Color Preference

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Synonyms

Color aesthetics; Color harmony; Favorite colors

Definition

How much people like different colors.

Overview

One of the most fascinating aspects of the perception of colors is that people have relatively strong preferences, liking certain colors and color combinations much more than others. This entry discusses what is known about human color preferences, not only in terms of *which* colors and color combinations people like but also *why* they like them.

Preference for Single Colors

Average relative color preferences for a given sample of colors are typically measured behaviorally by asking a group of people to perform one of three tasks. First, the observers can be asked to indicate which of two simultaneously presented colors they prefer for each possible pair of colors in the sample. The probability, averaged over observers, of choosing each color versus all other sample colors is then taken as a measure of its average relative preference within that sample. Second, observers can be shown all of the colors in the sample simultaneously and be asked to rank order them from most preferred to least preferred. The average rank of each color across observers provides a measure of average relative preference within the sample. Third, observers can be shown a single color on each trial and be asked to rate their preference for it on a discrete (e.g., 1–7) or continuous (e.g., marking along a line segment) rating scale. Average ratings across observers can then be taken as a measure of average relative preference for colors within the sample. Correlations among these different measures tend to be quite high when the same observers (or large samples of different observers from the same population) judge the same colors.

Although early researchers often claimed that color preferences were simply too idiosyncratic to be worth an empirical study, modern measurements of well-calibrated, computer-generated displays of standardized colors using improved data analysis techniques have now established that there are indeed reliable and repeatable patterns in group data [1]. These average color preferences are most easily understood in terms of the three primary dimensions of human color experience (see entry for ► Psychological color space and color terms): hue (its "basic color"), saturation (how vivid or pure the

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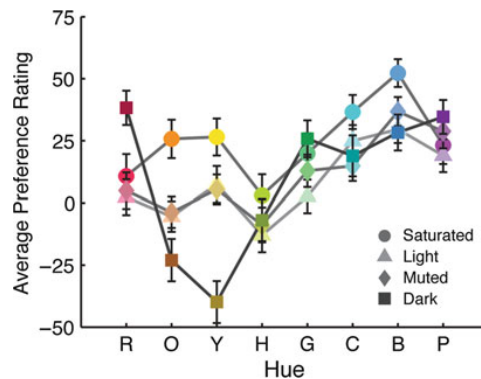*Email: palmer@cogsci.berkeley.edu

Fig. 1 Color preference ratings in the USA as measured by Palmer and Schloss [2]. Preferences for the saturated, light, muted, and dark colors are plotted as a function of hue: red (R), orange (O), yellow (Y), chartreuse (H), green (G), cyan (C), blue (B), and purple (P)

color is), and lightness or brightness (how light versus dark the color is). Figure 1 plots average adult preference ratings in the USA for a wide gamut of 32 chromatic colors, consisting of eight hues – red, orange, yellow, chartreuse (yellow green), green, cyan (blue green), blue, and purple – in shades that are either highly saturated, light, muted (desaturated, mid-level lightness), or dark [2].

As Fig. 1 shows, average color preferences show a clear maximum around saturated blue and a clear minimum around dark yellow (greenish brown or olive). The majority of this variation is due to differences along the blue-to-yellow dimension of hue, with bluer colors being generally preferred to yellower colors. There is much less variation in the red-to-green dimension. In addition, people generally prefer more saturated colors over less saturated ones, with little difference between the light (pastel) and muted tones, at least in the USA (see the entry for ► Comparative (cross-cultural) color preference). The most interesting finding theoretically is the rather striking difference between the shape of the hue preference curve for the dark colors versus those for the Munsell chroma matched light and muted colors. In particular, there are dramatic decreases in preference for dark orange (brown) and particularly for dark yellow (greenish brown, or olive) relative to the light and muted oranges and yellows, but there are also modest increases in preference for dark red and dark green relative to the light and muted reds and greens [2]. Although gender differences among American adults are relatively slight, men like saturated colors more than women do, whereas women tend to like muted colors more than men do [3]. The overall pattern of preferences for single colors is thus complex but clear and replicable. For a more extensive review of modern studies of single color preferences, the reader is referred to Whitfield and Wiltshire [1].

Infant Color Preferences

Infant color preferences are studied by examining the looking behavior of babies when they are shown pairs of colors side by side. It is generally assumed that the color at which the baby looks longer and/or first is preferred to the alternative. Color preferences are therefore measured by determining the average looking times and/or the probabilities of first looks [4]. Infants younger than about 3–4 months tend not to be studied because the short-wavelength sensitive cones do not mature until that age, making them functionally color deficient relative to adults (see entry on ► Development of Color Perception).

When infant looking preferences are measured for highly saturated colors, the hue preference function tends to have roughly the same shape as the corresponding adult hue preference function, with a peak around blue and a trough around yellow to yellow green [5]. Great care has to be taken to ensure that hue-based color preferences actually reflect differences in hue by controlling for luminance, brightness,

discriminability, colorimetric purity, and saturation. More recent studies that directly compared infant preferences with those of adults for less saturated, but better matched, colors have found important differences, however. In particular, infant preferences for these color samples vary primarily on the red-to-green dimension, with redder colors being more preferred, and do not vary much on the blue-to-yellow dimension [6]. Because this pattern for infants is opposite that for adults, color preferences must either be subject to learning as a result of experiences with differently colored objects or there must be a substantial maturational process that influences color preferences.

Color Preferences in Different Contexts

A question of considerable applied interest is how adult color preferences for patches of "context-free" colors, as described above, generalize to preferences for colored objects. Clearly, they do not generalize for natural objects that have prototypical colors, because yellow bananas and red strawberries are strongly preferred to blue ones, but better generalization is evident for artifacts that could, in principle, be produced in virtually any color, such as shirts, walls, sofas, and cars.

Schloss, Strauss, and Palmer [7] studied preferences for the same 32 colors graphed in Fig. 1 when they were judged as the colors of walls, trim, couches, throw pillows, dress shirts/blouses, ties/scarves, and T-shirts. They found that the shape of the hue preference function for context-free colored squares (i.e., as in Fig. 1, but averaged over different lightness and saturation values) was largely the same as that of hue preference functions for all the different object contexts they studied. The only clear exceptions were that large, red objects (e.g., walls, trim, and couches) were liked less than smaller red objects. In contrast, there were marked differences in preferred lightness and saturation levels across different objects, often depending on practical considerations, such as walls being preferred in lighter tones that make rooms appear more spacious and couches being preferred in darker shades that hide dirt. And although saturated colors are generally the *most* preferred colors for context-free squares of color (see above), they are actually the *least* preferred colors for all of the objects tested. Other researchers have found similar results: although context-free color preferences are dominated primarily by hue, object-specific color preferences were more strongly affected by lightness and saturation levels (e.g., in car colors, with darker tinted/shaded colors being more preferred than lighter, grayish colors) [8]. Even within the basic-level object category of cars, however, Schloss et al. found striking differences: the most preferred colors for a luxury sedan were achromatic (black, gray, or white), consistent with their conventional formality as serious, sophisticated cars, whereas color preferences for a VW "Bug" tended toward brighter, warmer, more saturated colors (e.g., yellow), consistent with their conventional informality as fun, sporty cars [7]. Such results can be interpreted as weaker cases of the prototypical banana and strawberry examples mentioned above but reflecting sociocultural conventions rather than natural prototypes. Emotional reactions to colors can also be important in preferences for colors chosen for different residential rooms. People prefer room colors to correspond with their desired feeling when inhabiting the room: e.g., light blue is preferred for the living room because it feels calm, whereas "near white," green, blue, and yellow are preferred for the bathroom because they feel hygienic and/or pure [9].

Theories of Color Preference

Thus far this entry has focused on describing *which* colors people like and dislike. But *why* do they like the ones they do? Indeed, why do people have color preferences at all? Although color in the natural world sometimes carries significant information (e.g., about ripe versus unripe fruit), it is relatively inconsequential in most modern artifacts (see above). Several theoretical explanations of color preference have been proposed and tested, including ones grounded in physiology, psychophysics, emotion, and ecological objects. Because all of these models have been tested against the data shown in Fig. 1, those data will be used as a benchmark.

The most physiologically oriented theory [10] suggests that people like colors to an extent that depends on a weighted average of cone contrasts relative to the background believed to be computed very early in

visual processing: L−M and S−(L + M), where S, M, and L represent the outputs of cones maximally sensitive to short, medium, and long wavelengths of light (see entry on ▶ Retinal Cone Contrasts). Hurlbert and Ling's model fits their own data very well (accounting for 70 % of the variance) but fits the data in Fig. 1 only about half as well (37 %), no doubt because their sample of colors did not include the highly saturated and nameable colors in Palmer and Schloss's [2, 3] color sample.

A related but purely psychophysical hypothesis is that color preferences are based on conscious color appearances. Palmer and Schloss [2, 3] tested this possibility using a weighted average of observer-rated redness-greenness, blueness-yellowness, saturation, and lightness of each color, roughly analogous to their coordinates in the Natural Colour System (see entry on ▶ Color Order Systems). This model did a much better job in accounting for the data in Fig. 1 (60 % of the variance), suggesting that a later, conscious representation of color provides a better basis for color preference than an early, nonconscious, one based on retinal cone contrasts.

A third type of explanation can be constructed in terms of the emotional associations of colors. The basic hypothesis is that people may like colors to the extent that they like the emotions that are evoked by or associated with those colors. Ou et al. measured *color emotions* through subjective judgments of many emotion-related terms and related those ratings to color preferences [11]. Their results showed that three factor-analytic dimensions underlay color emotions: *active-passive*, *light-heavy*, and *cool-warm*, explaining 67 % of the variance in their preference data. Palmer and Schloss fit observers' subjective ratings of these dimensions to the data in Fig. 1 and found that it accounted for 55 % of the variance, with people liking *active*, *light*, and *cool* colors more than *passive*, *heavy*, and *warm* ones [2, 3].

The ecological valence theory (EVT) of color preference was formulated by Palmer and Schloss to test the hypothesis that people like colors to the degree that they like the environmental objects that are characteristically those colors [2, 3]. For example, people tend to like blues and cyans because they like clear sky and clean water, and they tend to dislike browns and olive colors because they dislike feces and rotting food. The theoretical rationale of the EVT is that it will be adaptive for organisms to approach objects and situations associated with the colors they like and to avoid objects and situations associated with the colors they dislike to the extent that their color preferences are correlated with objects and situations that they like versus those that they do not like. They reported strong support for the EVT through empirical measurements of the weighted affective valence estimates (WAVEs) for the 32 chromatic colors in Fig. 1. The WAVE for each color measures the extent to which people like the objects that are associated with that color. It was computed from observers' average valence (liking/disliking) ratings for *all* things named as associates for each color studied, with each valence rating being weighted by the similarity of the given color to the color of that associate. Although blue is strongly associated with objects that are almost all liked (e.g., clear sky, clean water, swimming pools, and sapphires), most colors have associates with both positive and negative valences. Nevertheless, the average WAVE, computed as specified above, explained 80 % of the variance in the data shown in Fig. 1 with no estimated parameters. This does not mean that color preferences are irrelevant to object preferences: clearly they matter for functionally identical artifacts that are available in many colors (e.g., clothes, furniture, cars, and appliances). However, the EVT suggests that those preferences arose initially from associations with characteristically colored objects and were then positively or negatively reinforced to the extent that people have positive or negative experiences with them.

Preference for Color Combinations

Chevreul formulated the most influential art-based theory of color harmony (or color preference, because he used the terms interchangeably), which claimed that there are two distinct types: *harmony of analogous*

colors and *harmony of contrast* [12]. In brief, harmony of analogous colors includes *harmony of scale* (colors of the same hue that are similar in lightness) and *harmony of hues* (colors that are similar in hue and the same in lightness). Harmony of contrast includes *harmony of contrast of scale* (colors of the same hue that differ in lightness), *harmony of contrast of hues* (colors of similar hue that differ in lightness), and *harmony of contrast of colors* (colors that are different in both hue and lightness). Other theories include Itten's claim that combinations of colors are harmonious provided that the colors produce neutral gray when mixed as paints and Munsell's and Ostwald's theories that colors are harmonious when they have certain relations in color space (e.g., they are constant in hue and saturation but vary in lightness) [13]. None of these theories was formulated on the basis of aesthetic measurements, although some have since been tested empirically.

Empirical Research on Color Pair Preference/Harmony in Combinations

Schloss and Palmer attempted to clarify the confusion surrounding preferences for color pairs by explicitly distinguishing among three different concepts: *pair preference*, *pair harmony*, and *figural preference* for a color against a colored background [14]. They defined *pair preference* as how much an observer *likes* the combination of the two colors as a whole. They defined *pair harmony* as how well the two colors *go together*, regardless of whether the observer likes the combination or not (analogous to the distinction between harmony and preference in music, wherein nearly everyone agrees that Mozart's music is more harmonious than Stravinsky's, but some prefer Mozart and others prefer Stravinsky). They defined *figural preference* as how much the observer likes the single color of the figure when viewed against a different color in the background. Although figural preference involves a judgment about the single color of the figure, it is relevant to preferences for color combinations because the same color can look strikingly different on different background colors (see entry on ▶ Simultaneous contrast, simultaneous brightness contrast, simultaneous color).

Figure 2a shows average preference ratings for color pairs as a function of the hue of the figure (x-axis) and that of the ground (the different curves). The primary pattern in the data is that, for every background hue, people prefer combinations in which the figure has the same or a very similar hue. Clearly, people tend, on average, to like color combinations that are the same or similar in hue but differ in lightness, which Chevreul called harmonies of analogous colors. There is no evidence for Chevreul's harmonies of contrast, however, because there are no reliable increases in the functions at opposite hues (e.g., red and green). A secondary fact is that people tend to like color combinations to a degree that reflects their preferences for figure and ground colors, with combinations on blue backgrounds being generally most
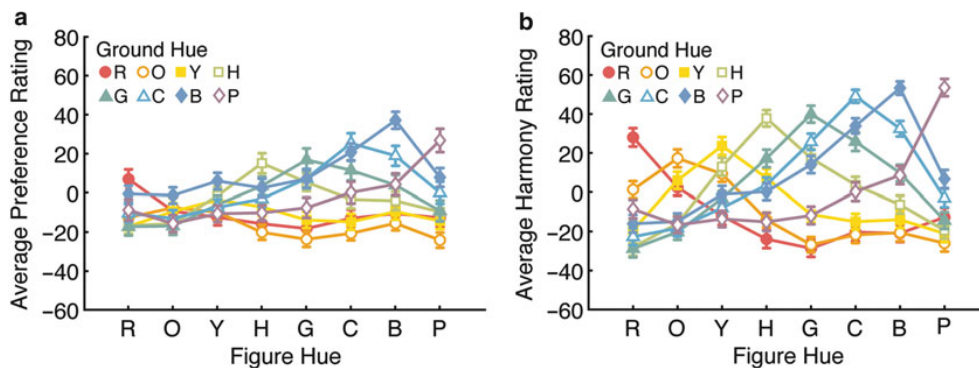

Fig. 2 Rated preference (**a**) and harmony (**b**) for pairs of colors as a function of the figural hue (x-axis) and ground hue (different curves)

preferred and those on orange backgrounds being least preferred. This tendency is relatively minor, however, accounting for only 22 % of the variance in preference ratings.

Harmony ratings of the same color pairs are plotted in Fig. 2b. Clearly, they are very similar to the preference ratings (r = +.79), except that the peaks at same-hue combinations are even more pronounced. This high correlation largely explains why preference and harmony have so often been equated: fully 62 % of the variance in preference ratings is explained by harmony ratings. An additional 14 % of the variance can be explained by including preferences for the individual figure and ground colors, explaining a total of 76 % of the variance in people's color preferences for figure-ground combinations.

Ratings of figural preference for colors against colored backgrounds are measurably different from ratings of both pair preference and pair harmony, showing clear effects due to the hue contrast and lightness contrast of the figure against the background: warm figures (e.g., red, orange, and yellow) were preferred against cool backgrounds (e.g., green, cyan, and blue) and vice versa [14]. It appears that what Chevreul termed harmonies of contrast actually apply to judgments about preferences for figural colors when viewed against different colored backgrounds. Given the general preference for saturated colors described previously, it is not surprising that observers prefer figural colors against highly contrastive background hues, because these would produce the strongest simultaneous color contrast effects, thus increasing the perceived saturation of the figural region.

Theories of Preferences for Color Combinations

The foregoing describes which color combinations people prefer and which ones they find harmonious, but why do these variations in preference and harmony arise? To the extent that pair preferences are influenced by preferences for the component colors, ecological associations of colors with objects are one important factor. Pair preferences are also influenced by people's positive/negative associations with objects and/or institutions that are associated with those colors in combination. For example, Schloss, Poggesi, and Palmer [15] investigated preferences for school colors among Berkeley and Stanford students: blue and gold for Berkeley and red and white for Stanford. They found that Berkeley students liked Berkeley color combinations better than Stanford students did and Stanford students liked Stanford colors better that Berkeley students did, with these effects increasing with increasing amounts of self-rated school spirit. Such results clearly imply that ecological effects are present in preference for color combinations as well as for individual colors.

Perhaps the most important finding about preferences for color pairs is that people generally like harmonious combinations of the same (or similar) hue that differ in lightness. Although it is not immediately obvious why this might be the case from an ecological viewpoint, Schloss and Palmer suggested that color harmony might stem from ecological color statistics in natural images corresponding to different areas of the same ecological object [14]. A red sweatshirt, for example, would be darker red where it was in shadow and lighter red where it was brightly illuminated. Accordingly, pairs that are judged to be most harmonious (i.e., that "go together" best) may, in fact, be those that are most likely to co-occur within the same object in natural images.

Acknowledgments

Cross-References

▶ Development of Color Perception
▶ Psychological Color Space and Color Terms
▶ Simultaneous Color Contrast

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