data. In discussing these results, Wilson (1966, p. 949) posited a U-shaped relationship between color wavelength and arousal effects:

> It is interesting to speculate about the origin of this differential response to red and green hues. Red and violet, falling as they do on the fringes of the visible spectrum, often occur in association with the potentially dangerous wavelengths just outside. . . . On the other hand, green is placed "safely" in the center of the visible spectrum. Therefore, we might expect either through natural selection or learning to find a U-shaped function relating arousal value to

> visible wavelength. . . . If substantiated, this relationship may help to explain why the psychological distance between red and violet is less than that between either color and green.

This U-shaped hypothesis, predicting that the colors with more extreme wavelengths are the most activating, offers much potential in explaining a pattern of activation responses to color. Yet, no known empirical test of the hypothesis across a variety of wavelengths has been conducted.

While color's arousal effects have not been addressed in the consumer behavior literature, the arousal construct in general has received considerable attention. Kroeber-Riel (1979) suggested, for example, that arousal enhances the processing of advertising information. Arousal may be especially effective in enhancing long-term memory, as opposed to short-term memory. Singh and Churchill (1987) present convincing evidence for this possibility.

1.3. Evaluative Reactions

The color experiments described above examined arousal effects. There have also been several studies that examined affective or evaluative reactions to various colors. Studies of color preference have sometimes dichotomized colors into a warm group (red, orange, yellow) and a cool group (green, blue, violet; see Sharpe 1979 for a review). Cool colors (especially blue) are consistently preferred over warm colors (cf., Silver and McCulley, 1988), although some cross-cultural differences have been found (see Wiegersma and Van Der Elst, 1988). Similarly, Mehrabian and Russell (1974) found that maximal pleasure associated with colors was reported in the green to blue region of the visible spectrum.

In a consumer behavior context, Middelstadt (1990) found that respondents shown the slide of a pen against a blue background exhibited a more positive attitude toward buying the pen than those shown the same pen against a red background. Similarly, Bellizzi, et al. (1983) found that subjects rated cool color store environments as more attractive and more pleasant than warm color store environments.

The studies described above have consistently shown that the color blue has strong evaluative appeal. This has been found when subjects were asked about their color preferences directly (Silver and McCulley, 1988), as well as when affective reactions were gauged when color functioned as a peripheral cue (Bellizzi, et al., 1983; Middlestadt, 1990). Red, on the other hand, consistently emerges as the most activating color, yet is among the least preferred colors in an evaluative sense. These distinct patterns of color response led to the development of the present hypothesis, which states that these two dimensions within consumer response to color follow different patterns across wavelengths.

2. Hypotheses

In the brief literature review above, color is posited to have at least two kinds of effects, with these effects exhibiting different patterns across the wavelengths of the visible spectrum. The possibility that there may be more than two color effects is also acknowledged, although the literature does not suggest what the nature of these dimensions might be.

Hypothesis 1: At least two distinct response patterns will be found in consumers' responses to the color of a marketing stimulus. One of these dimensions will represent arousal perceptions of the stimulus and another dimension will represent evaluative reactions to the stimulus.

Following Wilson's (1966) Darwinian logic that more extreme wavelengths are arousing because they are near potentially harmful wavelengths, a U-shaped arousal function is hypothesized:

Hypothesis 2: The arousal dimension of consumer response to color will follow a U-shaped function across the wavelengths in the visible spectrum, with the extreme wavelengths being associated with higher activation levels.

Based on prior research that shows blue to be the most affectively pleasing color, with notably lower evaluative reactions found for warmer colors (e.g., Mehrabian and Russell, 1974), it is hypothesized that

Hypothesis 3: The evaluative dimension of consumer response to color will follow a monotonically increasing function across wavelengths, being most positive at the short wavelength (blue) end of the visible spectrum.

The expected patterns of consumer responses to color for both the activation and evaluation dimensions are depicted in figure 1.

3. Method

3.1. Subjects and procedure

Subjects in this study consisted of 100 females between the ages of 18 and 64, selected with a convenience sampling technique (see Bellizzi, et al., 1983). The mean age of subjects was 29.6. All subjects were run individually. The subjects

signed at random to one of the four color conditions (blue, green, yellow, and red) with equal cell sizes of 25. The color of the stimulus was operationalized as the background color of a furniture store, with all aspects of the stimulus except color held constant across subjects. Fully saturated colors (i.e., pure colors containing no black or white to dilute the color) were used for all four treatments.

The experiment was conducted in a laboratory designed to accommodate color experiments. The floor and walls were carpeted in M/7 gray, a color that reflects all wavelengths of visible light to about the same degree. Thus, no color effects were introduced by the room itself.

Upon being seated in the experimental room, each subject was told: "We are going to imagine that we are going furniture shopping. Here is the front of a local furniture store." A slide depicting the store exterior was shown to the subject for approximately ten seconds. Then a second slide, showing a drawing of the interior of a furniture store (with the walls, floor and ceiling of the store depicted in the treatment color) was shown. The furniture itself was neutral in color. Subjects completed the dependent measures at their own pace while this second slide was shown.

3.2. Measures

The questionnaire used to measure perceptions of the store environment and merchandise consisted of twenty semantic differential items. The first thirteen of these items were taken from the "Judgments of Environmental Quality Scale" (Fisher, 1974), a scale designed to assess general perceptions of environmental quality. The remaining questions related to the subject's perceptions of various aspects of the retail store and merchandise.

3.3. Analysis

To examine the existence of distinct components within consumer responses to the stimuli, the twenty semantic differential scales were subjected to principal components analysis using VARIMAX rotation. The results support hypothesis 1 if two or more main factors emerge, with one of these factors reflecting an "activation" dimension, and another main factor reflecting an "evaluation" dimension. To examine the findings in relation to hypotheses 2 and 3, tests for linear and quadratic trends were conducted across the red, yellow, green and blue treatment means using coefficients for orthogonal polynomials (Edwards, 1985). These trend tests were conducted to determine if the hypothesized U-shaped (hypothesis 2) or linear (hypothesis 3) relationship exists between a color's wavelength and consumer perceptions.

4. Results

Item means for each treatment color, along with the results of the principal components analysis, are shown in table 1. Using the criteria of eigenvalues greater than one, three factors emerged from the analysis, with the items loading most heavily on factor 1 being clearly nonevaluative and appearing to reflect an activation dimension (i.e., motivating, modern, colorful, stimulating, cheerful, lively and bright; coefficient alpha within factor 1 = .85). Factor 1 explained 23.1% of the total variance. Factor 2 appears to describe an evaluation dimension (i.e., positive, attractive, relaxed, comfortable, good and pleasant; coefficient alpha within factor 2 = .91) and includes some of the same evaluative scales used by Osgood, Suci, and Tannenbaum (1957) to describe the evaluative aspect of meaning (bad/good, tense/relaxed, unpleasant/pleasant). This second factor explained 22.2% of the total variance. Factor 3 appears to represent a price/quality dimension rather than an environmental dimension. Only two variables were found to load primarily on this third factor, and the factor explained only 6% of the total variance. Thus, this third factor was dropped from further analyses, although the first two factors explain less than 50% (45.3%) of the variance. In addition, five of the variables did not have loadings greater than 0.5 on any of the factors. The emergence of two key factors representing an activation and evaluation dimension provides support for hypothesis 1 in this particular context with this group of subjects.

Results of the trend tests using orthogonal polynomials are also presented in table 1. Among the seven variables that loaded most heavily on factor 1, four showed a significant quadratic trend in the treatment means. It is worthy of note, however, that a U-shaped pattern is evident in the means of the other three variables loading on this factor, although these trends are not statistically significant at $p < .10$. Most importantly, a significant ($p < .05$) quadratic trend was found in the composite scale means across the four color treatments. These results support hypothesis 2, which states that the activation dimension within consumers' response to color exhibits a U-shaped pattern across color wavelengths.

The trend analysis results for factor 2 (evaluation) shows fairly strong support for the linear component in the evaluative dimension of consumer response to color. For example, of the six variables loading most heavily on factor 2, five variables showed a significant linear trend. An examination of the treatment means for these scales indicates that, in all cases, this is a linear *increasing* function as evaluations move from the longer wavelengths (red) to the shorter wavelengths (blue). Even the scale that did not produce a significant trend (bad/good) exhibits a monotonically increasing pattern in the treatment means. This linear trend was also found in the composite (average) scores of the scales loading on factor 2 ($p < .05$). These results support hypothesis 3, which predicted that consumer evaluations show an increasingly positive linear trend as evaluations move from longer to shorter (cooler) wavelengths.

Table 1. Item means, factor composite means, and significance levels of 20 environment and merchandise items

Factor	Scale[b]	Item means and factor composite means[a] Red n = 25	Yellow n = 25	Green n = 25	Blue n = 25	Probability of significant quadratic trend	Probability of significant linear trend
Activation Dimension							
1	Unmotivating/Motivating	3.04	2.88	2.80	3.48	N.S.[d]	N.S.
1	Store image: Outdated/Modern	3.88	3.08	2.68	3.48	<.05	N.S.
1	Drab/Colorful	4.84	3.48	3.64	4.00	<.05	N.S.
1	Boring/Stimulating	3.84	3.44	3.28	3.88	N.S.	N.S.
1	Depressing/Cheerful	3.84	3.72	3.52	3.92	N.S.	N.S.
1	Unlively/Lively	3.60	3.32	2.92	3.72	<.10	N.S.
1	Dull/Bright	5.44	4.20	3.60	3.96	<.05	<.01
	Factor 1 Composite Mean	(4.07)	(3.44)	(3.21)	(3.78)	<.05	N.S.
Evaluation Dimension							
2	Negative/Positive	3.12	3.20	3.68	4.08	N.S.	<.01
2	Unattractive/Attractive	3.52	3.16	3.68	4.16	N.S.	<.10
2	Tense/Relaxed	2.52	3.32	3.40	4.00	N.S.	<.01
2	Uncomfortable/Comfortable	3.28	3.76	3.64	4.20	N.S.	<.10
2	Bad/Good	3.64	3.72	3.76	4.28	N.S.	N.S.
2	Shopping environment: Unpleasant/Pleasant	3.04	3.32	3.44	3.96	N.S.	<.05
	Factor 2 Composite Mean	(3.19)	(3.42)	(3.59)	(4.12)	N.S.	<.05
3	Merchandise Price: Low/High	4.12	3.52	3.56	3.44	N.S.	<.10
3	Merchandise Quality: Low/High	3.92	3.32	3.76	3.68	N.S.	N.S.
[c]	Small/Large	2.52	2.76	2.76	3.00	N.S.	N.S.
[c]	Store Personnel: Unfriendly/Friendly	4.16	4.00	3.68	4.32	N.S.	N.S.
[c]	Merchandise selection: Inadequate/Adequate	3.04	2.72	2.68	3.40	<.10	N.S.
[c]	Merchandise style: Outdated/Up-to-date	4.12	3.56	2.80	3.24	N.S.	<.05
[c]	Closed/Open	3.76	3.60	3.68	3.56	N.S.	N.S.

[a]Numbers in parentheses are the average scores for each color treatment on scales loading on each factor and appropriate significance levels.
[b]Anchor to the left of the slash represents the lowest value (1) of the scale; that to the right represents the highest value (7).
[c]Scale does not load heavily on any factor (.5 or greater).
[d]N.S. = Not significant at $p < .10$

The results also allow an examination of how the impact of color translates to perceptions of the furniture/merchandise. Perceptions of merchandise quality did not differ across the color treatments, although these perceptions were significantly correlated with composite ratings on the activation dimension ($r = .41$, $p < .01$) and the evaluation dimension ($r = .38$, $p < .01$). A linear trend in the treatment means was found for perceptions of merchandise style ($p < .05$) and merchandise price ($p < .10$), with merchandise in the red environment being perceived as most up-to-date and higher in price. Merchandise in the green environment was perceived as relatively outdated. Regarding merchandise selection, a quadratic trend in the means was found ($p = .08$), with the blue environment being the most effective for enhancing these perceptions.

5. Discussion

In this paper, it was posited that there are at least two dimensions within human response to color. This "two dimensional" hypothesis was supported by the results. Retail store environments in the more extreme wavelength colors (red and blue) were perceived as more active environments. A distinct evaluative dimension was also found in consumers' ratings of the store environments, with the evaluations becoming steadily more positive as wavelength moved from red to blue. While the two dimensions have been found in perceptions of environments as a whole (Russell and Pratt, 1980), these results show that the dimensions also are found in a subset (color) of overall environmental cues.

Clearly, prior conceptualizations of color response have tended to simplify consumers' reactions to this particular peripheral cue. For example, attempts to generalize about the effects of black and white versus color advertisements (e.g., Childers and Houston, 1984) have ignored two important questions. In examining color response, we must first ask, What color? as the effects may be markedly different depending on the color of the ad. Second, we must also ask, What effect? because evaluative responses to a color can be quite different from the activation effects of the color.

The findings of this study have implications for future research to guide the selection of appropriate colors in a variety of consumer behavior contexts. For example, the activation dimension may be more relevant to impulse buying situations. An activated consumer may be more likely to engage in impulse buying. For this type of situation, the more activating colors such as red and blue are most appropriate, while moderate wavelength colors such as green should be avoided. For some consumer behavior contexts such as waiting in line, a lower level of activation may be more desirable.

In other contexts, evaluative considerations are paramount. To obtain more positive responses for constructs such as attitude toward an advertisement, shorter wavelength colors such as blue are likely to be most effective. Similarly,

in retail environments such as financial institutions, upscale jewelry stores, and exclusive restaurants creating an evaluatively pleasing atmosphere is more important than activating the consumer.

Results of the study also indicate that color can affect perceptions of the merchandise within the store environment. While perceptions of merchandise quality were not significantly impacted by store color, other aspects of merchandise perceptions were partially driven by the color of the store environment. For example, the finding that merchandise in a red environment was perceived as especially "up-to-date" may indicate that activation is more important than evaluation in driving perceptions of merchandise style, as red is most notable for its activating effects. Taken as a whole, the results suggest the use of red for retail environments where impulse buying of stylish merchandise is the goal.

While this study generated support for the "two-dimensions" hypothesis in consumers' perceptions of store environments, future research is necessary to determine whether the hypothesis generalizes to other consumer behavior contexts such as advertising (print, television, and direct mail), packaging, point-of-purchase materials, etc. Color effects in an advertising context seem to pose particularly interesting research questions. As described earlier, there is evidence that increased arousal can facilitate learning and thereby enhance advertising effectiveness (see Singh and Churchill, 1987; Kroeber-Riel, 1979). Perhaps colors such as red and (to a lesser extent) blue engender higher activation during the processing of an advertising message and thus result in higher recall of the message. Blue may offer the additional benefit of enhancing evaluative reactions to the advertisement. It is hoped that the present study will encourage future research that further develops our understanding of consumer response to color in a wider variety of contexts. Research examining the relative impacts of activation and evaluation would provide an especially useful contribution.

Finally, there are certain limitations of this analysis which should be kept in mind. Perhaps most importantly, the 'two dimensions' hypothesis implies a continuous function across the visible spectrum. This study provided results for only four colors. It is not known, for example, if results for colors such as blue-green, violet, or orange would follow the patterns found in this analysis. Second, this study examined color effects at the aggregate level. Personal characteristics such as color preference and preferences for lower versus higher activation levels may be important moderators of color effects, and could be examined using a within-subjects research design. Third, the 'two dimensions' hypothesis has been examined within the context of only one study. There are likely to be important situational variations in color effects. What works in a furniture store context may not be effective in other contexts (e.g., computer stores, travel agencies). Much more empirical evidence would be needed before we would conclude that there truly are two components to human response to color. Indeed, there could be *more* than two components that fully explain this phenomenon.

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