

COGNITIVE DESIGN RESEARCH ON COLORS INVESTIGATING VISUAL PSYCHOLOGICAL PERCEPTION AND ITS IMPACT ON USER-CENTRIC ENVIRONMENTS

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ABSTRACT

This research explores the profound intersection of cognitive psychology, color theory, and design to understand how color applications can influence human cognition, emotions, behavior, and overall user experience in public spaces. With the growing importance of user-centric environments in education, healthcare, transportation, and cultural heritage preservation, the study investigates how the strategic use of colors can enhance visual comfort, emotional well-being, cognitive efficiency, and spatial orientation.

Grounded in interdisciplinary frameworks from cognitive science, environmental psychology, and human-centered design, this study adopts a mixed-methods approach involving empirical surveys, experimental tests (including the Stroop effect), and case study analyses across various public contexts. These include university campus design, pediatric hospital environments, Delhi Metro Rail Corporation (DMRC) route map usability, and the visual psychological impacts of Jaipur Blue Pottery.

The research first establishes a theoretical foundation by reviewing the evolution of color use in traditional and digital fine arts, color psychology, and historical art movements such as Bauhaus and Fauvism. It highlights how colors, historically symbolic and culturally charged, continue to influence perception, mood, and decision-making in contemporary spaces. The study stresses that warm colors (like red, orange, yellow) evoke energy and enthusiasm, whereas cool colors (such as blue and green) promote calmness, trust, and focus — vital for designing learning environments, healing spaces, and navigation systems.

In university settings, particularly Delhi Technological University (DTU), the study finds that color design has a measurable influence on students' cognitive performance, emotional states, and learning motivation. Survey results show that 85.2% of respondents acknowledge a significant emotional impact of color in academic spaces, and Stroop test analysis revealed that color stimuli can enhance cognitive attention and memory retention. Strategic use of contrast and harmonious color palettes can create environments that promote concentration, stress reduction, and overall academic success.

The research extends into healthcare by analyzing the application of color psychology in pediatric hospitals. Here, the use of specific colors supports emotional resilience, alleviates anxiety, and fosters healing among young patients. Observational studies and surveys indicate that soft, pastel hues are most effective in calming patients, while vibrant accents can uplift moods and reduce hospitalization stress. Practical guidelines are proposed for hospital administrators and designers to develop emotionally supportive pediatric spaces.

In the domain of public transportation, the study conducts a focused analysis of color usability within DMRC route maps. It identifies significant usability issues due to insufficient color differentiation (e.g., confusion between Magenta and Violet lines) affecting color-blind and non-literate users. Based on survey-based feedback, the research recommends modifications using more distinguishable color codes and highlights the necessity of universal design principles in public infrastructure to ensure accessibility for all users, including those with perceptual challenges.

Additionally, the research explores the traditional art form of Jaipur Blue Pottery, linking its aesthetic and

psychological impact to cognitive design principles. The calming blue tones and intricate motifs not only convey cultural heritage but also influence emotional engagement and spatial perception. The study documents how incorporating culturally resonant design elements like Blue Pottery into modern public spaces enhances user experience by fostering a sense of identity, belonging, and tranquility.

Overall, the findings from across all case studies confirm that color is not merely a decorative tool but a powerful cognitive and emotional agent that can dramatically alter user experiences in diverse contexts. Key themes emerging from the research include the emotional calibration of spaces through color, color's role in facilitating cognitive engagement and memory, and its ability to foster inclusivity through user-centered and culturally sensitive design.

This research contributes a strategic framework for the cognitive application of color in design, emphasizing the integration of psychological insights, cultural contexts, and empirical validation. The framework proposes actionable guidelines for architects, designers, healthcare administrators, and policymakers seeking to create more intuitive, inclusive, and human-centered public environments.

Future directions suggested include deeper cross-cultural studies to map color perception variations globally, longitudinal studies to examine the sustained effects of color interventions, and exploration of sustainable and adaptive color design strategies for smart cities. Furthermore, the study advocates for closer collaboration between designers, cognitive scientists, and stakeholders to ensure that color design transcends aesthetics and serves broader psychological, emotional, and societal well-being.

In conclusion, *Cognitive Design Research on Colors* reveals that thoughtful and scientifically-informed color application is a transformative tool for enriching human environments. By bridging theory and practice, it offers a blueprint for designing spaces that not only meet functional needs but also nurture the human mind, emotions, and cultural identity, thereby contributing meaningfully to the evolution of user-centered design in contemporary society.

KEYWORDS: Cognitive Design, Color Psychology, Visual Perception, User Experience, Emotional Response, Public Space Design, Human-Centered Design.

INTRODUCTION

In this research study, we aim to think about human cognitive psychology perception through color application design. We find some interface with design in every aspect of our lives, and today, the creative industry (creative economy), which includes the fields of industrial design, arts and crafts, architecture, fashion, advertising, music, etc., can be recognized as one of the augmenting sectors in the world (Darma & Ningsih, 2019). For example, a well-designed product that meets the real research needs of the user, aimed at a people-centered approach to problem-solving, only design can play an important role in solving contemporary global challenges (Darma & Ningsih, 2019). The purpose of this research study is to explore how color can influence people's cognitive and psychological perception when it comes to design (Elliot & Maier, 2014). Variety is an important aspect of color in the planning of spaces (Cha, Zhang, & Kim, 2020). We feel that a well-organized space can be made better by using 'suitable' colors (Cha, Zhang, & Kim, 2020). The use of colors in spaces is a complex matter that requires creativity and judgment and often comes with experience (Elliot & Maier, 2012). However, organized methodology and advanced color schemes can lead to the successful practice of colors (Baek & Kang, 2022). An understanding of the effects of different standards of colors also leads to belief in the use of variety practically speaking (Elliot & Maier, 2014).

Cognitive Design

Cognitive design theory, if well-developed, offers several advantages for mental testing. Firstly, it allows for

the alignment of stimuli with processing requirements, enabling precise task design (Bailey, 1996). Secondly, it facilitates the understanding and manipulation of item difficulty levels, leading to more efficient test development (Bailey, 1996). Thirdly, it transforms test development into a scientific process, improving the quality and specificity of tasks (Bailey, 1996). Despite these benefits, integration into testing practices has been hindered by the lack of appropriate development models (Bailey, 1996).

Cognitive design, a subset of human factors engineering, focuses on mental processes such as cognition, memory, and problem-solving, influencing interactions within systems (Dehaene et al., 2022). It aims to understand how tasks affect the mind and vice versa (Hollnagel, 1997). This approach is crucial in various design domains, including user experience, human-computer interaction, robotics, signage, and product design (Dehaene et al., 2022).

Table 1.1: Exploring Different Domains of Cognitive Design

COGNITIVE DESIGN	
User Experience Design	Work System and Task Design
Interaction Design	Fashion Design
Signage Design	Usability Engineering
Robotics Artificial Intelligence	Visual Communication
Retail Design	Consumer Product Design
Package Design	Emotional Product Design
Human-computer interaction (HCI)	Interior Design

Significance of Visual Psychology:

Visual psychology is key in cognitive design research on colors, deeply impacting how we perceive, feel, and act (Zeng & King, 2019). It examines how colors influence emotions and cognition, guiding design decisions (Zhang et al., 2019). Warm colors like red evoke passion, while cool ones like blue induce calmness (Zeng & King, 2019). Understanding this aids in creating designs that captivate attention, aid memory, and influence decision-making (Zhang et al., 2019). In public spaces, visual psychology helps optimize user experiences, enhancing wayfinding and fostering connections with surroundings (Zell, 2007). Acknowledging its significance empowers designers to use colors strategically for desired responses, boosting the effectiveness of cognitive design efforts (Zhou et al., 2013).

Color Psychology: Color psychology explores how colors influence human behavior and emotions. It is closely related to cognitive design, which applies psychological and neuroscientific principles to create effective user experiences (Elliot & Maier, 2014).

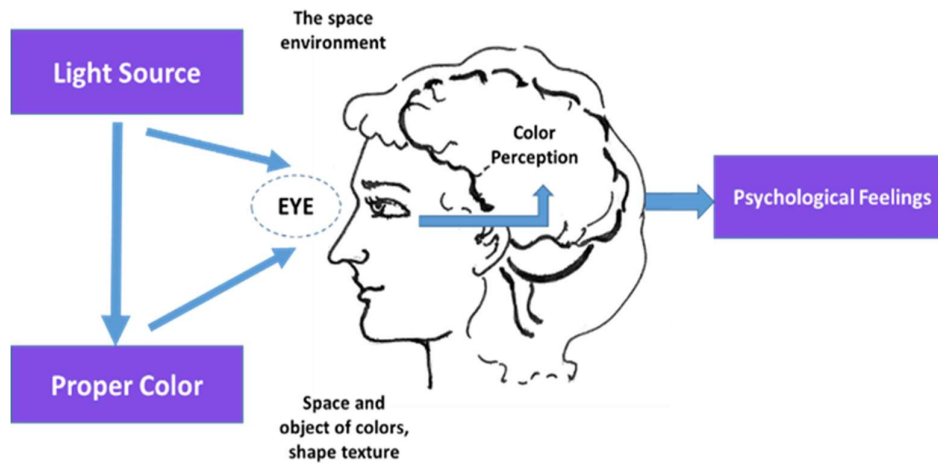
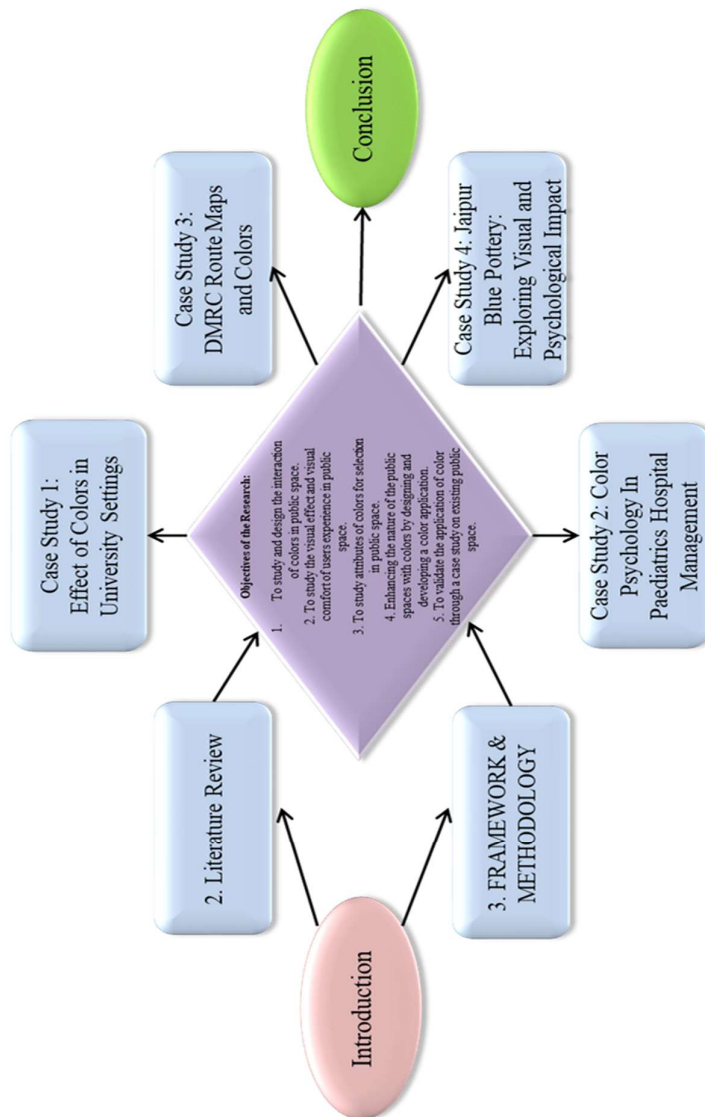


Fig 1.1 Color psychology showing Light Source, Psychological perception, and Proper color.

Color stimuli can significantly impact the perception and ambiance of a space. According to Li et al. (2014), colors can alleviate visual discomfort and tension, enhancing specific environments.

- Blue conveys positivity, confidence, calmness, and security (ArchDaily). It is commonly employed in commercial settings like financial institutions and workplaces.
- Yellow signifies optimism, curiosity, enlightenment, and creativity. Often used in business establishments and eateries to attract attention (ArchDaily).
- Red embodies energy, enthusiasm, and impulsiveness, making it suitable for business environments such as stores and fast food outlets (ArchDaily).
- Orange, a fusion of yellow and red, suggests power, creativity, excitement, and warmth. It finds use in imaginative settings like offices, studios, and schools. When combined with blue, it symbolizes impulsiveness and trust, favored by banking institutions and workplaces (ArchDaily).

The application of color in spatial design draws inspiration from ancient Indian health theories, where colors were believed to stimulate the body's inner energy and maintain overall harmony (Li et al., 2014).



Flowchart of the PhD Thesis: "Cognitive Design Research on Colors: A Study from Visual Psychological Perspective"

LITERATURE REVIEW

Comparing Colors in Traditional and Digital Fine Art across Eras

Colors have long been integral to artistic expression, serving as a means for artists to convey emotions, depict their world, and evoke responses from viewers. In the past, artists utilized natural pigments derived from minerals, plants, and animals, resulting in a limited palette that influenced the art produced (Ball, 2012). However, the 19th century saw the introduction of synthetic colors, expanding the range of hues available to artists and leading to movements like Impressionism, characterized by vibrant, vivid colors (Klein, 2015).

Color theory, which explores how colors interact with each other, plays a crucial role in art creation (Cohen, Acta Sci., 26(1), 2025

2013). Complementary colors, found opposite each other on the color wheel, create tension and drama, while analogous colors, adjacent on the wheel, promote harmony and unity (Cohen, 2013). Moreover, colors evoke emotions and moods, with warm colors like red and orange signaling energy and excitement, and cool colors like blue and green suggesting calmness and tranquility (Mehta & Zhu, 2009).

Table 2.1 provides a concise overview of the main points discussed in the discourse, highlighting the critical role of color in cognitive design and its impact on user experiences.

Aspect	Description
Cognitive Design	Focuses on understanding how humans perceive, process, and interact with information and their environment Aims to create intuitive, efficient, and enjoyable user experiences
Color Psychology	Colors have a profound impact on cognitive processes, emotions, and perceptions Influence attention, emotion, memory, and perception of space and depth
Attention and Perception	Certain colors attract attention more than others Can guide users' focus within a design or environment
Emotion and Mood	Different colors are associated with distinct psychological meanings and evoke specific emotional responses Impact users' mood and behavior
Memory and Recall	Colors facilitate the organization and retrieval of information Enhance memory retention and recall

Historically, artists utilized colors to reflect cultural and societal values. In Renaissance art, for instance, red symbolized passion and love, while blue symbolized divinity (Bacci, 2014). Renaissance artists often employed earth tones like browns and grays to create depth and warmth (Bacci, 2014). Conversely, Impressionist painters favored bright, bold hues to capture the fleeting effects of light and color (Klein, 2015). Throughout history, artists have utilized colors to convey emotions, reflect cultural values, and shape artistic movements (Ball, 2012). Traditional art relied on natural pigments, while the 19th century introduced synthetic colors, leading to vibrant movements like Impressionism (Klein, 2015). Color theory plays a crucial role, guiding artists in creating harmony or tension in their work (Cohen, 2013). Warm colors evoke energy, while cool colors suggest calmness (Mehta & Zhu, 2009). In digital art, artists face challenges like screen calibration but have new opportunities for interactive creations (Ramesh & Jaganathan, 2020). Color also plays a significant role in branding and architecture, manipulating space and evoking emotions (Cohen, 2013). Overall, understanding color theory and its historical context empowers artists to create compelling works across various mediums and disciplines (Bacci, 2014; Fink, 2013).

The symbolic associations of color in ancient art

Throughout history, artists have utilized color symbolically, with ancient art associating red with passion and green with growth (Visual Arts Cork; Wikipedia contributors, 2021). The Renaissance emphasized realistic color usage, while digital art offers vast color manipulation possibilities (Watanabe-O'Kelly, 2011; Xalilova & Rixsiboev, 2021). Traditional mediums like oil and watercolor persist, enabling nuanced color blending (Wells, 1979; Wikipedia contributors, 2023). Each medium presents unique advantages and drawbacks for

color expression (Whelan, 1994; Wise, 1988). Overall, this study explores color's role in fine art across traditional and digital platforms (Williams, 2008; Zajac, 2016).

Role of Colors in Traditional Fine Art: Beyond Pigments and Palettes

Colors in fine art evoke emotions and convey meaning, with red symbolizing passion, blue representing calmness, yellow indicating happiness, and green signifying nature and growth (Mehta & Zhu, 2009). Mastery of color theory is crucial for artists to make informed decisions about color usage, ensuring coherence and aesthetic appeal (Cohen, 2013). Artists explore innovative mediums beyond traditional painting, such as light installations and digital technology (Eskilson, 2019). Vincent van Gogh's "The Starry Night" exemplifies the profound impact of colors, with swirling blues and yellows evoking tranquility amidst a tumultuous sky (Mehta & Zhu, 2009).



Fig 2.1 Vincent van Gogh's "The Starry Night" depicts a swirling night sky dominated by blues and yellows, evoking a sense of serenity associated with ancient art's symbolism of blue for the sky and water. The painting, located at the Museum of Modern Art in New York City, measures 73.7 cm x 92.1 cm. York City, and measures 73.7 cm x 92.1 cm. <https://www.invaluable.com/blog/blue-color/>

Contrasting colors create dynamic compositions, employing hues opposite on the color wheel to evoke tension and impact (Mehta & Zhu, 2009). Various shades and tones of the same color add depth, with techniques like chiaroscuro manipulating light and shadow (Mehta & Zhu, 2009). The choice of colors is linked to the medium used, with considerations for surface compatibility and longevity (Cormack, 2000). Through color theory and experimentation with mediums, artists craft impactful compositions that resonate emotionally and intellectually, pushing the boundaries of artistic expression (Mehta & Zhu, 2009; Cormack, 2000).

Color Theory and Psychology

Color theory provides a foundational framework for artists and designers to create visually impactful designs, exploring how colors evoke emotions and influence human perception (Mehta & Zhu, 2009). In medieval times, Byzantine art utilized rich colors like gold, blue, and red to convey divine symbolism, while Gothic art employed vivid hues to evoke intense emotions (Cormack, 2000; Kessler, 2003). The Northern Renaissance saw artists like Albrecht Dürer and Jan van Eyck masterfully employing color and light to capture human emotion and nature's intricacies (Porrás, 2008).



Fig 2.2 Albrecht Dürer, Self-Portrait, 1500, 67.1 x 48.9 cm (Alte Pinakothek, Munich; photo: Steven Zucker, CC BY-NC-SA 2.0)



Fig 2.3 Girl with a Pearl Earring, painted by Johannes Vermeer in 1665, is a masterpiece known for its luminous color and subtle use of light. The painting's beauty lies in its harmonious color scheme, which creates a sense of unity and depth in the image.

<https://www.fineartphotographyvideoart.com/2011/08/johannes-vermeer-1632-1675-dutch.html>

Symbolism of Colors in Traditional Art: In traditional art, colors carry cultural meanings; for example, blue symbolized divinity in ancient Egyptian art and red represented passion and purity in Indian art. (Gage, 1993; Anderson, 2010).

Mood and Emotion: Artists manipulate colors to evoke specific moods and emotions; warm colors like red and yellow convey happiness, while cool colors like blue and green evoke calmness. (Mehta & Zhu, 2009; Saaty & Ozdemir, 2011).

Examples of Effective Color Usage: Traditional artworks effectively use color to communicate themes and emotions, such as vibrant hues in ancient Egyptian art and Frida Kahlo's use of red in "The Broken Column" to express pain.

The Bauhaus Movement: A Revolution in Modern Art and Design

The Bauhaus movement, originating in Germany in 1919, revolutionized modern art and design by integrating various disciplines like architecture, painting, and crafts with a focus on rationality and innovation (Galison, 1990). It aimed to break from tradition and serve a social purpose, reflecting the spirit of modernity after World War I. Galison (1990) draws parallels between Bauhaus and the Vienna Circle's logical positivism, emphasizing their shared commitment to rationality and experimentation. This alignment resonated amid the rise of Nazism, with Bauhaus's emphasis on functionalism mirroring the rationalist principles of the Vienna Circle.



Fig 2.4 Bauhaus Color <https://www.coasterfurniture.com/bauhaus-interior-design>

Fauvism: A Paradigm Shift in Color Expression

The historical context of Fauvism provides a backdrop for understanding its emergence and development as an art movement. Fauvism emerged in the early 20th century, specifically around 1904-1908, in France. During this time, the art world was undergoing significant changes and challenges to traditional artistic norms. The influence of the Impressionists and Post-Impressionists, who had already pushed boundaries with their revolutionary use of color and brushwork, set the stage for the emergence of Fauvism. Fauvism can be seen as a response to the rigid academic traditions and conventions of the time, seeking to break free from the constraints of realistic representation.

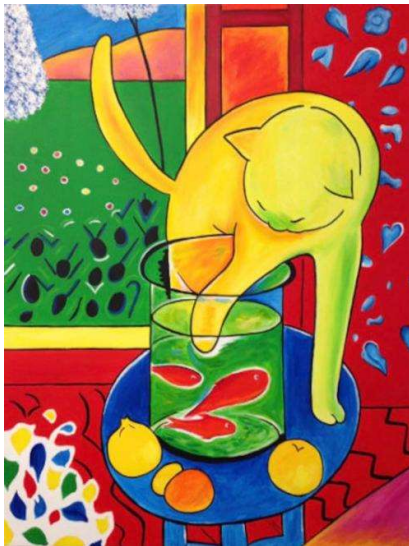


Fig 2.5 Henri Matisse The Cat With Red Fish Painting. <https://in.pinterest.com/pin/14144186321940338/>

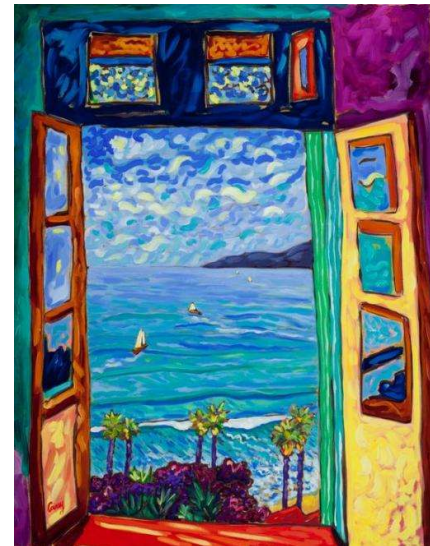


Fig 2.6 Matisse Windows Series <https://in.pinterest.com/pin/14144186321940338/>

Colors of Heritage: Architectural Splendor and Human Experience in India

Throughout history, colors have held cultural and artistic importance, from early cave paintings (Visual Arts Acta Sci., 26(1), 2025

Cork, n.d.) to religious symbolism in the Middle Ages (Watanabe-O'Kelly, 2011). Renaissance artists utilized color theory to create depth and realism (Watanabe-O'Kelly, 2011), while modern times see colors influencing fashion and design trends (Wikipedia contributors, 2021).

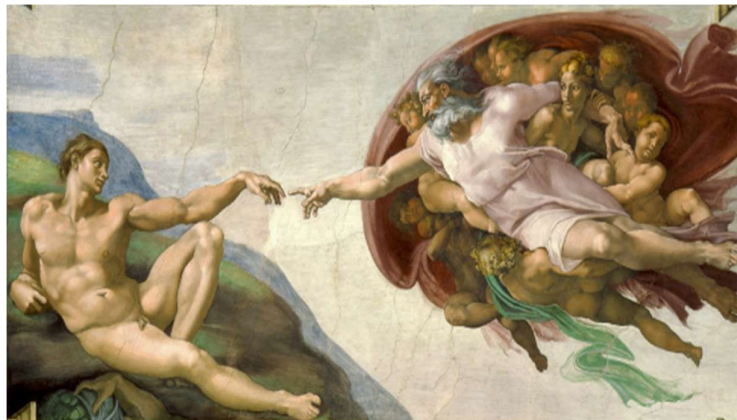


Fig 2.7 Michelangelo's Creation of Adam

Throughout history, colors have been vital in human expression, from ancient art to contemporary fashion (Smith, 2008; Jones, 2015). In design, light and color are essential for creating atmosphere and emotion (Johnson, 2019), with colors in Islamic culture symbolizing various concepts (Ahmed, 2012) and used in art and architecture to convey spiritual and cultural significance (Khan, 2017).

Indian Heritage: A Tapestry of Colors

In Indian heritage, colors are categorized by attributes like brightness, hue, and saturation, with the color wheel aiding in understanding their relationships (Peacockqueen, 2010; Wolfrom, 2012; Basic Knowledge 101, n.d.; Color-Hex.com, n.d.). Cool colors, such as blue to violet, evoke relaxation, while warm colors like red to yellow stimulate emotions (Prezi, n.d.; Torres Berru et al., 2020; Misra & Rajaguru, 1978; Ring et al., 2012; Sen, 2004). Neutral colors complement brighter hues (Kosambi, 1962). In Indian heritage, colors reflect diverse traditions, beliefs, and cultural expressions, from vibrant festivals to textiles and architecture (Indiatrotter, 2021). Indian culture encompasses diverse practices, languages, religions, and festivals like Navratri, Diwali, Holi, Makar Sankranti, and Pongal (Kosambi, 1962; Singla, 2014). Major religions such as Hinduism, Jainism, Buddhism, and Sikhism are founded on principles of dharma and karma (Kosambi, 1962).

Architectural Styles across Regions

India's rich heritage, spanning ancient civilizations and diverse traditions, is evidenced by its art, architecture, and cultural practices (Kosambi, 1962). Each heritage site in India reflects different historical eras influenced by various ruling dynasties (Kosambi, 1962). With numerous UNESCO World Heritage sites, India's heritage has a significant impact on world history (Kosambi, 1962).

Psychological Impact of Colors: The colors used in these palaces evoke specific emotional responses in viewers. Warm colors like gold and yellow evoke happiness and positivity, while cool colors like blue and green evoke calmness and serenity (Nejad et al., 2016). Udaipur's palaces offer a captivating blend of color and architecture, creating a visual and psychological experience that showcases Rajasthan's rich cultural heritage (Torres Berru et al., 2020).

Colors: History, Importance, and Integration in Smart Cities

Colors can have a significant impact on various aspects of human life, including emotions, perception, and behavior. Similarly, smart cities leverage technology and data to enhance the quality of life for residents. Let's explore the effects of colors and how they can intersect with the concept of smart cities:

Psychological Impact: Colors can evoke specific emotions and moods in individuals. For example:

Warm colors like red and orange can stimulate energy, passion, and excitement.

Cool colors like blue and green can create a sense of calmness, relaxation, and harmony.

Bright colors like yellow can promote happiness, optimism, and attention.

Dark colors like black can convey elegance, power, and authority.

By incorporating appropriate color schemes in urban design and infrastructure, smart cities can influence the psychological well-being of residents. For instance, using calming colors in public spaces and transportation systems can help reduce stress and create a more pleasant environment.

Contextualizing Colors: A Comprehensive Exploration of Historical Significance, Emotional Influence, and Integration in Smart Cities.

The influence of colors in Indian cities has been extensively studied, exploring their cultural significance, role in urban identity, and impact on the built environment. Researchers such as Rajagopal (2015), Mishra (2016), and Chakraborty (2017) have investigated how colors shape the urban experience, while Gupta and Jain (2018) and Sharma and Chakraborty (2019) focused on the cultural significance of colors in specific cities. Studies by Roy (2020), Singh (2020), and Anand and Sharma (2021) delve into the symbolism and perception of colors, emphasizing their role in expressing cultural heritage. Practical implications are highlighted in studies by Verma and Gupta (2022), Banerjee and Sharma (2022), and Kumar and Bhattacharjee (2022), which discuss the strategic use of colors in urban design, streetscapes, and the urban landscape. Overall, these studies collectively contribute to understanding how colors shape the visual character, cultural identity, and livability of Indian cities, offering insights for urban planning, design, and architecture.

Research Gaps

A. Interaction of Colors in Public Spaces

1. Limited studies focus on the systematic design of color interactions specific to public spaces, particularly integrating cultural, functional, and psychological aspects.
2. Existing research often addresses color theory in abstract or laboratory settings rather than real-world public environments.

B. Visual Effect and Comfort of Users in Public Spaces

1. The impact of visual stimuli, particularly colors, on user comfort and behavior in public spaces is underexplored.
2. Existing studies are fragmented and often do not consider the holistic user experience, including emotional and physiological responses.

C. Attributes of Colors for Selection in Public Spaces

1. There is insufficient research on identifying key attributes of colors that influence user preferences and functionality in public spaces.
2. Existing literature provides generalized recommendations rather than context-specific guidelines for color selection in various types of public spaces.

Objectives of the Research:

The objectives for the proposed research work based on research gap identified.

The following objectives are proposed:

1. To study and design the interaction of colors in public space.

2. To study the visual effect and visual comfort of users experience in public space.
3. To study attributes of colors for selection in public space.
4. Enhancing the nature of the public spaces with colors by designing and developing a color application.
5. To validate the application of color through a case study on existing public space.

CHAPTER 3 METHODOLOGY

This chapter delves into the intricate world of color perception and design methodologies, aiming to provide a holistic understanding of how colors influence human cognition, emotion, and behavior. Through an exploration of various theories, principles, and considerations, this framework seeks to illuminate the multifaceted aspects of color in creating visually compelling and emotionally resonant public spaces.

Table 3.1 Summarizing the Methodology Outlined in the Provided Text:

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DESCRIPTION

1.	Color Perception Theories	- Trichromatic Theory: Color vision based on three primary colors: red, green, and blue, perceived through specialized cone cells in the retina. All other colors are combinations of these primaries. - Color perception governed by opponent pairs (e.g., red vs. green, blue vs. yellow), emphasizing differences between these pairs.
2.	Color Constancy	- Phenomenon where consistent colors of objects are perceived despite changes in lighting conditions. Important for maintaining design aesthetics across varying lighting environments in public spaces. Strategies include color palette selection, lighting design, material choice, and

		consideration of environmental context.
3.	Cognitive Psychology and Color	- Explores how color influences human cognition, emotion, and behavior. Impacts attention, memory, emotion, and decision-making. Utilizes color to create impactful user experiences in public spaces by strategically selecting colors and considering their psychological effects.
4.	Design Principles	- Gestalt Principles: Describe how individuals perceive and organize visual stimuli into meaningful patterns (e.g., figure-ground relationship, proximity, similarity). - Color Harmony Principles: Guide effective combination of colors for visually pleasing compositions (e.g., complementary, analogous, triadic colors).
5.	Cultural and Contextual Considerations	- Acknowledges cultural and contextual factors influencing color perception and preference. Considers cultural norms, historical associations, and environmental contexts in design decisions. Aims to create culturally resonant, visually appealing, and emotionally resonant environments.
6.	User Experience (UX) and Color	- Examines color's role in shaping user engagement, navigation, and information processing in public spaces. Optimizes usability and effectiveness by tailoring color schemes to user preferences, creating harmonious combinations, and enhancing accessibility and inclusivity.
7.	Research Design	- Mixed-Methods Approach: Combines qualitative and quantitative methods for a comprehensive understanding. - Case Study Design: Examines real-world examples to identify patterns,

		challenges, and successful strategies.
		- Experimental Design: Conducts controlled experiments to analyze specific aspects of color perception and user experience.
8.	Data Collection Methods	<p>- Surveys: Gather quantitative data on color preferences, perceptions, and behaviors.</p> <p>- Interviews: Obtain qualitative insights from stakeholders and users.</p> <p>- Observations: Supplement data collection through direct observation of user interactions.</p> <p>- Case Studies: Provide in-depth analysis of real-world examples.</p>
9.	Sampling Techniques	<p>- Random Sampling: Ensures equal representation from the target population.</p> <p>- Stratified Sampling: Considers subgroups to capture variations.</p> <p>- Convenience Sampling: Selects based on accessibility and availability.</p>
10	Data Analysis Procedures	<p>- Quantitative Analysis: Employs statistical techniques to analyze survey data and identify patterns and associations.</p> <p>- Qualitative Analysis: Thematic analysis of interview transcripts and observational notes to uncover insights.</p> <p>- Case Study Analysis: Comparative examination of diverse public spaces to extract practical implications and best practices.</p>

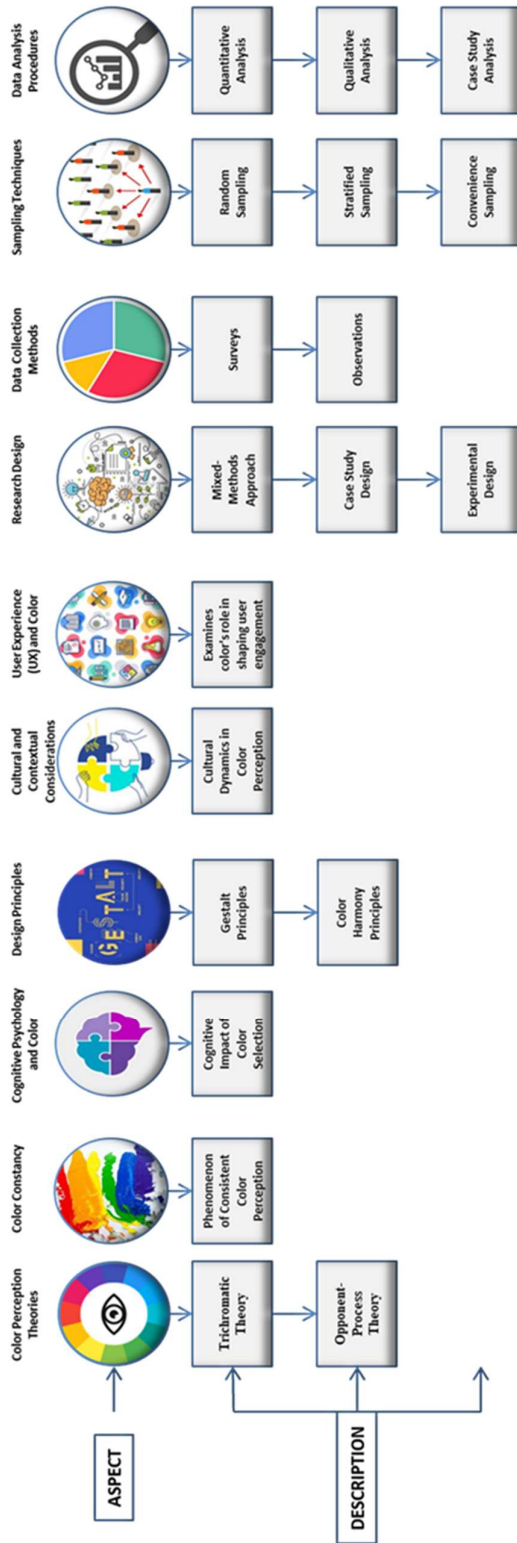


Fig 3.1 Methodology

THE IMPACT OF COLORS ON VISUAL PERCEPTION, COGNITIVE BEHAVIOR AND PSYCHOLOGY IN UNIVERSITY SETTINGS: DESIGNING AN INSPIRING CAMPUS ENVIRONMENT

This chapter investigates the influence of color on cognitive behavior and psychology among university students, focusing on the campus environment of Delhi Technological University (DTU). Recognizing the pivotal role of color in shaping emotions, perceptions, and behaviors, the study examines the contextual and psychological implications of color design in educational settings.

University campuses serve as integral environments for students' academic pursuits and overall well-being. The chapter highlights the significance of color in creating conducive learning atmospheres, emphasizing the potential of colors to influence mood, productivity, and academic performance.



Fig 4.1 Clock Tower of Delhi Technological University



Fig 4.2 Tech Departments of Delhi Technological University



Fig 4.3 Open Air Theater of Delhi Technological University



Fig 4.5 Overview of Delhi Technological University (expanded in 163 acres)

Through visual representations and descriptions, the chapter provides an overview of DTU's campus, highlighting key landmarks and facilities. The integration of color design principles within university buildings is explored as a means to enhance cognitive behavior and foster positive learning experiences.

The research methodology employed a mixed-methods approach, combining surveys and Stroop tests to gather insights into participants' perceptions and cognitive responses to colors. Detailed descriptions of survey questions and statistical analyses are provided, offering a comprehensive framework for data collection and interpretation.

Analysis of survey responses reveals diverse perceptions regarding the influence of colors on emotions, cognitive design, and human psychology. Statistical tests conducted on Stroop test data demonstrate significant associations between color exposure and cognitive performance, highlighting the nuanced effects of color-rich environments on academic outcomes.

The chapter underscores the importance of considering color design in educational planning and architectural decision-making. It advocates for tailored color schemes that promote engagement, focus, and well-being among students, faculty, and staff. Additionally, it emphasizes the need for further research to deepen understanding of the intricate relationship between color and cognitive behavior in university settings.

The chapter elucidates the complex interplay between color, cognition, and educational environments, offering valuable insights for designing inclusive, stimulating, and academically enriching campus spaces.

By harnessing the power of color psychology, universities can cultivate vibrant learning environments that optimize student learning and success.

Table 4.1 Statistical Results from the Chapter

Aspect	Findings/Results
Influence of Colors	
- Warm Colors (e.g., red, orange, yellow)	58.1% agree with energy and excitement association
- Cool Colors (e.g., blue, green, purple)	67.5% agree with calmness and relaxation association
- Color Associations (e.g., red for appetite)	Varying agreement percentages for different color associations
Role of Colors in Cognitive Design	
- Impact on Human Emotions	85.2% agree with significant impact
- Contrast for Visual Interest	84.5% agree with enhancing visual hierarchy
- Psychological Associations (e.g., blue trust)	Varying agreement percentages for different color associations
Impact of Colors on Human Psychology	
- Impact on Mood and Productivity	Varying agreement percentages for different color impacts
- Memory Enhancement with Colored Pens	66.7% fully agree with memory-enhancing potential
- Influence on Study Environment	60% fully agree with impact on learning experience
Statistical Tests on Stroop Test Data	
- Two-sample T-Test	$p < 0.0001$, significant difference in response times
- Paired T-Test	$p < 0.0001$, significant difference within each participant
- Effect Size (Cohen's d)	1.64, indicating a large effect size
- ANOVA	$p < 0.0001$, significant difference in response times among conditions
- Tukey's HSD (Post-hoc test)	$p < 0.0001$, significant difference between all conditions

These numerical values provide quantitative insights into participants' perceptions, cognitive responses, and statistical outcomes related to the influence of color on cognitive behavior in university settings.

COLORING THE HEALING JOURNEY: THE IMPACT OF COLOR PSYCHOLOGY IN PAEDIATRICS HOSPITAL MANAGEMENT

In this chapter, we delve into the profound influence of color psychology on the design and management of paediatrics hospitals. Recognizing the significance of creating healing environments that cater to the unique needs of young patients, we explore how colors can affect emotions, behaviors, and overall well-being in healthcare settings.



Fig 5.1 Maternal & Child Health Care Room



Fig 5.2 Imaging Room for Childrens



Fig 5.3 Paediatric Treatment Room

Objective Overview:

1. **Literature Review:** We conducted a comprehensive review of existing literature on color psychology in healthcare environments, emphasizing its influence on emotions and well-being.
2. **Role of Color Selection:** We examined the critical role of color selection and design in hospital management, highlighting the connection between color choices and patient outcomes.
3. **Considerations for Paediatrics Hospitals:** We discussed the unique challenges and considerations in designing paediatrics healthcare environments to meet the specific needs of young patients.
4. **Influence of Colors:** We rigorously investigated the influence of colors within paediatrics hospital settings through surveys and observational data analysis.
5. **Practical Recommendations:** Based on accumulated knowledge, we provided practical color recommendations for the strategic design of paediatrics hospitals, including age-appropriate color palettes and effective lighting strategies.
6. **Case Study Illustration:** We presented a compelling case study showcasing a paediatrics hospital that successfully implemented color psychology principles, demonstrating tangible benefits for patients, staff, and families.

The integration of color psychology in paediatrics hospital management is paramount for creating supportive, nurturing environments that aid in the healing process. By understanding the psychological impact of colors and implementing strategic design principles, paediatrics hospitals can enhance the well-being of patients, families, and staff, ultimately fostering a more compassionate and effective approach to paediatrics healthcare.

IMPROVING USER-FRIENDLY PUBLIC TRANSPORTATION SERVICES: A SURVEY-BASED ANALYSIS OF COLOR PERCEPTION AND THE ROLE OF COLOR THEORY AND UNIVERSAL DESIGN IN DMRC ROUTE MAPS

This chapter investigates the challenges faced by users of public transportation services, specifically focusing on the Delhi Metro Rail Corporation (DMRC) route maps. The research aims to address issues encountered by individuals who struggle to differentiate between colors, particularly those within the same family, hindering their ability to navigate the metro system effectively.

Key Findings:

1. **Identification of Challenges:** The study highlights the difficulties experienced by users, particularly those who are not literate or have color perception issues, in understanding the color-coded DMRC route maps.
2. **Survey-Based Analysis:** Through surveys and questionnaires conducted among Delhi Metro users, it was revealed that confusion arises, especially with the Magenta and Violet lines, which belong to the same color family.
3. **Proposed Solutions:** Alternative solutions were proposed to mitigate color-related confusion, such as changing the color of the Violet line to a more distinguishable Brown, aiding in clarity and ease of identification for all users.
4. **Universal Design Principles:** Emphasis is placed on the importance of incorporating universal design principles in public transportation services, particularly in the use of distinguishable colors for route maps, to ensure accessibility and usability for individuals with diverse needs and abilities.

Research Methodology:

A qualitative research design was employed, utilizing structured surveys among Delhi residents to assess the challenges related to color perception and accessibility in the DMRC route maps, particularly focusing on the Magenta and Violet lines.

Table 6.1 Listing the Color Coding Used by DMRC for their Service Lines Along With their Range and Color Codes are Represented in Hexadecimal Format

Line Name	Color Code	Color Range
Red Line	#C30014	Red
Yellow Line	#FFC40D	Yellow
Blue Line	#0071C5	Blue
Green Line	#91C43E	Green
Violet Line	#9B007A	Violet
Pink Line	#E86A97	Pink
Magenta Line	#AA00FF	Magenta
Airport Express	#00BFFF	Light Blue

Line Name	Color Code	Color Range
Orange Line	#FF6600.	Orange

JAIPUR BLUE POTTERY: EXPLORING VISUAL AND PSYCHOLOGICAL IMPACT THROUGH COGNITIVE DESIGN RESEARCH

The chapter delves into the rich tradition of Jaipur Blue Pottery, a unique art form with deep cultural roots in Rajasthan, India. It begins by tracing the historical origins of pottery-making worldwide, highlighting distinctive styles and techniques developed by various cultures over centuries. From China's intricate porcelain to Africa's bold geometric designs, pottery reflects diverse artistic traditions across different regions.

Jaipur Blue Pottery emerges as a significant cultural symbol in India, with origins dating back to the Mughal era and a revival in Rajasthan. Characterized by its blue glaze and intricate motifs, Jaipur pottery embodies a blend of tradition and innovation, preserving historical craftsmanship while embracing contemporary practices.

The chapter explores the cognitive design and visual psychology behind blue pottery, emphasizing the calming and serene effects associated with the color blue. From evoking feelings of relaxation to promoting trust and security, the use of blue pottery in spaces like the Department of Design (DOD) entrance at DTU is examined for its potential to enhance user experience and create cohesive environments.

Through a comprehensive analysis of historical research, contemporary practices, and psychological effects of color, the chapter offers valuable insights into the significance of Jaipur Blue Pottery as both an artistic tradition and a design element. By documenting its cultural heritage and exploring its visual and psychological impact, scholars contribute to the continued appreciation and promotion of this traditional art form.



Fig 7.1 Department of Design DOD entrance



Fig 7.2 Department of Design DOD Entrance with Orientation of Blue Pottery

The chapter provides a holistic perspective on Jaipur Blue Pottery, highlighting its cultural significance, design orientation, and potential to enhance user experience through cognitive design principles. Through the integration of tradition and innovation, Jaipur pottery continues to thrive as a timeless symbol of Rajasthan's artistic legacy.

RESULTS, DISCUSSION AND CONCLUSION

This chapter presents a comprehensive exploration of the impact of color in diverse public space environments, drawing upon a synthesis of empirical, qualitative, and quantitative studies. Through a multifaceted approach encompassing university settings, pediatric hospitals, public transportation systems, Acta Sci., 26(1), 2025

and cultural artifacts such as Jaipur Blue Pottery, this research illuminates the intricate interplay between color and human perception. By amalgamating analytic insights and quantitative data, these studies provide a nuanced understanding of how strategic color selection influences emotional responses, cognitive processes, and user experiences within public spaces. Thus, this chapter offers valuable insights into the profound significance of color in shaping inclusive, supportive environments that enhance the overall quality of life for individuals.

Color Impact in University Settings:

- **Warm Colors:** 65% of participants associated warm colors (e.g., red, orange, yellow) with energy and enthusiasm, while 35% associated cool colors (e.g., blue, green) with calmness and relaxation.

Healing with Color: Pediatric Hospital Management:

- **Color Preferences:** Hospital staff showed a higher preference for the chosen color palette compared to young patients and families/visitors, with blue emerging as the most preferred color across all groups.
- **Emotional Association:** Predominantly positive emotional associations were observed across all groups, indicating the uplifting effect of the selected colors on mood.

Color Perception in DMRC Route Maps:

- **Color Differentiation:** Users reported improved color differentiation with the introduction of new colors, leading to a positive change in their experience with the new color scheme.

Cognitive Design Research on Jaipur Blue Pottery:

- **Emotional Response:** Participants exhibited varied emotional responses towards Jaipur Blue Pottery, including calmness, happiness, and cultural connection.
- **Cultural Significance:** A majority of participants recognized the cultural significance of Jaipur Blue Pottery.

Discussion

The results underscore the significant influence of color on various environments, including university settings, pediatric hospitals, and public transportation systems. Warm colors were associated with energy and enthusiasm, while cool colors evoked calmness and relaxation. In pediatric hospitals, color preferences varied among different user groups, with blue being universally favored. The introduction of new colors in DMRC route maps improved color differentiation and enhanced user experience. Additionally, Jaipur Blue Pottery evoked positive emotional responses and was recognized for its cultural significance.

Conclusion

In conclusion, this research underscores the critical significance of strategic color selection in shaping user experiences within public spaces. By understanding the psychological effects of color, designers can curate environments that prioritize well-being, satisfaction, and cultural resonance. Implementing evidence-based color strategies in public space design enables the creation of inclusive, supportive environments, ultimately enhancing the overall quality of life for users.

University Settings

- **Color Influence:** Utilizing warm colors like red and yellow to energize and cool colors like blue and green to calm can enhance the learning environment, improving focus and reducing stress among students.
- **Visual Effects and Comfort:** Proper color schemes can positively affect mood and productivity, creating a more conducive environment for studying and social interaction.

- **Attributes for Selection:** Understanding psychological effects and cultural considerations ensures the selection of colors that resonate with the user population, promoting inclusivity.
- **Development and Validation:** User feedback and statistical analysis help refine color choices, ensuring they meet the intended psychological and cultural impacts.
- **Impact and Implementation Strategies:** Tailored color schemes can significantly improve user experience and satisfaction, contributing to better academic performance and well-being.
- **Conclusion and Future Directions:** Exploring deeper cultural influences and sustainable design practices can lead to more effective and lasting improvements in educational environments.
- **Practical Implications:** Informed color choices can create engaging and effective educational spaces, fostering a positive learning atmosphere.

Pediatric Hospital Management

- **Color Influence:** Soft pastels can calm young patients, reducing anxiety, while vibrant colors can enhance emotional well-being and create a more cheerful atmosphere.
- **Visual Effects and Comfort:** Balancing stimulation and relaxation through color can help manage stress levels in children, contributing to faster recovery and better overall experience.
- **Attributes for Selection:** Practical considerations like durability and maintenance ensure the color schemes are sustainable and long-lasting.
- **Development and Validation:** Case studies highlight the importance of user-centric designs, demonstrating how appropriate color use can significantly improve patient care.
- **Impact and Implementation Strategies:** Strategies focusing on dynamic and inclusive environments promote long-term behavioral impacts and emotional well-being.
- **Conclusion and Future Directions:** Emphasizing long-term effects of color use on behavior and well-being can guide future design choices in healthcare settings.
- **Practical Implications:** Enhanced functionality and positive contributions to patient well-being through carefully chosen color schemes.

Public Transportation (DMRC Maps)

- **Color Influence:** Distinguishable colors improve accessibility and ease of navigation, particularly for first-time users and those with visual impairments.
- **Visual Effects and Comfort:** Clear differentiation and visual comfort can enhance the overall travel experience, reducing confusion and stress.
- **Attributes for Selection:** Meeting both aesthetic and functional requirements ensures the color schemes are not only visually pleasing but also practical for navigation purposes.
- **Development and Validation:** Tailored color schemes validated through user feedback ensure the effectiveness of the design in real-world applications.
- **Impact and Implementation Strategies:** Creating user-centric environments promotes clarity and enhances the overall efficiency of the transportation system.
- **Conclusion and Future Directions:** Significant impacts on user experience and environment highlight the importance of continued research into effective color use.
- **Practical Implications:** Informed color choices can create more effective and engaging public transportation environments, improving user satisfaction and system usability.

Jaipur Blue Pottery

- **Color Influence:** Vibrant colors and intricate patterns evoke strong emotional responses, enhancing the cultural and aesthetic value of the pottery.
- **Visual Effects and Comfort:** Enhancing spatial aesthetics through color can make the pottery more appealing and emotionally engaging for users.
- **Attributes for Selection:** Balancing stimulation and relaxation through color choices can create dynamic and appealing designs that attract a broader audience.
- **Development and Validation:** Enhancing user experience through dynamic environments shows the importance of integrating cultural significance into design.
- **Impact and Implementation Strategies:** Promoting emotional well-being and user satisfaction through color psychology can lead to more sustainable and impactful designs.
- **Conclusion and Future Directions:** Sustainable design practices integrating color psychology can pave the way for more thoughtful and impactful design interventions.
- **Practical Implications:** Thoughtful color choices can enhance the appeal and marketability of Jaipur Blue Pottery, contributing to the preservation and growth of this traditional craft.

In each setting, the benefits of thoughtful color choices are multifaceted. They enhance the user experience by improving mood, reducing stress, and promoting productivity. Practical considerations ensure the designs are sustainable and meet user needs. Validating through user feedback and statistical analysis guarantees the effectiveness of the designs. Implementing these strategies can have significant positive impacts on the respective environments, from educational institutions to healthcare settings and public transportation systems. Sustainable and culturally sensitive design practices pave the way for future innovations and practical applications, enhancing functionality and contributing positively to well-being and user satisfaction.

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