

The Effects of Color to People's Emotion and Behavior

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Abstract. This paper examines the profound impact of color on human psychology and behavior through biological, cognitive, and sociocultural lenses. From a biological perspective, specific wavelengths of light trigger innate autonomic nervous system responses, with red shown to increase arousal and blue to promote calmness. Cognitively, color perception is filtered through learned associations and cultural stereotypes, leading to significant variations in meaning across different societies. Sociocultural, color is strategically employed in marketing, environmental design, and the reinforcement of social norms, though these meanings are fluid and historically contingent. Evidence from neuroscience, cross-cultural studies, and applied fields demonstrates that color acts as a powerful non-verbal communication system. A key conclusion is that effective application requires moving beyond simplistic rules. Instead, it must integrate an understanding of universal physiological reactions with the deep-seated, culturally specific codes that shape our subjective experience of color, acknowledging that our perception is a product of both biology and culture.

Keywords: Color, psychological functioning, emotion, behavior

1. Introduction

Color plays a huge role in our everyday lives. We have different feelings about different colors, and colors convey messages depending on the situation. For example, red generally conveys a feeling of energy. On the other hand, blue usually gives a sense of calm and relaxation. The thought that color can produce moods, feelings, and emotions has been recognized by artists and designers for many years. Pablo Picasso states, "Colors, like the features, follow the changes of the emotions [1]." But the importance of colors in our lives is not recognized. The effects of colors on people are far beyond what artists and designers have conceived. Research indicates that color will affect mood, cause physical reactions, and affect speech behavior. Different colors have their associations with physical effects. For example, purple is associated with an increase in blood pressure, a stimulation of the metabolism, easily tired eyes, and other effects [2]. The research of Elliot, "Color and psychological functioning: The effect of red on performance attainment," shows that seeing red just before an examination could be detrimental to examination performance [1]. In the first of the 6 experiments here, 71 college students in the United States saw a number assigned to them in participant numbers in the colors red, green, or black and took a five-minute test. The results were

that the students receiving the red numbers scored over 20% less than the students who received the green and black numbers.

Based on the above research, the way that color affects people in daily life can be surprising and unconscious. Therefore, this research aims to sort out the influence of colors on individual behavior and emotions from a psychological perspective. Based on empirical research, this paper focuses on summarizing color's effect on individuals' emotions and behavior, investigating how color affects people biologically, how color affects people through mindset, like stereotypes, and what behavior and emotions these effect leads to the performance of individuals.

2. Biological aspect

From a neuroscience perspective, color processing involves multi-stage neural processes. When the human eye perceives different colors, multiple regions of the brain produce several reactions. The visual cortex first processes raw color information, followed by activation of the amygdala (emotion center) and hypothalamus (autonomic nervous system regulator). This process explains why colors can trigger rapid emotional and physiological reactions [3].

Different colors have differentiated effects on the autonomic nervous system. Research has shown that warm tones such as red and orange can stimulate sympathetic nervous system activity, increase heart rate and blood pressure, and create excitement or tension [4]; and cool tones (such as blue and green) activate the parasympathetic nervous system, reduce cortisol levels, and help relax emotions. Specifically, a red environment can increase anxiety scores by 15%, while a blue environment can improve creative thinking test scores [5].

Anderson and De Rosa's research challenges the traditional cognitive model that posits perception as a precursor to affective evaluation. Their work demonstrates that affective responses are, in fact, integral to the perceptual process itself. Through a two-part experiment, participants were conditioned to associate specific colors (red or blue) with monetary rewards. Results indicated a significant bias: even when colors were displayed simultaneously, individuals with a reward-sensitive predisposition who associated blue with reward reported perceiving blue first. Neuroimaging (fMRI) confirmed activation in the mesolimbic reward system during color perception, illustrating that top-down motivational states can alter basic sensory processing. This suggests that color perception is not a passive registration of objective reality but is actively shaped by learned associations and individual neurobiological predispositions. The findings underscore the profound subjectivity of perception, with implications for understanding cognitive biases in broader social contexts [6].

The study of color and its influence on psychology and behavior was brought to light by Goethe in his book *The Theory of Colors*. In this work, he classifies color in various ways and gives certain meanings to them; for example, the "plus" colors of yellow, red, yellow, and yellow red. Also, the relationships of these colors to emotions, such as warmth and stimulation [1]. Goldstein emphasizes Goethe's general theory and states that some of the colors, such as red and yellow, give rise to systematic physiological reactions, which give rise to the emotional experiences, such as negative arousal, or cognitive orientation, such as awareness of external stimuli, and overt behavior, which is vigorous activity. The later theories developed from the ideas of Goldstein have had to do with wavelength, in which it has been shown that colors with longer wavelengths (generally red or orange) give rise to stimulation or warmth of feeling, while colors with short wavelengths give rise to rest or coolness (blue and purple). Another statement of the idea of color and its association with psychological functioning has to do with the general associations that man makes with colors and their consequent influence on affect, cognition, and overt behavior. Last of all, considerable writing

has been published concerning color and its influence on psychological functioning, which has been entirely theoretical, and which has had as its subject of research investigation certain definite problems, such as the influence of color in texts on the educational achievement of learners. All the research, theories, concepts, etc., mentioned above are interesting and stimulating research problems in the field of color and psychological functioning.

3. Cognitive aspect

The symbolic meaning of color has both cultural universality and cultural specificity. For example, red is lively and unrestrained, symbolizing joy and progress; Green is the color of life, displaying the vitality and vigor of youth. However, although different ethnic groups have a generally consistent understanding and perception of the true nature of nature, due to differences in cultural backgrounds such as ethnic customs, geographical environments, ways of thinking, religious beliefs, and national psychology, as well as differences in language expression, various colors have different associations, symbolic meanings, and implied meanings for different ethnic groups in terms of visual and psychological aspects [7].

The cultural differences in color meanings are particularly evident in cross-cultural contexts. For example, in Western culture, white is often associated with weddings and purity, while in some Asian cultures, white is associated with mourning and funerals. Similarly, red in China represents joy and good luck, while in some cultures it represents danger or radicalism. Purple was once exclusive to royalty in Europe, but in Brazil, it is associated with funerals; Green is sacred in Islamic culture, but in some regions, it represents jealousy. These differences mean that color applications must consider cultural backgrounds, especially in globalized marketing and design projects [8].

Color is also closely related to social stereotypes, especially in the field of gender. Traditionally, there have been stereotypes (pink female, blue male), but now more and more brands are breaking boundaries and using neutral or non-traditional colors. The formation of this color gender association is mainly a social construct rather than a biological instinct, reflecting how colors are used to reinforce or challenge social norms [9].

4. Sociocultural aspect

4.1. Marketing and consumer behavior

In the field of marketing, color is widely used to influence consumer behavior and brand awareness. Successful brands are well-versed in the principles of color psychology and use strategic color choices to convey specific brand values. Fast food chains often use a combination of red and yellow because red stimulates appetite and yellow conveys happiness; Technology companies prefer blue because it conveys trust and reliability; Luxury goods prefer black and gold combinations to create exclusivity. Research has shown that the influence of color on brand perception accounts for as much as 60-80%, far higher than other visual elements [10].

Specific examples include Coca-Cola's "red" marketing, which combines vitality and enthusiasm; McDonald's' yellow marketing emphasizes a sense of happiness and positivity; Tiffany's iconic blue conveys a high-end and refined brand image. These cases demonstrate how consistent color strategies enhance brand recognition and memory.

In the digital environment, color is equally important. The color selection of action buttons can significantly affect click-through rates: red buttons usually bring higher conversion rates (sense of urgency) than green buttons, but in the financial field, green buttons may be more effective (positive

associations with money). The background color selection of e-commerce websites also follows specific principles, with Amazon's white background not only reducing visual fatigue but also highlighting product images.

4.2. Environmental design and health care

In environmental design, colors are used to create specific atmospheres and influence behavior. Hospitals using light blue-green tones can reduce patients' pain perception by 28%, while fast food restaurants using red and yellow tones can increase the turnover rate by 19%. The matching degree between color and spatial function directly affects emotional comfort. When the illumination in the office is 500lux, the work efficiency in a blue, white light environment is 12% higher than that in a warm white light environment [11].

The application of colors in medical environments is revolutionizing traditional hospital design. The pediatric ward adopts bright and lively colors to alleviate children's anxiety; Using Calming Blue Green in the surgical preparation area to lower patient blood pressure; The rehabilitation center introduces natural greenery to promote psychological recovery. Research shows that an appropriate color scheme can reduce patients' pain perception by 10-15% and shorten hospitalization time by 8% [12].

In the workplace, color selection directly affects employee performance. The blue environment enhances logical thinking and concentration, making it suitable for tasks that require precision; Yellow stimulates creativity but may increase error rates; Red is suitable for short-term, explosive work but not conducive to long-term stress management. Flexibly applying this knowledge can optimize the design of work environments for different departments.

4.3. Culture and stereotype

Different cultures indeed attach distinct stereotypes and meanings to colors, which are often deeply rooted in history, religion, and social norms. A well-known example is the association of pink with girls and blue with boys, a stereotype that is not only culturally specific but has also changed over time [13].

Stereotypes based on color can also extend to human physical characteristics, such as hair. In Western cultures, particularly those with Northern European roots, certain hair colors have been loaded with cultural meaning. For Blonde Hair, the stereotype of the “dumb blonde” or “dumb blonde” is a persistent trope in Western pop culture, portraying blonde women as physically attractive but unintelligent. This image was often artificially reinforced, as exemplified by Marilyn Monroe, who was a sharp-minded individual but had to conform to this Hollywood stereotype. For Red Hair, people with natural red hair, sometimes pejoratively called “Gingers”, have historically faced significant prejudice, especially in the UK and North America. Rooted in medieval superstition, red hair was sometimes associated with witchcraft, deceit (Judas Iscariot was often depicted with red hair), and a volatile temperament. This bias was so strong that it became intertwined with ethnic discrimination against Irish and Scottish immigrants in the 19th century [14].

These color associations are not innate but are culturally constructed, often influenced by historical events, material scarcity, and commercial interests. First, Historical Shifts, the link between pink and girls is a recent development. In 1918, a trade publication stated the opposite: “pink is more suitable for boys, while blue is more delicate and daintier for girls” [15]. The modern association only became dominant around the 1980s, heavily driven by marketing strategies that

encouraged gender-specific product lines. Second, for Historical Trauma, aversion to certain colors can stem from difficult historical periods. For instance, people in France and Belgium often dislike dark green because it was the color of Nazi military uniforms during World War II. Third, consider Economic and Social Factors; the value of a color can be tied to its historical cost. Purple was exceedingly expensive to produce in ancient times, making it a symbol of royalty, status, and divinity in Roman and Byzantine societies.

The above examples show that color stereotypes are powerful but not the same across different cultures and time periods. They are human-made concepts that can, and do, change over time. As global interaction increases, understanding these cultural nuances becomes more important to foster mutual respect and avoid misunderstandings.

5. Conclusion

The evidence shows that color not only has aesthetic function but can also be seen as a nonverbal communication system. It has significant investigation and impact in mainly three aspects: biological, cognitive, and sociocultural.

People's reaction through color begins with the biological aspect. Different colors have specific wavelengths, and people have different feelings toward different wavelengths. However, based on the social scenario and culture difference. This biological sensation can be reshaped and emphasize several more important identifications of color identification in real life. This leads to the significant reason why different cultures have misunderstandings. Based on the unique properties of color, when professional people like designers and artists whose work relate to color, they should carefully choose the color they use and avoid stereotypes. By controlling people's connection and feelings with different colors, products can be made to arouse people's emotions. Finally, the study of color reveals the extent to which human perception of reality is positively shaped by symbolic visual codes.

References

- [1] Elliot, A. J. (2015). Color and Psychological functioning: a Review of Theoretical and Empirical Work. *Frontiers in Psychology*, 6(368). <https://doi.org/10.3389/fpsyg.2015.00368>
- [2] Marieke Lieve Weijjs, Domicèlè Jonauskaitė, Reutimann, R., Möhr, C., & Bigna Lenggenhager. (2023). Effects of environmental colours in virtual reality: Physiological arousal affected by lightness and hue. *Royal Society Open Science*, 10(10). <https://doi.org/10.1098/rsos.230432>
- [3] Palmer, S. E., & Schloss, K. B. (2010). An ecological valence theory of human color preference. *Proceedings of the National Academy of Sciences*, 107(19), 8877–8882. <https://doi.org/10.1073/pnas.0906172107>
- [4] Jha, K., Modi, P., Kumar, Y., Kumar, T., Singh, R., & Mishra, A. (2019). The effect of short-term exposure to red and blue light on the autonomic tone of the individuals with newly diagnosed essential hypertension. *Journal of Family Medicine and Primary Care*, 8(1), 14. https://doi.org/10.4103/jfmpe.jfmpe_375_18
- [5] Xia, T., Song, L., Wang, T. T., Tan, L., & Mo, L. (2016). Exploring the Effect of Red and Blue on Cognitive Task Performances. *Frontiers in Psychology*, 7(784). <https://doi.org/10.3389/fpsyg.2016.00784>
- [6] Sadeghi, S., Gu, Z., De Rosa, E., Kuceyeski, A., & Anderson, A. K. (2024). Direct perception of affective valence from vision. *Nature Communications*, 15(1). <https://doi.org/10.1038/s41467-024-53668-6>
- [7] Rashed, M. A. (2013). Culture, salience, and psychiatric diagnosis: exploring the concept of cultural congruence & its practical application. *Philosophy, Ethics, and Humanities in Medicine*, 8(1), 5. <https://doi.org/10.1186/1747-5341-8-5>
- [8] Kulishova, N., & Sajek, D. (2025). Using Machine Learning and Generative Intelligence in Book Cover Development. *Journal of Imaging*, 11(2), 46. <https://doi.org/10.3390/jimaging11020046>
- [9] Wang, C., Zhu, C., & Zuo, B. (2025). If colors have gender: Color-gender stereotype and the impact on impression evaluation and interpersonal interaction. *The Journal of General Psychology*, 152(4), 1–40. <https://doi.org/10.1080/00221309.2025.2478002>

- [10] Gupta, J. (2025). The Psychology of Color in Marketing: How Visual Elements Affect Consumer Perception. *Journal of Marketing & Social Research*, 2(3), 128–133. <https://doi.org/10.61336/jmsr/25-03-14>
- [11] Rasouli Kahaki, Z., Jahangiri, H., Smith, A. P., & Kazemi, R. (2022). Subjective and objective survey of office lighting: effects on alertness, comfort, satisfaction, and safety. *La Medicina Del Lavoro*, 113(3), e2022024. <https://doi.org/10.23749/mdl.v113i3.12371>
- [12] Wiercioch-Kuzianik, K., & Babel, P. (2019). Color Hurts. The Effect of Color on Pain Perception. *Pain Medicine*, 20(10). <https://doi.org/10.1093/pm/pny285>
- [13] McKay, R., & Whitehouse, H. (2019). Religion and Morality. *Psychological Bulletin*, 141(2), 447–473. <https://doi.org/10.1037/a0038455>
- [14] Block, K., Gonzalez, A. M., Choi, C. J. X., Wong, Z. C., Schmader, T., & Baron, A. S. (2022). Exposure to stereotype-relevant stories shapes children's implicit gender stereotypes. *PLOS ONE*, 17(8), e0271396. <https://doi.org/10.1371/journal.pone.0271396>
- [15] Brooks, D. (2011, April 22). Pink And Blue. *History.umd.edu*. <https://history.umd.edu/news/pink-and-blue>