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THE EFFECT OF COLOR ON VIEWERS' RATINGS OF PAINTINGS*

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ABSTRACT

Sixty college students rated digitized facsimiles of 20 paintings on 12 semantic differential scales. The paintings represented two classes of content, landscape and portrait, and two styles, traditional and modern. Half the participants viewed the paintings in color, half in black and white. Removing color from portraits increased their perceived pleasantness and beauty and reduced tension. In contrast, removing color from landscapes reduced their perceived beauty. It is argued that for landscapes color may provide a critical channel for transmitting increased amounts of information such as depth. For portraits, color can be superfluous or even distracting.

Although art does not require color, the work of most artists, particularly painters, contains color. Yet little is known of its effect on the viewer. Most of the relevant research has been on color harmony, the suitability of juxtaposed colors (e.g., Helson & Lansford, 1970; Pieters, 1979; Polzella & Montgomery, 1993), but Hekkert and van Wieringen (1996) did examine viewers' reactions to paintings—with and without color—as part of a larger study of the impact of level of expertise

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on reactions. They found that removing the color from paintings decreased liking among average viewers. Two features of Hekkert and van Wieringen's experiment limit its generality. First, because color was manipulated within-subjects, there is a possibility that demand characteristics may have influenced the results. Indeed, the investigators hypothesized that the lack of color in paintings is felt by average observers to be a serious omission. Second, the paintings used by Hekkert and van Wieringen were in a common style (i.e., post-impressionistic) and did not include portraits.

In the present experiment color was manipulated between-subjects, and its effects were measured across two categories of content and style. Combining content and style with color is a sensible strategy for two reasons. First, content and style are known to have strong effects on viewers' reactions to visual art. For example, Berlyne (1973) and Polzella (2000), using the same measurement scales as those in the present experiment, reported robust effects across a variety of visual aesthetic stimuli and styles of paintings. Second, and more important, the aesthetic impact of color varies as a function of context. According to Kreitler and Kreitler (1972), "responses to colors in a painting interact not only with each other but also with responses to the contents and forms, on which they are partly dependent" (p. 78). (See, for example, Oyama, 2003.)

Assuming that the findings of Hekkert and van Wieringen (1996) are broadly applicable, we expect that removing the color from various kinds of paintings will lessen their appeal. And while the literature suggests also that the impact of color may be different for different subjects and styles of paintings, specific predictions are untenable.

METHOD

Participants

The participants were 60 introductory psychology student volunteers at the University of Dayton—10 males and 50 females (Mean age = 18.4, *SD* = 1.3). Their participation partially fulfilled a course requirement.

Stimuli and Apparatus

The stimuli were digitized color facsimiles of 20 representational paintings from the collection of the National Gallery of Art in Washington, D.C. (Whitely, 1983). The paintings were not randomly selected. Rather, they were chosen to represent two major classes of content, landscape and portrait, and two styles, traditional and modern. Ten of the paintings were landscapes, 10 portraits; and 10 were traditional in style, 10 modern. The titles and artists are listed in Table 1.

A Macintosh Quadra 700 computer running the ArtWare multimedia software (Brake, Polzella, & Kozar, 1997) provided full automation to the study, including

Table 1. Paintings Used in the Study

Traditional Landscape
The Mill (ca. 1645/1648) by Rembrandt van Rijn
Landscape with Merchants (ca. 1630) by Claude Lorraine
Stormy Landscape (1720s) by Marco Ricci
The Old Bridge (ca. 1775) by Hubert Robert
Italian Landscape (1790) by Joseph Wright of Derby
Modern Landscape
A Spring Landscape (ca. 1935) by Pierre Bonnard
Landscape at Le Pouldu (1890) by Paul Gauguin
Mountains at Collioure (1905) by André Derain
Church and Farm at Eragny (1890) by Camille Pissarro
The Bridge at Beaugency (1944) by Jacques Villon
Traditional Portrait
The House of Cards (ca. 1735) by Jean-Baptiste-Siméon Chardin
Mrs. Davenport (1782-1784) by George Romney
John Randolph (1805) by Gilbert Stuart
Louis Husson (1889) by Thomas Eakins
Baldassare Castiglione (ca. 1515) by Italian School
Modern Portrait
Self-Portrait (1889) by Paul Gauguin
Head of Christ (1909) by Emil Nolde
Le Gourmet (1901) by Pablo Picasso
Woman with Red Hair (1917) by Amedeo Modigliani
Portrait of a Man (1919) by Erich Heckel

the display of each work and the prompting and storing of the participants' reactions. Two monitors were used, placed side by side, approximately one-half meter apart. The right-hand monitor (Sony 13 in. Color Video Monitor PVM-1390) was used to display the works. The images ranged in size from 187 cm^2 to 403 cm^2, averaging 272 cm^2. The left-hand monitor (Macintosh 16 in. Color Display) was used to gather the ratings.

Rating Scales

Participants indicated their reactions to each painting on twelve 7-point bipolar rating scales: 1. SIMPLE-COMPLEX, 2. DISPLEASING-PLEASING, 3. UNINTERESTING-INTERESTING, 4. UGLY-BEAUTIFUL, 5. WEAK-POWERFUL, 6. PASSIVE-ACTIVE, 7. UNBALANCED-BALANCED, 8. CLEAR-

INDEFINITE, 9. no pleasure-extreme pleasure, 10. no discomfort-extreme discomfort, 11. relaxed-tense, 12. drowsy-alert. The scales were the same as those used by Berlyne (1973) to measure viewers' reactions to various aesthetic stimuli, including paintings. Berlyne chose these scales because they had been used extensively in previous studies, and their psychometric properties were well understood. The first eight scales (those in upper case) are for judging stimulus characteristics, whereas the last four (those in lower case) are for viewers' self-reported motivational state.

Procedure

Participants were tested individually, seated approximately one meter from the viewing monitors. The works were displayed on the right-hand monitor one at a time in random order and each work remained visible while it was being rated. The rating scales were displayed on the left-hand monitor, also one at a time and in random order. Participants indicated their ratings by clicking a mouse at the desired position along each 7-point scale, e.g., simple-complex. Half the participants viewed the paintings in color, half in black-and-white. The three-factor mixed design included two within-subjects variables—Content (landscape versus portrait) and Style (traditional versus modern) and one between-subjects variable—Condition (color versus black-and-white).

RESULTS

The analyses of the effects of Content, Style, and Condition were applied to mean ratings obtained by averaging over the respective categories of paintings, an appropriate procedure given sufficient internal consistency in the ratings. Prior to obtaining these means, then, the internal consistency of the ratings was determined by computing Cronbach alpha coefficients for each classification, i.e., traditional landscape, modern landscape, traditional portrait, and modern portrait. Internal consistency was quite high. Alphas ranged from .79 to .91 with a mean of .84.

Stimulus Characteristics

A repeated measures multivariate analysis of variance was used to test for differences among the mean ratings on the stimulus characteristics scales 1 through 8. The main effect of Content was not significant, $F(8, 51) = 1.15, p > .10$, but there was a significant Content by Condition interaction, $F(8, 51) = 4.93$, $p < .001$, $\eta^2 = .44$. Significant univariate interactions were found for Scale 2 (displeasing-pleasing), $F(1, 58) = 19.58$, $p < .001$, $\eta^2 = .25$ and Scale 4 (ugly-beautiful), $F(1, 58) = 19.24, p < .001, \eta^2 = .25$. These interaction effects are plotted in Figures 1 and 2. They were analyzed further by comparing the black-and-white and color versions of landscapes and portraits, separately. On scale 2, viewers

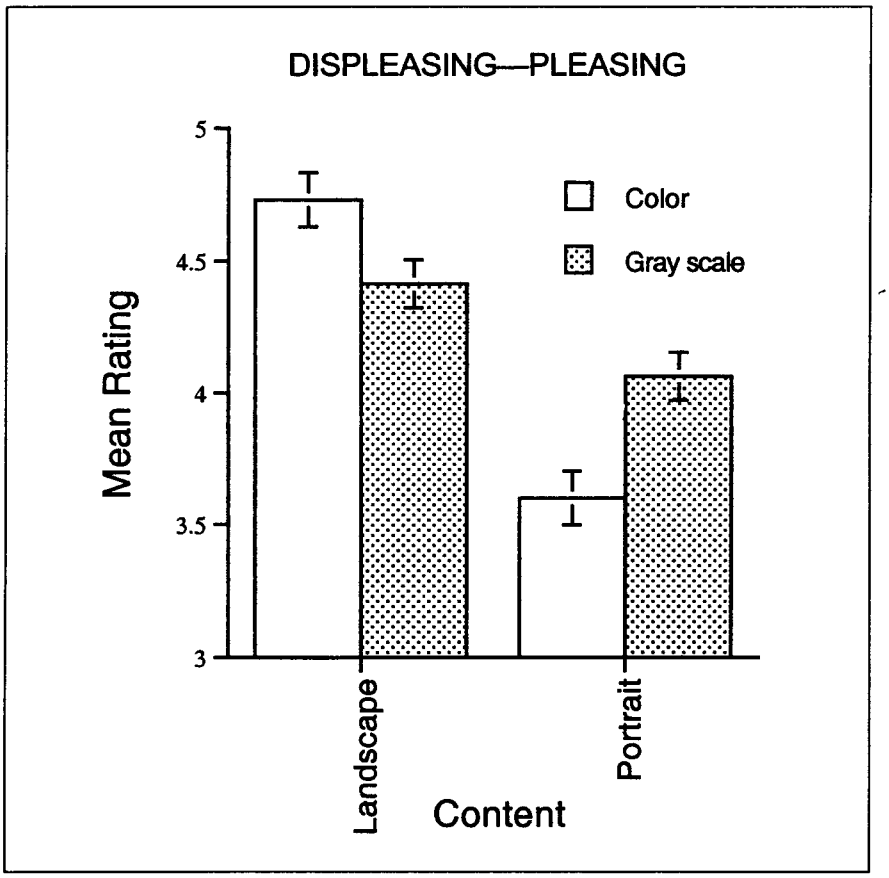

Figure 1. Mean rating (and standard error) of pleasantness as a function of painting content and color.

judged the black-and-white versions of portraits as more pleasing than the color versions ($p < .01$). The difference in pleasantness between black-and-white and color landscapes (color versions rated higher) was marginal ($p < .10$). On scale 4, viewers judged the black-and-white versions of portraits as more beautiful than the color versions ($p < .01$). In contrast, viewers judged the color versions of landscapes as more beautiful than the black-and-white versions ($p < .05$).

The Style by Condition Interaction was not significant, $F(8, 51) = 1.68, p > .10$. However, there was a strong main effect of Style, $F(8, 51) = 58.16, p < .001$, $\eta^2 = .90$. Significant univariate effects were found for every scale except

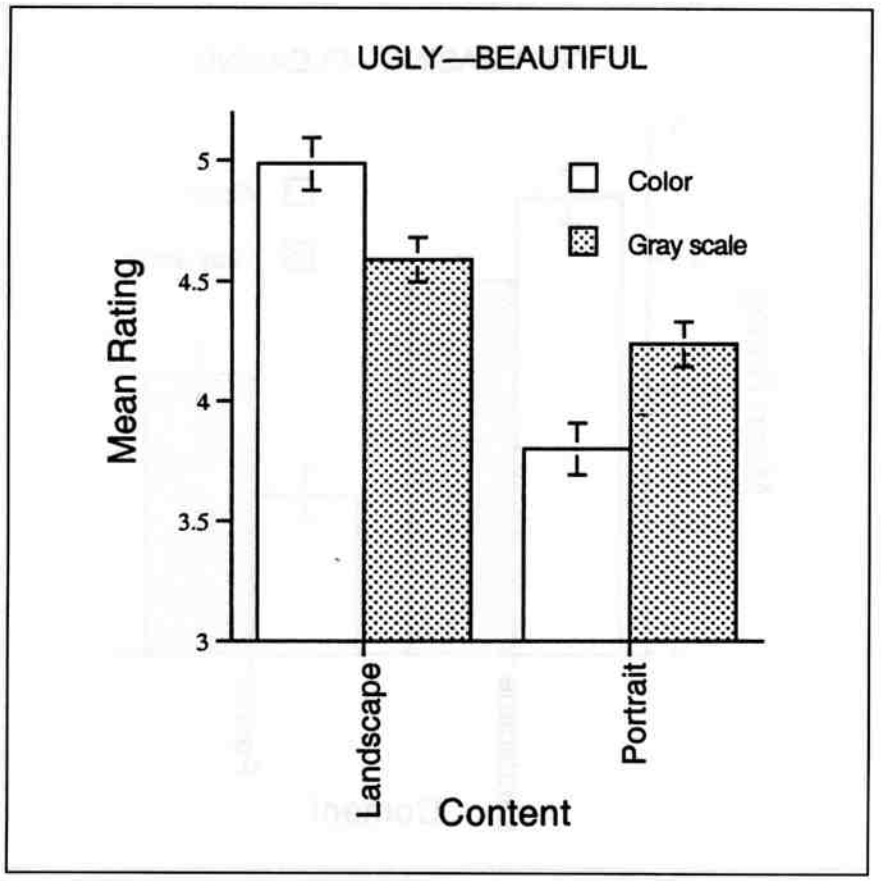

Figure 2. Mean rating (and standard error) of beauty as a function of painting content and color.

uninteresting-interesting. In general, traditional paintings reflected more favorable stimulus characteristics.

Motivational State

A repeated measures multivariate analysis of variance was used to test for differences among the mean ratings on the motivational state scales 9 through 12. The main effect of Content was not significant, $F < 1.0$, but there was a significant Content by Condition interaction, $F(4, 55) = 5.27$, $p < .001$, $\eta^2 = .28$. Significant univariate interactions were found for scale 9 (no pleasure-extreme pleasure), $F(1, 58) = 14.12$, $p < .001$, $\eta^2 = .20$, scale 10 (no discomfort-extreme discomfort),

$F(1, 58) = 4.14$, $p < .05$, $\eta^2 = .07$, and scale 11 (relaxed-tense), $F(1, 58) = 5.75$, $p < .025$, $\eta^2 = .09$. These interactions were analyzed further by comparing the black-and-white and color versions of landscapes and portraits, separately. Significant effects were observed on scales 9 and 11. They are plotted in Figures 3 and 4. Viewers judged the black-and-white versions of portraits as more pleasurable ($p < .01$) and more relaxing ($p < .05$) than the color versions. There were no significant differences between black-and-white and color landscapes.

The Style by Condition interaction was not significant, $F(4, 55) = 1.37$, $p > .10$. However, there was strong main effect of Style, $F(4, 55) = 12.60$, $p < .001$,

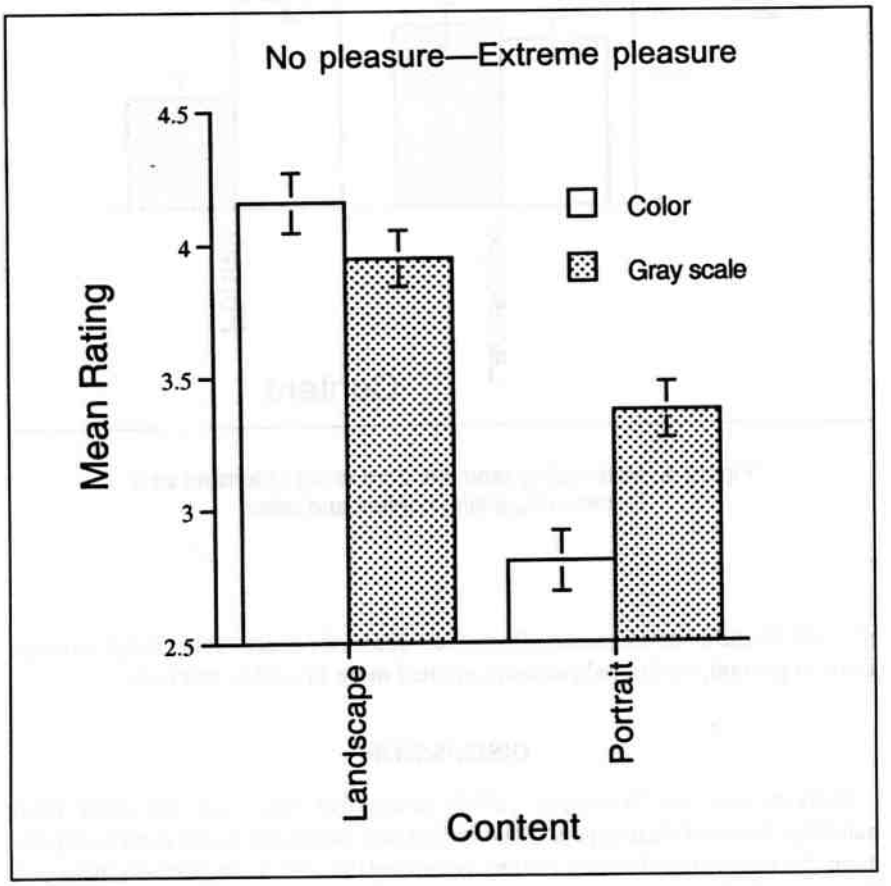

Figure 3. Mean rating (and standard error) of pleasure as a function of painting content and color.

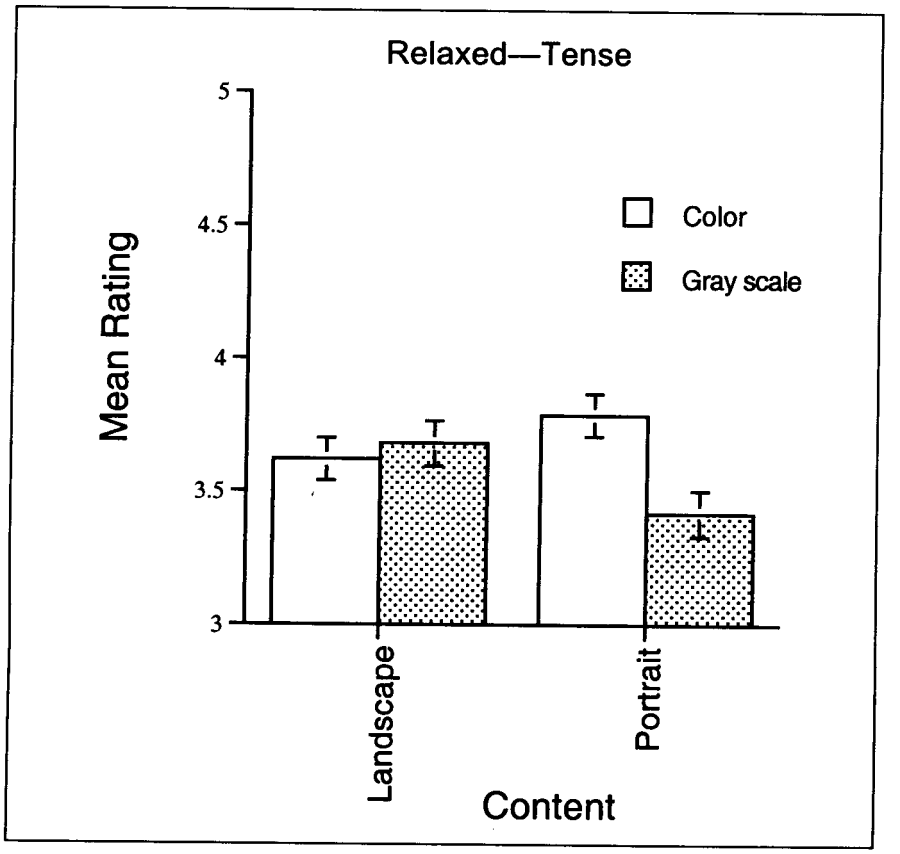

Figure 4. Mean rating (and standard error) of tension as a function of painting content and color.

$\eta^2 = .48$. Significant univariate effects were found for every scale except drowsy-alert. In general, traditional paintings elicited more favorable reactions.

DISCUSSION

Hekkert and van Wieringen (1996) found that removing the color from paintings lessened their appeal. This finding was supported in the present experiment, but only for landscapes. Instead, removing the color from portraits increased their appeal. Since portraits were not included among the paintings used by Hekkert and van Wieringen, it would appear that their findings generalize only to certain categories of paintings. Why might color enhance the aesthetic appeal

of one type of painting while detracting from the aesthetic appeal of another type? Differences between the perceptual processing demands of landscapes and portraits help to answer this question.

Notwithstanding their distinctiveness, all portraits depict persons and thus convey a core of redundant information. In contrast, landscapes depict general aspects of nature and thus convey a greater range of information. There is evidence that color provides a critical channel for transmitting this increased information. Wright (1983, cited by Solso, 1994, p. 173), for example, showed that there is a physical basis for colors acting as cues to depth, due to the fact that different colors come into focus at slightly different distances from the eye. More recently, Laarni (2001) found that color cues facilitated visual response speed and accuracy, particularly when processing load was high. Snowden (2002) demonstrated that color was as effective as luminance in capturing attention and concluded that color is an important cue not only for target identification but also for target detection and localization.

What about the perceptual processing of portraits? A fundamental characteristic of the portraits used in this experiment was the presence of a human face. Recent evidence indicates that the primary neuropsychological mechanisms underlying human face perception are distributed between posterior and anterior cortical locations. Tong, Nakayama, Moscovitch, Weinrib, and Kanwisher (2000), for example, used functional magnetic resonance imaging (fMRI) to measure the response characteristics of the fusiform face area (FFA), a region of the extrastriate cortex. The FFA was strongly responsive to a wide variety of animate and inanimate faces while less responsive to specific features, such as eyes or heads, suggesting that the FFA is linked to the phenomenal experience of face perception. Vignal, Chauvel, and Halgren (2000) found they could elicit face-related hallucinations, illusions and distortions by stimulating areas of the right ventrolateral prefrontal cortex (VLPFC). These findings and those of Tong, et al. (2000) suggest that face perception is a holistic process involving feedback between the primary FFA and secondary VLPFC projection areas.

Understanding the role of color in visual information processing and the neuropsychological mechanisms underlying face perception helps explain why color had different effects on landscapes and portraits. The evidence suggests that color enhances the processing of a landscape painting by facilitating the detection, identification, and location of its contents. A colorless landscape is relatively impoverished because it lacks information that is critical to its interpretation and, hence, its aesthetic appeal. In the case of a portrait, color is less critical for the detection and identification of its subject. This fact could account for the absence of a portrait color effect, but it does not explain why the aesthetic appeal of portraits was lessened when color was added.

A study by Allison, McCarthy, Nobre, and Puce (1994) helps provide a more complete explanation. Electrophysiological activity was recorded in the striate and extrastriate cortex while subjects viewed a variety of visual stimuli, including

faces, words, numbers, and colors. They found that visual processing in these areas was "modularized" into four separate streams, depending on the particular stimulus. Thus, face and color perception reflect separate neuropsychological processes. We conclude that the effects of color on viewers' reactions to paintings depend on the paintings' contents. Color enhances reactions to landscapes because it facilitates the extraction of critical information. Color attenuates reactions to portraits because it provides superfluous information while adding to the processing load.

Although it was not a primary focus of this experiment, the effect of painting style on viewers' reactions warrants some comment. In general, viewers preferred the traditional paintings to the modern ones, which is consistent with the findings of Polzella (2000). Of greater interest is the apparent absence of any interaction between color and style, which suggests that color has a similar impact across various styles of painting. Because we employed a rather coarse distinction between traditional (pre-20th century) and modern (post-20th century) paintings—one that reflected chronological rather than stylistic differences—this hypothesis, though plausible, must remain speculative.

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