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**VISUAL QUALITY ASSESSMENT OF INTERIOR
SPACE THROUGH COLORS**

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Master's Thesis

Supervisor

Asst. Prof. Can UZUN

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Signature



DEDICATION

I thank God Almighty for supporting me to make it possible for me to finish this thesis. In this work, I would like to dedicate my master's thesis to my wonderful parents (in memory of my father), my mother, my sisters, and my brothers, who have been remarkably encouraging and supportive throughout my academic years to write this thesis—the architectural engineering department at Altinbas University, including my supervisor Asst. Prof. Dr. Can UZUN and other lovely professors and doctors in this department, are also recognized and thanked for their assistance, guidance, and extensive expertise during my work on this thesis. In addition, it is worth mentioning that I got a lot of direction and help from my supervisor throughout the analysis of this master's publication.

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PREFACE

I thank Allah for giving me the talent, stamina, and determination to complete this master's thesis!

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Further, I would like to thank the members of the test committee who provided significant advice and criticism. I would also like to thank the architectural engineering faculty and staff at Altinbas University for their unwavering encouragement.

ABSTRACT

VISUAL QUALITY ASSESSMENT OF INTERIOR SPACE THROUGH COLORS

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This study uses a mixed-methods approach to examine the effects of color on interior space visual quality. Specifically, quantitative color dominance analysis and qualitative user input are combined. K-means clustering analysis was used to identify prominent colors and evaluate their distribution within each living room image collection, which consisted of 100 images chosen for their varied colors. Concurrently, an assessment is given to 87 individuals to find out how they feel about the colors in terms of aesthetic appeal, comfort, functionality, and overall satisfaction with the colors. The results of the color analysis are compared with user input to detect trends that guide design choices. The study offers a nuanced understanding of the effect of color dominance and harmony on the aesthetic and functional dynamics of interior spaces, providing valuable insights for enhancing design practices in the fields of architecture and interior design.

Keywords: Visual Quality, Interior Design, Color Dominance, K-means, Specifically.

ÖZET

RENKLER ARACILIĞIYLA İÇ MEKANIN GÖRSEL KALİTE DEĞERLENDİRMESİ

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Bu çalışmada, rengin iç mekan görsel kalitesi üzerindeki etkilerini incelemek için karma bir yöntem yaklaşımı kullanılmıştır. Özellikle, niceliksel renk baskınlığı analizi ve niteliksel kullanıcı girdisi birleştirilmiştir. K-ortalamlar kümeleme analizi, öne çıkan renkleri belirlemek ve bunların çeşitli renkleri için seçilen 100 görüntüden oluşan her bir oturma odası görüntü koleksiyonu içindeki dağılımını değerlendirmek için kullanılmıştır. Eş zamanlı olarak, 87 kişiye estetik çekicilik, konfor, işlevsellik ve renklerden genel memnuniyet açısından renkler hakkında nasıl hissettiklerini öğrenmek için bir değerlendirme verilmiştir. Renk analizinin sonuçları, tasarım seçimlerini yönlendiren eğilimleri tespit etmek için kullanıcı girdileri ile karşılaştırılmıştır. Çalışma, renk hakimiyeti ve uyumunun iç mekanların estetik ve işlevsel dinamikleri üzerindeki etkisine dair incelikli bir anlayış sunarak, mimarlık ve iç tasarım alanlarındaki tasarım uygulamalarını geliştirmek için değerli içgörüler sağlamaktadır.

Anahtar Kelimeler: Görsel Kalite, İç Tasarım, Renk Baskınlığı, K-ortalamlar, Özellikle.

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1. INTRODUCTION

Interior design elements such as colors, textures, and inherent qualities have a big influence on how users see and use a space. The way these components are chosen might elicit different kinds of responses, impacting psychological and emotional aspects of the response. For example, the colors used in a space might influence one's emotions, such as calmness or energy. The colors and textures that are used in a space can also have big effect on mood warmer colors tend to calm users, while cooler hues may help users feel quiet. Additionally, the usage of colors can change how a space appears to be larger or smaller by altering the perception of space. By creating an atmosphere that is either comfortable or overwhelming, textures and colors also influence a space's comfort level on a physical and psychological level. The harmony of these components ultimately determines the space's aesthetic appeal, which in turn affects how satisfied the user is with the design (Potočnik et al., 2022; Reddy et al., 2012).

In the field of interior design, the development and optimization of spaces have experienced substantial changes, with a growing focus on the critical role that color plays as a basic component of design. Modern interior design gives users psychological and emotional reactions to color just as much weight as aesthetics. The intentional use of color has become an essential component of design, with designers using color schemes to create rooms that improve productivity, well-being, and comfort (Duan, 2022).

Since colors have a major effect on the overall quality and aesthetic appeal of interior spaces, they are a crucial component of interior design. Given the well-established psychological and perceptual impacts of color, choosing the right color scheme is essential to creating comfortable and visually beautiful spaces (Awad et al., 2024). Colors not only have a powerful impact on visual aspect but also psychologically affect users. This can help manipulate mood, perception of space and even how we feel about the temperature of a room. If colors are used effectively, it will contribute to indoor comfort and useability of a space, while the wrong color palette can cause discomforting condition.

In the field of interior design, visual quality is the holistic aesthetic and psychological integration of a space in terms of perception by its users as written in (Bozbek et al., 2023). This involves the ways that different parts work together to create a beautiful spatial

environment, and a space which is fit for its intended use. These elements are colour, lighting, furniture position and architectural details (Jaglarz, 2023). A well-handled visual is far more comfortable and beautiful to experience, as well as other benefits such as productivity improvements and a better space in which to work. By doing so, it helps to maintain a functional and beautiful space (Nassar et al., 2024).

One of the key aspects of architecture and design approaches is to consider how users perceive and move these interior spaces based on their visual qualities. It should be noted that the versatility different components or factors lighting, nature materials, layout, color of a space compose together interactively moderate the spatial practicality (Bozbek et al., 2023). One of the most significant factors is the color in interior spaces, acting as a design element that establishes atmosphere, mood and overall impression for them. Interior color fabric can enhance or degrade the aesthetic appeal of other design elements and the space itself (Wei et al. 2023).

Understanding main colors within a space is crucial to evaluating and developing design since color plays a fundamental role in shaping the visual characteristics of an interior environment. The creation of dominant color analysis will allow designers to see which primary colors are impacting how a space is perceived. In addition, by combining with other types of design components, may also investigate the impact of these colors on the aesthetics and functionality in a larger context (Enwin et al., 2023; Tang et al., 2024). Dominant color clustering partitions the color information within an image so that there is a reasonable number of representative colors for the visual content of the image (Tang et al., 2024). This method is widely used in computer vision and image processing to determine the color the most conspicuous in an area of a given picture. One approach toward this is to analyse colors of an image and how they cluster into a set of dominating hues (Chłopek et al., 2023).

The approaches of the study are color segmentation and color dominance analysis. Color Dominance Analysis provides the distribution of the most dominant colors of furniture in interior space, by suggesting a numerical measure of color influence as illustrated in Fig. 1.1 (Kong et al., 2024). The color segmentation analyses how different colors are organized and interpreted by each other, decomposing as components (Anna et al., 2023).



Figure 1.1: Examples of Different Colors in The Living Room (Kong et al., 2024).

It uses Dominant color clustering to group similar colors and shades in clusters and helps us study how these clusters are connected and inter-related with each other in the interior spaces. This clustering approach will also help in a deeper analysis of how different color combinations and transition between different colors influence the spatial-visual properties of interior spaces (Tang et al., 2024).

1.1 PROBLEM STATEMENT

The relaxation, mood, and well-being of users are greatly affected by the visual quality of interior spaces. However, assessing the visual quality of interiors objectively is difficult due to the subjective nature of the aesthetic appeal and the multiple effects that colors have on different users (Bozbek et al. 2023).

The methods now used in interior design usually don't provide a methodical way to measure how colors affect how well the space is viewed. Although a significant amount of research has been done on color psychology and design principles, there is an obvious absence of empirical data that is combined with user perceptions to assess color's significance in interior spaces completely. This study attempts to close this gap by assessing how color dominance

and distribution affect the functional and aesthetic qualities of living spaces using a mixed-methods approach that combines quantitative image analysis with qualitative responses from users.

1.2 AIM OF THE RESEARCH

The main goal of this study is to create a thorough assessment of how color relates to the visual aspect of interior spaces. This study combines user surveys and color dominance analysis with the following objective. The objective is to analyse the effect of identified color schemes on user perceptions of comfort, aesthetic appeal, functionality, and overall satisfaction.



2. LITERATURE REVIEW

This literature review will investigate and study the paramount roles of color in interior environment, specifically color impacting psychological-emotional reactions as well as spatial perception. The purpose of reviewing the literature is to provide an in-depth understanding of how color impacts the functional characteristics and aesthetic aspects of interior environments. This assessment will detail the use of technology in color design, just one current theme within a broad range of contemporary topics and trends in the field.

2.1 THE ROLE OF COLOR IN INTERIOR DESIGN

In this section, you will find out the significance of colors in constructing interior environments. It will examine how color changes the nature of space and influences users to help give a psychological emotional feeling in place and contribute to design proposals. The discussion will be based on research and how to use it for functional and aesthetic purposes.

2.1.1 Psychological and Emotional Impact of Color

Color is to interior design what emotionality is to psychological geography. Literal-split Essential in the decorative composition, colour has influence on both emotional and subconscious space. Several well-documented studies, investigating the emotional and behavioural impact of colour on humans demonstrate that colour has a significant influence on affective responses, cognitive processing and overall health. Early studies on color psychology suggested that colors may evoke emotional responses (Maghraby et al., 2024; Elkhayat et al., 2024). This is where the psychology of color comes in as certain colors can trigger different emotions. The colors you see have a deep effect on you psychologically and these are not just ordinary eye sweets because they can make or break the business Red, orange and yellow are colors of warmth, passion, stimulation. These colors are thought to boost your energy and elicit feelings of ease and relaxation. Blue, green, and purple are generally associated with feelings of calmness, tranquillity, and restfulness. Research in psychology established that cold colors besides calming the soul can give the sense of more space and peace (Dong et al., 2024; Popovski et al., 2024).

How colors are Cali fornicated and perceived is heavily determined by differences in individual perception. Elliot et al. According to Mehta, Zhu, and Cheema (2014) The way colors influence mood and behaviour may be dependent on a variety of factors such as

cultural background, individual preferences, or prior experiences. As mentioned above, cultural background might influence color associations and preferences. For instance, red all too frequently denotes good luck across numerous cultures, but similarly the color can also threaten or foreboding. Additionally, Popovski et al. (2024) Reminiscing memories and personal moments with colors too can influence users in the same way. For instance, a color that recalls thoughts of something pleasant to someone is not going to be the same for the next person.

To allow interior designers to fashioning spaces that obey the functional requisites desirable yet the required psychological climate of a place, it is obligatory to give information regarding the impact of color. Popovski et al. (2024) and Awad et al. (2024) establish that colour is a resource which designers intentionally popular to determine the colour scheme and emotion of a space. Related colours are used for comfort areas like bedrooms and spas while warm colours can be used to elicit talkativeness and enthusiasm in social or public domains. Ski et al. (2024) and Awad et al. (2024) prove that color is a tool that designers use strategically to define the color and mood of a space. Cool colors are chosen for spaces meant for relaxation, such as bedrooms and spas, while warm colors can be utilized to encourage discussion and enthusiasm in social or public spaces. More supporting information on how color selection provides enhanced functionality of the space is available by Dong et al. (2024). For example, bright colors that enforce low speaks boost workplace productivity while creative settings require use of bright colors that enforce creativity.

With innovation enriching its focus, new research on color and its link with technology and affection are gradually pushing color psychology to the foreground of scientific studies. Wei et al. (2023) has pointed out that modern technologies that have been incorporated in the interior lighting systems include dynamic lighting systems in which lighting changes color depending on the user's preferences or the color of the environment, thus making it easier to introduce color in the interior setting.

Future studies could focus on developing customized colors based on user's psychological profiles and preferences to improve the functional and emotional results of interior spaces, as proposed by Dong et al. (2024) and Elkhayat et al. (2024).

2.1.2 Color and Spatial Perception

Users' perceptions about space and how they relate to the environment are greatly influenced by color. Interior designers may effectively affect perceptions of size, form, and ambiance through the planned use of color. The impact of light and dark colors on spatial perception is among the most thorough effects of color. Enwin et al. (2023) accord those light colors, such as pastels, whites, and soft neutrals, can extend and expand spaces. The reason for this is that light colors reflect more light, resulting in a space show larger and open. It is possible to visually expand a space and lessen a sense of limitation by using light colors on the walls and ceiling. When increasing the sense of space is essential this effect is especially helpful in smaller spaces, as shown in Figure 2.1.



Figure 2.1: Examples for Color And Spatial Perception (Enwin et al., 2023).

While, on the other hand, dark colours like rich browns, greens and blues absorb light and area recombine areas. According to Enwin et al., dark colors can make a space feel confined and small, but they can also add drama and sophistication. Jaglarz (2023). When you have spaces that are too open or slip into the cold and impersonal, this is often an idea used to give it warmth and a sense of containment. The way in which colours are arranged within a space directly affect its perception. According to Enwin et al. (2023), painting the surface of the ceiling with bright colors may give a notion that the space is higher, creating an impression of being brighter and larger. Conversely, darker ceiling colors can be more grounding and make the space feel cozier. The colors of the walls additionally have a strong effect on how large the rooms appear to be. Dark walls will lower the ceiling, whereas light wall will give the impression of a higher and wider room (Enwin et al., 2023; Jaglarz, 2023). Designers often rely on accent walls, painted in deeper hues, to provide that depth and interest without overwhelming the canvas of a room. The color of the floor also affects how

we perceive a room. Enwin et al. Dark floors can anchor a space, giving it more of a sense of containment and ground, while light floors can help accentuate space by making a room feel larger (Akhil & Jaglarz 2023). A balanced perception of the place is to choose a floor color that fits with the overall project.

Using contrasting colors allow a viewer to visually differentiate the boundary of a single space and navigate. High contrast colors like black and white or blue and yellow can create strong visual borders and focal points (Bozbek et al., 2023; Enwin et al., 2023; Jaglarz, 2023). In breaking up large stretches into oversized characters through contrasting overly regional typographies and architectural elements. On the other hand, low-contrast colors create a soft, harmonious look where colors blend into each other. This enables to ensure continuity and flow in open-plan spaces, where it is important that parts contexts feel associated better of isolated (Bozbek et al. And Enwin et al., 2023; Jaglarz, 2023).

In addition to its physiological effects, color has psychological effects. Blues and greens, classified as cool colors are said to recede (that is they push walls outwards), which makes space appear larger. The calm and serene hues they provide make them perfect for use in the spaces designed to restore our spirits such as bathrooms and spas (Wei et al., 2017). Red, orange, and yellow are considered warm colors because they seem to bring walls and objects toward us. Overuse may even diminish the perceived space (and create a sense of crowding); however, this can make social spaces such as living rooms and dining areas feel more comfortable (Bozbek et al. 2023). This way of how color can change its perceived space so much influenced by culture, manner and perception. Your cultural background has a lot to do with how colors are perceived and interpreted in a space. Thus, to give an example noted by Pavlenko et al. White, for example could stand for Purity and space in (2023) some cultures where others may denote sorrow.

They are culturally inappropriate quirks that designers working in multicultural environments need to understand so their color choices do not stand out like a sore thumb. It is the personal experiences and tastes most certainly but also how one sees color. As Song et al. (2024) and Yin et al. (2023), Herman Ouse claims that a darkness-lover and security-miner of desegregated color may thrive in the womb-like but non-claustrophobic darkness of a dark-coloured room. Consequently, it is important that to ensure that the colour fits the

needs and preferences of their consumers these gaps will be accounted for by designers in choosing colours (decoration tips).

Using color theory in Interior Design: The application of color theory to practical interior design is about creating a balance between what empirically works for humans and personal visual preference for the space being designed. Colors are simply a technique utilized by designers to point out specific elements of an area. The contrast in a single bright accent color can be used purposefully to make one element the focal point of a space (Hou et al. 2024). In addition, as Li (2024) also notes, the utility of a space can be enhanced by judiciously employing color. A darker color will make a larger room feel cozy and warm, while a lighter color will make a small room feels airy and expansive.

In the meantime, advances in our understanding of how color acts to define spatial perception are leading us towards new discoveries and applications for color. The advancement of smart lighting and digital design tools has enabled dynamic colors changing according to different time of day, season or user preference (Hou et al. in 2024). This creative way to use color within interior spaces is now becoming flexible and Interactive.

2.2 METHODOLOGIES FOR COLOR ANALYSIS IN INTERIOR DESIGN

The approach to color analysis for interior design with focus on dominant color clustering, color dominance analysis and color segmentation methods will be described in this section. It will also look at the evolution from subjective assessments to digital analysis from visual observation to software computation as noted by Dong et al (2024). Besides, as described by Hou et al. (2024). it will examine color segmentation technologies that employ color models and grading algorithms including Mean Shift and K-means clustering which assist in analysing dispersion of colors in spaces.

Finally, it will discuss clustering of dominant color, which breaks down complicated color into simpler understandable form on how to determine which of the shade matters most in creating cohesion in the conceptual arts. Discussing each methodology, their advantages, limitations and areas of application based on the publication of Adilova et al. (2024), current practices of color analysis for interior design will be given.

2.2.1 Color Dominance Analysis

It is color dominance analysis which allows us to see how much and in what way, users control as well as manipulate their perception of inner space by only a few colors. The dominant colors being the colors which powerfully impact a given space's atmosphere, mood and unity. As stated by Bao et al. (2023) mainly into five bin sets, where some of the most well-known organoleptic tools include color histograms, digital imaging analysis systems, visual inspection, and specialized software packages for quantification of certain color attributes. Traditionally, this process was by visual inspection and judgement to define the most significant colours. This was a basic principle of the method; unfortunately, its reliance on individual judgment made it often inaccurate (Bao et al. 2023).

Along with technological advancements, the computerized image analysis is an increasingly objective process. Bao et al. (2023), this method, detailed in Hutchinson and Moreland (2023) is how it produces a numeric breakdown off colour distribution seeing my software is used to determine the ratio of each colour within an image. Also, Color histograms, which show the distribution of colors for detecting a dominant color via analysing the peaks in the histogram as illustrated in Figure 2.2 (Bao et al. 2023).

According to Bao et al. (2023), software programs such as Adobe Photoshop and MATLAB enhance the capacity of designers to color balance effectively, thus creating batch of placid spaces by providing elaborate reports and comprehensive calculations that enhance accuracy in studying color dominance. Divers et al. (2023). Many practical benefits come from the use of color dominance analysis. Bittmann et al. (2014) makes spaces more conducive to relaxation if designers are allowed to reduce the dominance of highly stimulating colors. It can be seen from the expression this enhancement process, given by equation (2024), is indeed able to greatly improve visual quality.

In addition, Bao et al. (2023), which by the strategic use of key colors placed next to focal elements in design, like art setting within a composition is very valuable to create focal points and better parse the design story.

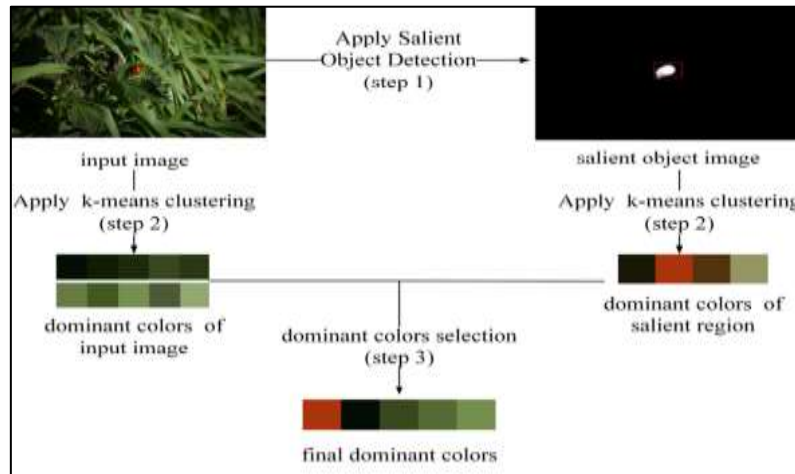


Figure 2.2: Example For Color Histograms (Bao et al., 2023).

This analysis is also significant because colors have to be balanced in order for designs not to become overpowering or keeping the interest of them. This allowed them to, e.g., calculate for each subset of cells how well it combined with other cell types into supercells Marrow et al. or how similar gene expression was in all subsets. (For example, as done by Bao et al. (2023). This key color dominance can help to introduce complementary or neutral colors in a way that the eye perceives a visual equilibrium if strong colors, let's say bright reds, are dominant in the space. In addition, Bao et al. (2023). Optimization of space functionality can be accomplished by adjusting color dominance based on intended use of space, T. Bao et al. (2023). So, for instance calming blues can be employed in offices to boost concentration and on the flip side dark colours can be used in social space for engagement.

The work of analysing color dominance is not devoid of complexity, however. Xie et al. (2023). The perception of color dominance is random and affected by neighbouring colors, or lighting (as shown in Figure. 2.3). Furthermore, Divers et al. (2023) points out that in dynamic spaces, where the function of a space changes during parts of the day, color dominance may change too, and more complex analyses are required.

Besides, as reported by Irawan et al. Finch (2023) Identifying colors at such a fine level of detail can be challenging, not that the smaller areas are unimportant; they often have very light or dark hues and thereby make more of an impact if the overall palette is known.

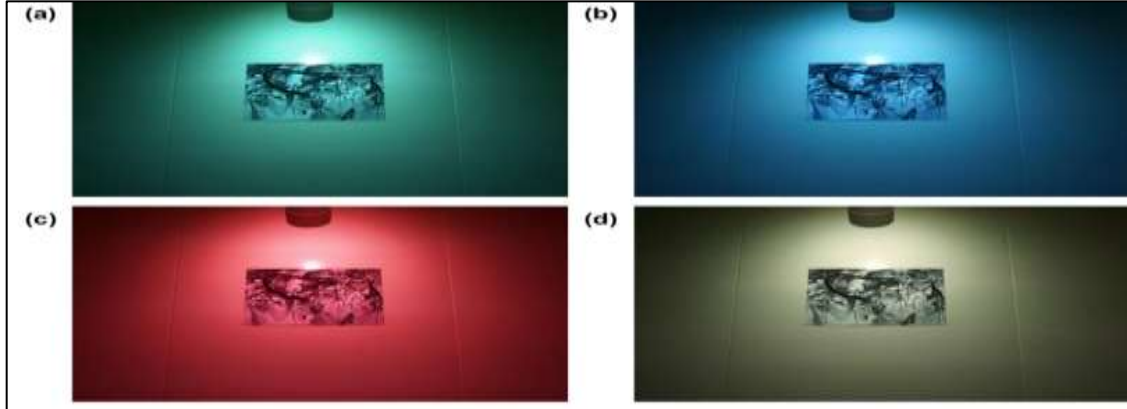


Figure 2.3: Examples Different Lighting (A) Green Light; (B) Blue Light; (C) Red Light; (D) Yellow Light (Xie Et Al., 2023).

2.2.2 Color Segmentation Techniques

Since it breaks down an image in different areas with respect to alike colored, color segmentation is significance to examine the behaviour of various colors which interact in space. This method of visualization allows for a detailed consideration of the color distribution and spatial arrangement within an interior. García-Lamont et al. (2019), similarly and Tehrani et al. (2020). Color assumptions make use of the color models such as RGB, HSB specifies colors according to their hue, saturation, brightness or by its red, green and blue components.

Image segmentation through algorithms such as thresholding, Mean Shift and K-means clustering. Wu et al. Sedov et al. (2021) explained that K-means clustering is a clustering algorithm in the field of data analysis, and use color values to group pixels into segments, and the optimal number of clusters or segments in an image control how detailed a segmentation is. The non-parametric method Mean Shift for clustering on pixel density does not require a preset number of clusters (Wu et al., 2021; Feng et al., 2020). Thresholding this method groups similar colors in a range of values, which allows for an easier color classification process (Palus, 2018; Sathya et al., 2021).

Color segmentation provides significant advantages when it comes to understanding complex interiors. According to Pang et al. (2024) and Duan et al. (2023) with its ability to

dissect different colour regions, the concept makes a more intuitive sense of interaction and visual performance across spaces with richly varied colours, necessary for the analysis of complex colours spatial configurations. Designers can obtain better color balance and contrast, while also understanding the visual significance of various color spaces, including room features such as dividing wall colors, flooring finishings and décor items (Enwin et al., 2023; Feng et al., 2024). Texture analysis incorporated in segmentation can provide insight into how different textures interact with colors and detail the compositional visual dynamics of the space (Kong et al. 20, 24).

However, color segmentation poses its own challenges. Looney explains, changes in color due to light, shadows and reflections can make proper segmentation challenging. However, more advanced techniques that encode both color and texture together become necessary since the complex textures can bring color variations impossible to detect through static algorithms (Salmi et al., 2021). Finally, there is a very real risk of over segmentation when too many segments can hide the overall color especially in images where subtle color variation exists (Cardenas-Cornejo et al., 2022). New methods are being developed which address these problems and should be able to offer much more accurate segmentation methods (Praksyvyi et al., 2024; Zalesky et al., 2024). Examples of such methods include deep learning models and interactive tools.

2.2.3 Dominant Color Clustering

However, more recent research has since corrected this and expanded our understanding of how color affects psychological states. According to the research, color can impact cognitive functioning like attention and efficiency. Blue, for instance, in numerous workplaces is associated with increased calmness and focus (Elliot et al., 2014). Other studies have expanded the research on how color can affect comfort and stress levels as well. Awad et al. Wood et al. (2024) state warm colours have been shown, to lift energy a focus while cool colour as Blue and green can help calm stress and anxiety.

Because the use of dominant colors in an image eliminates most of the rest, it makes images less complex in their color palette easily contributing to your understanding when determining paint schemes for rooms and overall interior design.

Chang et al. The process, as (2022) describe it, begins by transforming any image into some color space like RGB, HSB, etc., in which any of them is just a continuous diagram and whose points are only made up according to the value of each pixel. Lastly, clustering algorithm like GMM or K-means groups the closest related colors together. In line with Bao et al. (2023) and Chang et al. (2023).

GMM model for color distribution is a GMM mixture color distributions which can model more complex color variations, while K-means clustering clusters the colors to K clusters where before we have to specify how many clusters (k) should be in the image and tries to minimize the within-cluster variance. In Figure 2.4 (Chang et al., 2022), we can see that clustering results in a simple display of color that indicates the main color parts inside an image.

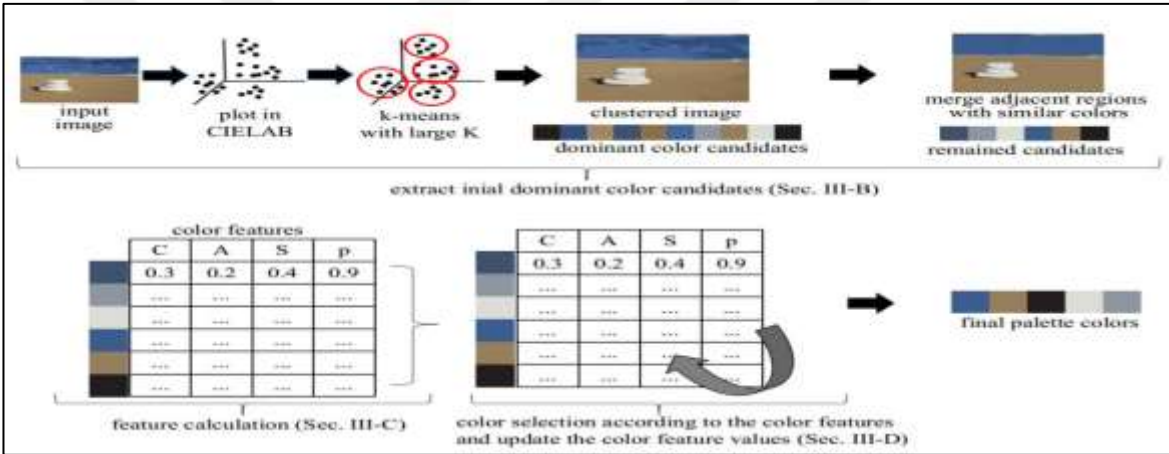


Figure 2.4: Example of Dominant Colors (Chang Et Al, 2022).

Professionals in design may benefit from the kind of dominant color clustering used here. It helps in color harmony on how dominant colors work well together, allowing designers to easily identify and adjust color schemes to achieve visual coherence. In addition, according to Bao et al. (2024) and Enwin et al. (2023) mention balance and contrast, to aid with that task as balance is assessed in terms of warm color dominance either being accompanied by cooler colors or whether the appropriate number of those reds are made, knowing full well they will be harder to get right. Analyse the colors that are dominating in programmers' favourite designs and change them in new projects so, it can help us to make changes accordingly with users likeful designs. However, dominant color clustering is prone to some problems. This will influence the accuracy of clustering results, as discussed by Liu et al. (2023); whether street protests are justified due to differences in color perception related to

ambient lighting and color. K-means clustering selectivity is subjective and impacts the degree of detail with which this analysis is conducted (Liu 2023). Guo et al. (2023), the detailed color information of complex spaces gets lost due to an excessive simplification. However, Escamilla et al. (2023). The emergence of technology such as AI in addition to tools such as real-time clustering is forecasted to help the functionality and precision of dominant color clustering. Liu et al. (2023) to enable a more interactive and personalized design experience.

2.3 VISUAL QUALITY ASSESSMENT IN INTERIOR SPACES

This section aims to investigate from the literature, how various design elements specifically color fill in the aesthetic value of interior spaces. Through the lens of substantial research covering these aspects subjectively and objectively, this study will address how color impacts on visual beauty, user comfort and overall spatial congruence in fashion (Adilova et al. 2024). This will also cover the significance of color in high quality interior design and will discuss some techniques for assessing visual quality using color segmentation, clustering, as well user surveys (Wei et al. 2023).

2.3.1 Visual Quality

The appendage that the general impression users have of the balance in the interior reflects the visual quality of the space is multifaceted. This perception is brought about by such factors such as colour and illumination, texture and spatial arrangement of furniture in the building. Based on Zanon et al. (2019). Since the aspect of visual quality is directly associated with user comfort and satisfaction, as well as interior climate in design it is highly important to assess it. There is no doubt that the overall organization of an image can directly concern its appearance. This is the opinion of Kumar et al. (2023) According to the findings of, the overall aesthetic coherence is directly dependent on the interrelation and interconnection of the colours within the predetermined place.

Selecting a chromatic in which the colors are either harmonic in terms of harmonic (similar color relationship something like color wheel neighbors) or contrast ant, in terms of color contrast, require choosing a chromatic in which the harmonic color relationships are correct is crucial to harmony. From such harmony, balance and unity are produced visually. Further also highly relevant to creating the richness and layered nature of an environment is texture.

According to Kumar et al. (2023), to avoid such conflicting motifs, any integration of textures in respect of floorings, wall coverings or fabrics must harmonize with the current color and design scheme. Rough textures.

For instance, can provide warmth and excitement, while the light can help in getting a modern style. The use of light and darkness is vital in procedures aimed at focusing on, or visually obscuring certain features in space. According to Muxamadiyev et al. (2023). Improvement in colour and texture contrast requires the consideration of artificial lighting and supplementary natural lighting. Shadows play a huge role in giving perspective and depth to any area and as such, the quality of the spaces overall aesthetic charm. Bulk visual quality is also impaired by the concept of functional integration while at the same time being associated with furniture layout.

This claim is supported by Ifroh Ya Albi et al. (2024), the placement of furniture is one of the factors that contribute most to usability and aesthetics. Properly placed furniture ensures a space aesthetically pleasing and practical for its use. Also, it depends on the movement design of the user and spatial use and influences in visual quality by space. The last study in relation to this abstract is from Muxamadiyev et al. (2023). The arrangement of furniture, lighting and decorative factors can affect the visual quality of an area more decisive, contributing to a human's experience with the space by either facilitating or obstructing users' paths throughout space. Mastering great visual quality is about being able to make it work wherever are whether that's a large open plan office or a tiny apartment. Determined that each part had its stand apart function, with respect to the appearance while maintaining it completely functional without taking up any space available. According to Hazbei et al. (2021), In this respect, the quality of vision is sustained by keeping such balance mood atmosphere which falls under the emotional resonance category and makes.

It clear that visual quality is not only utility & aesthetics feelings evoked are considered as well as Livia et al. (2018) and Lomas et al. (2022) demonstrates that the emotional effects of feeling comfortable, energetic, calm or led by nature are undeniable aspects of a visually quality space. Designers often evoke a particular mood for a space by what they use in terms of either color, lighting, or materials as much as its intended function and feel. A user centric approach to designing spaces that have a social element, but which should still be mindful of end users needs preferences and look good. Shao et al. (2022) and Rill et al. (2018) The

space will be found more visual of quality if the space designed with great thought about how the design balanced with user experience towards the place and met by good architectural approach.

This way you do look good, comfortable to ride and quality is assured for the users. Visual quality is in some capacity influenced by culture, this sense of appropriateness also extends to cultural seed. Colors, materials and design elements frequently have associations or meanings. Following Sinclair (2009) and Yudhanto et al. (2023) Understanding and gathering this cultural small difference will help to add more meaningful context and relevance to its situation in terms of its setting. An interior has to resonate with the architecture of the building. Respecting design architectural harmony and at the same time enhancing, whether it be modern or traditional or both. Objective and subjective means of evaluating interior visual quality are often combined in practice. Lighting levels, color balance and space percentage Objective assessment via quantitative metrics. In line with Adilova et al. (2024) and Kumar et al. (2023) One such as colorimeters, light meters, spatial analysis software or image analysis methods such as color segmentation and clustering provide an unbiased basis for assessing visual quality.

Remember image quality is partly subjective, as well as objective. This is feedback we can identify as user opinions through surveys and responses. state that Adilova et al. (2024) Singam et al. (2023). They include polls about satisfaction, comfort, usability, and aesthetics. Furthermore, assessments of architectural and interior professionals who are expert in accepted design principles along with know-how, can succinctly articulate where non-obvious strengths and weaknesses may lie. The primary aim of visual quality assessment is to improve the user experience.

Adilova et al. (2024) and Kumar et al. (2023) emphasize the importance of good visual quality for creating environments that are both beautiful and functional regarding human health and well-being. Productivity and well-being can increase significantly in a well-designed environment that reduces visual distractions and promotes relaxation. Perfect visual quality environment improves/enhances mental and physical health (Adilova et al, 2024; Singam & Co. 2023)

2.3.2 Assessing Visual Quality: Survey

When it comes to interior design, surveys are the only way to evaluate the visual quality of things from the perspectives of end-users. As stated by Vinkers et al. Surveys (2024), Surveys provide qualitative data, insight on how people think its ambiance, functionality, and aesthetic of a place and so on. Otherwise, you are missing out on hundreds of valuable inputs which are critical for determining if a design is good for its intended users. Answers to Likert scale questions on structured face to face surveys provide measures of user satisfaction with design elements including color palette, lighting and textures. As stated by Min et al. (2024), these surveys often include participants to rate aesthetic, functional and comfort levels within the space. The idea enables a deep understanding of how different elements of design, like color can impact the visual attractiveness of interior spaces.

2.3.3 The Role of Color in Visual Quality

Users have a perception and occupy the color of the interior area, making it crucial when determining them with an adequate choice of color to express that anywhere around the place, so one can understand how important this factor is to define the visual quality of an area. Interior color has both functional and visual implications. According to in line with Awad et al. (2024) colors create warmth and comfort. Warm colors, have warm in nature and its color usually mix from orange, yellow, red. Warm paint colors in a living room, for example, can have a calming and comforting effect. Conversely, warm colors like red, orange, and yellow stimulate energy while cool colors such as purple, green, and blue to create a calm serene experience.

According to Wei et al. (2023), such colors are described as invigorating and good for a forgiving atmosphere ideal for bedrooms or study locations where people need both to relax and concentrate at times. Light colored walls can make a room feel bigger and more open as they reflect the light and reduce visual clutter. In keeping with the goal of improving the impression of spatial capacity, this is particularly helpful in smaller areas.

Wei et al. (2023) reports that when darkening a small space can give the impression of increased spaciousness, the specifications are generally idealising light walls. This is particularly the case in smaller spaces, and feeling of claustrophobia can be created by darker walls. Even in larger spaces it is a good idea to try and create an atmosphere of comfort. Xie et al. (2023) found that in large spaces, dark walls can keep the area more closely wrapped and hence give you a comfortable feeling. Contrasting colors on all the walls or major components (such as floors) will make a room more visually exciting. Göktaş et al. (2024) even demonstrated how with powerful contrast, using dark wall colors becomes not just a focussed point of fat and vitality for the whole space but also contributes to its vertical scale. Conversely, low contrast can form a progressively unified and sensible appearance the wall color blends naturally with the different decorative elements. Tang et al. (2024) reported that this is a technique widely used in minimalist designs, meant to create and preserve an even, peaceful line of sight throughout the space.

3. METHODOLOGY

This research uses both quantitative and qualitative data collection and analysis to effectively evaluate the visual quality of space by analysing the impact of color on the users. To give a comprehensive insight into the effects of colors to the perceived aesthetic and functionality of interior environments, the methodology incorporates quantitative image analysis with user responses.

The study combines two main components questionnaires targeting the users as well as subjective analysis of dominance particularly the coloured dominance. Objective in the first component, color dominance is measured using quantitative image analysis techniques. Performing this analysis on a dataset of 100 images of living rooms that have been well-chosen to show versatile color schemes is easy. For the purpose of identifying all the major colours in each of the spaces, the images are divided and sorted based upon the amount of colour dominance. The second stage is also the collection of the qualitative data with the help of the surveys. The objective of these surveys is to elicit the user perspectives and commentaries of the spaces, the visual representation of which is presented in the study. The participants shall be required to assess the overall satisfaction of the color schemes as well as other factor such as comfort, functionality, and aesthetics.

Therefore, the following research objectives are proposed to create a research framework that will both quantify and qualify the effects of colour in the context of the identity and Celebration of interior spaces: While the distribution of color patterns can be evaluated in an accurate numerical sense, the users' preferences and the emotions they feel can be elicited through questionnaires. An integrated approach will help use to compare understandings across studies more easily and integrate empirical findings with users' evaluations of color impact on interior design.

3.1 DATA COLLECTION

The goal with this section is to explain how we went about gathering information for our study. Specifically, how 100 living room images can be found on the Internet in various forms.

This section will include the standards we used to select our images, which ensures that there really is a diversity of colors and interior styles. Moreover, the paper will explain the importance of high-resolution graphics. It needs associated colour segmentation to be accurate detailed analysis. It outlines the method of colour analysis for determining dominances and distributions in selected images. This is significance if you wish to know how color influences the atmosphere of an interior space.

3.1.1 Images Selection

To gather 100 high quality images of living rooms, only websites that dealt with interior design, architectural design and home décor blogs were approached. As can be seen from Figure 3.1. The images were selected in such a way to cover broad ranges of colour and interior design styles, which ensure that the study occupies a vast space in terms of visual experience that can be investigated in relation to the perceived interior quality. To ensure the relevance of the images along with their fit for the study goals, the following criteria were used (Images are given in the Appendix).

To improve the variability of the approaches used in the study on the usage of color in interior spaces, the images of the color combinations and multi-coloured designs were incorporated into the work. To ensure that the color analysis and segmentation processes were correct, images with sharp features were used only. Color dominance and segmentation analysis is in fact more accurate if the images are clear. Arrangement, furniture, wall decoration, floor, and lights were considered while determining the relation between images and living room. These components are very crucial helps for understanding color dominance and color distribution analysis.

3.1.2 Colors Analysis

The main goal of this analysis is to assess the dominant colors in each chosen interior space and determine how they affect the space's aesthetic appeal. The study aims to ascertain the dominant colors' contribution to the interior space's aesthetic and functional appeal. The methodology comprises a methodical color analysis process that starts with the computation of color frequencies and ends with the application of clustering algorithms to group colors that are similar. The steps that follow are listed below in steps:



Figure 3.1: Samples of Data Collection Images.

3.1.2.1 Step 1: Color frequency calculation

Hence, the primary objective of the analysis under consideration is to evaluate the prevalence of the leading tone within selected interior space and identify the correlation of the particular hue in regard to the attractiveness of the interior space. The research questions are to determine the extent to which the identified dominant colors enhance the concept of interior space both aesthetically and in functionality. The methodology involves a stochastic color analysis that involves computation of color frequencies then application of clustering algorithms to group the colors close in color frequency. The next steps which come following are enumerated below in steps.

3.1.2.2 Step 2: Image Processing Algorithm (Color Dominance Clustering)

In this work, the image is analysed using a certain color dominance clustering algorithm to identify clusters of colors the image contains and their frequency. The clustering employed here is the so called K-means clustering. One of the strengths of this method is that it works very fine especially when segmenting the colors into different clusters. For the analysis that follows, color quantisation means that the image has been converted to an appropriate colour space such as RGB.

The most significance colors are preserved because the algorithm reduces colour space to a reasonable number of colours. Afterwards, the pixels are partitioned into groups, hereinafter referred to as clusters, based on the K-means clustering technique in which each cluster is associated with the most widely used color. If k is 5 the algorithm can identify five main colors present on the picture. The choice of k is made such that it can be analytically possible and still obtain a satisfactory k value which could give a good estimation of the overall color of the image. The final choice of the dominant color within each cluster is made after the clustering algorithm has been performed. This is the distribution of major pixels in the identified image color spectrum. These quantified colours are then presented in a palette thus giving a representation of their proportionate in the space (Figure 3.2)



Figure 3.2: Samples of Colour Dominance Clustering.

3.1.2.3 Visual Quality Assessment

Introduction evaluation of visual quality is one of the most crucial parts in the different stages of color analysis. As for this part, it will try to elaborate how the colours which are dominant in each living room for both appearance and utility. A relative assessment is based on a set of basic principles: proportionality and symmetry. Organizing and interpreting received through eyes information function of the brain is named a “visual perception”. This is the reason we can understand and interact with the environment that is around us.

These include recognition of the size, texture, hue, cleft, and movement, and placement of one thing relative to another. Realizing how can see a space is crucial towards gauging the layouts, hues, and overall usability with regards to interior design. They allow special between different spaces, seeing how things are placed, how each height and width of shapes, colors and lights feel to the spatial sense. Effective implementation concerning design and aesthetics ensures that corridors are well designed to complement the general layout and provide coherence and order in the performance of various activities and organization of spaces. The primary components of visual perception are form and shape recognition, meaning recognizing the objects and their arrangement in the space, color perception which interprets the intensity, warmth or coolness of the object, depth perception which simply judges the distances and spatial relationships and lastly spatial perception which is correctly utilizing the space. Collectively, these components influence how people use, and interact with interior environments, to enhance aesthetics and comfort.

In a similar manner that colours, shapes, textures, and patterns organized cohesively in a layout make an aesthetically appealing design or setting, then the composition is referred to as having visual harmony. Moreover, the thought of being in space without any shocking elective triggers becomes comforting and harmonized. The concept of visual harmony in interior design is said to have been accomplished when all the components being used harmoniously blend together and create an appealing point of view of balance and order. The idea is to make every aspect of the design fit into the outlook of the whole place and not dwarf it.

Color harmony is one of the main components in harmony in visual compositions in which they arrange complementary, similar, or even monochromatic schemes so as to achieve a space that is visually satisfactory for its use of colors that are compatible in mixing. It is about balance and measures; no part in the space can look out of place or to dominate any other part. Another feature that is useful in the design process is proportion and scale so that items are the appropriate size and items and space connect harmoniously. Consistency is the key if you want a room to look balanced, then I believe that relying on certain aspects in the interior design of the room such as colors or patterns helps to put the room in order.

Lastly, unity maintains continuity and structure in space and stops it from looking chaotic while contrast adds appeal. In other words, the spatial effectiveness and visual beauty gain

an increase when visual harmony is applied. Therefore, the view is calm, well structured, which guides the observer through the design and does this in the most unobtrusive manner, as indicated in Table 3.1.

Table 3.1: Survey Questions on Visual Quality, Perception, And Harmony Of Interior Colors.

Visual Quality	
Visual Perception	Visual Harmony
Q _{1.1} The space looks comfortable with its colors.	Q _{2.1} The color harmony (distribution) within the interior is good.
Q _{1.2} The space appears aesthetically pleasing (visual quality) with its colors.	Q _{2.2} The color intensities in the interior are balanced.
Q _{1.3} The spatial perception is clear and understandable with its colors.	Q _{2.3} Colors are used consistently throughout the space.
Q _{1.4} The space provides a warm and inviting atmosphere with its colors.	Q _{2.4} The use of colors is creative and impactful (Color-Architectural quality relationship).
Q _{1.5} The space is functionally effective with its colors.	Q _{2.5} The spatial arrangement and color scheme are harmonious (Positional and visual relation).

3.2 SURVEY DESIGN

A carefully thought-out survey was created to gather subjective user input on the aesthetic quality of the living rooms shown in the chosen images. The survey was created with the research objectives in mind, with the goal of obtaining thorough information about user's perceptions of various colors used in interior spaces. One hundred images of living rooms with various colors were shown to each participant. Using a Likert scale with a range of 1 to 5, the participants were asked to rate each image based on five distinct criteria. The criteria included the following questions:

Q_{1.1} The space looks comfortable with its colors.

Regarding color choices and how they affect the overall atmosphere of the space, this question gauges the participant's sense of comfort.

Q_{1.2} The space appears aesthetically pleasing (visual quality) with its colors.

By evaluating the space's aesthetic quality and visual appeal, this question shows how much the colors add to the overall impression of beauty and appeal.

Q1.3 The spatial perception is clear and understandable with its colors.

This question assesses how well users perceive the spatial layout and design, considering how color is used to define space.

Q1.4 The space provides a warm and inviting atmosphere with its colors.

It is determined by answering this question whether the colors improve the general mood of the space by fostering a warm and inviting atmosphere.

Q1.5 The space is functionally effective with its colors.

This question evaluates how much the colors help the space function, considering things such as usability, navigation, and sensible design choices.

Q2.1 The color harmony (distribution) within the interior is good.

This question evaluates how well the colors are distributed and balanced throughout the space, which helps to create a unified and visually appealing atmosphere.

Q2.2 The color intensities in the interior are balanced.

This question evaluates the effectiveness of the contrast between light and dark color to create a visually pleasing impression.

Q2.3 Colors are used consistently throughout the space.

This inquiry evaluates the degree to which colors are applied consistently to various components and spaces, ultimately resulting in a cohesive and melodic arrangement.

Q2.4 The use of colors is creative and impactful (Color-Architectural quality relationship).

This question evaluates how well-thought-out and useful color selections are in elevating the space's architectural value and visual appeal.

Q2.5 The spatial arrangement and color scheme are harmonious (Positional and visual relation).

This question evaluates how well the color complements the spatial design, resulting in a visually harmonious and well-balanced relationship between the color distribution and the spatial elements.

The Likert scale options were: Strongly Disagree, Disagree, Neutral, Agree, and Strongly Agree, as shown in Figure 3.3. The survey was distributed to a diverse group of 87 participants, comprising both professional designers and non-designers.

A wide range of viewpoints from people who regularly interact with interior spaces and those who have in depth knowledge of design principles were obtained by including participants with varying levels of experience and expertise. An online platform, Question Pro, was used to administer the survey. This methodology facilitated participants' ability to easily peruse the images and offer their assessments (In the Appendix survey link is provided).

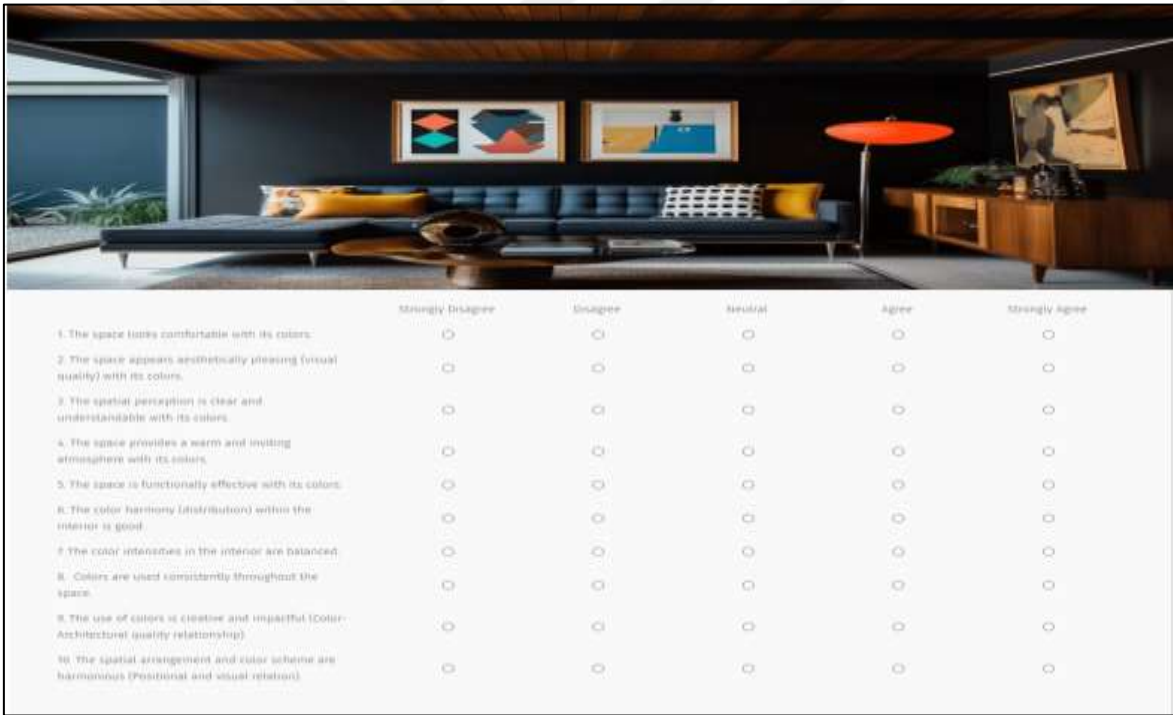


Figure 3.3: Example for Survey.

4. VISUAL IMPACT AND PERCEPTION OF COLORS

This chapter examines how color affects comfort, aesthetic appeal, perception of space, atmosphere, and practical efficacy, among other elements of interior design. The opinions of participants regarding how different colors influence these aspects of interior spaces are gathered from survey questions and used to explain each section. The association between the use of color and the aesthetic appeal and practicality of interior spaces is then determined by analysing the data. (In the Appendix tables with photos provided).

4.1 COMFORT OF THE SPACE

Q1.1: "The space looks comfortable with its colours." In the Appendix tables with photos are provided.

An interior space's colors were evaluated according to how comfortable it is, as reflected in the responses provided by the participants. The use of light colors in the highest-rated images influenced participants' increased comfort levels by creating a feeling of lightness and openness. Lighter colors have been seen to improve natural light reflection, resulting in creating a lighter and more open atmosphere. However, the participants who assessed the images with the lowest ratings said that the darker colors made the room feel less large and tighter, as shown in Table 4.1.

Table 4.1: Influence of Colors on Interior Comfort Based On Participant Ratings.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Highest					
Lowest					

Dark colors can absorb light, making an area seem confined. The sense of size and comfort might be diminished by the overuse of dark colors. The following figures show participants' perceived levels of comfort in connection to the colors used in interior spaces, as well as comfort ratings based on light and dark colors, as shown in Figure 4.1, 4.2.

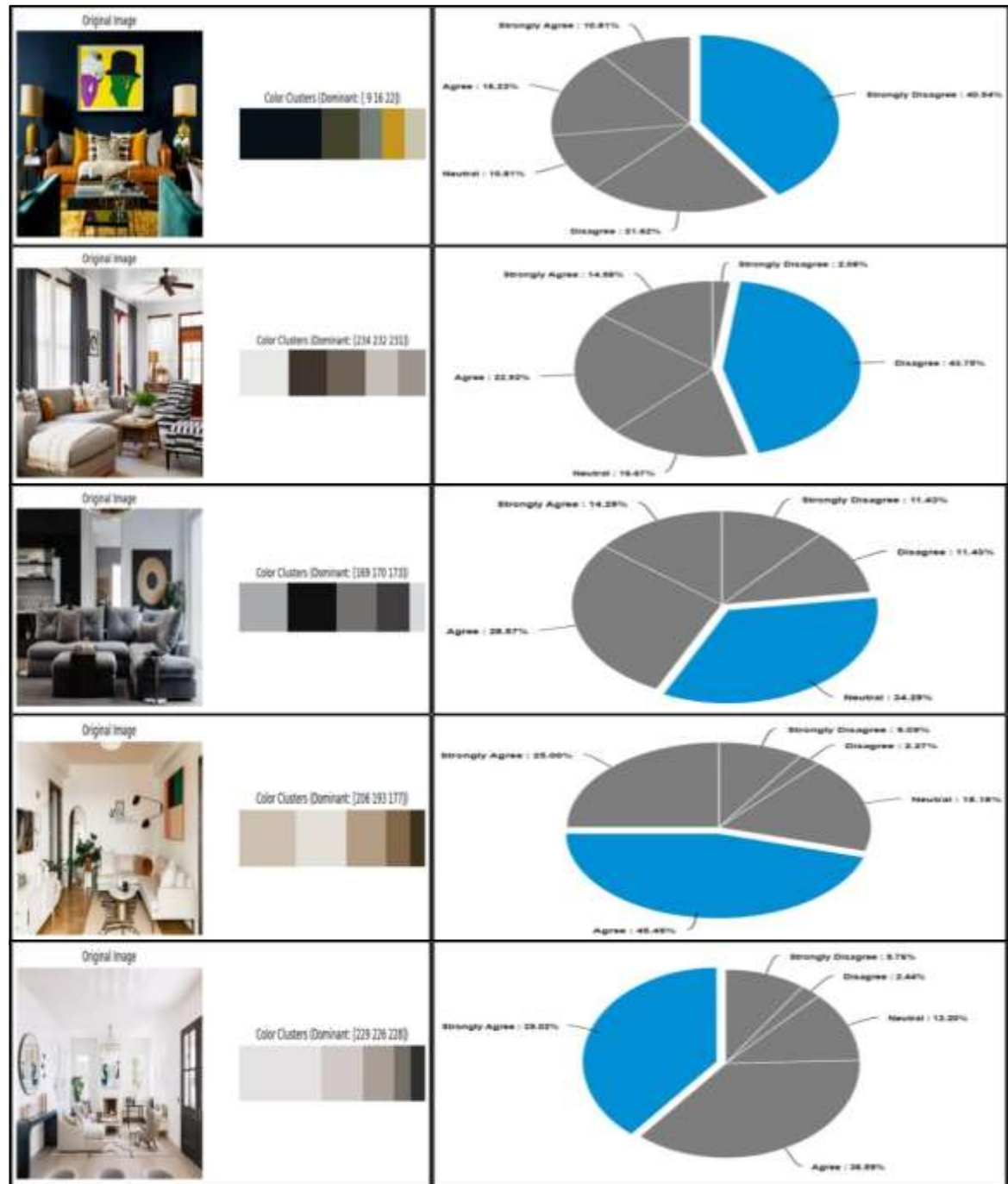


Figure 4.1: The Images and Charts Show The Highest Rate Colors On Interior Comfort Based On Participant Ratings.



Figure 4.2: The Images and Charts Show The Lowest Rate Colors On Interior Comfort Based On Participant Ratings.

4.2 AESTHETIC APPEAL

Q1.2: "The space appears aesthetically pleasing (visual quality) with its colors." (In the Appendix link for results and charts provided).

In terms of aesthetic appeal, the data shows that images with calm, light colors scored the highest. Participants showed a preference for colors that provide an interior design with a sleek, modern appearance because they felt these colors encouraged harmony and visual balance. One way to create a neat and organized appearance was to use light colors options.

Dark colored images, on the other hand, received a low visual appeal rating. It was sometimes thought that using too many dark colors would create a cluttered, formal atmosphere. This shows that dark colors can have a negative visual effect if they are not harmonized correctly, as shown in Table 4.2.

Table 4.2: Influence of Colors On Aesthetic Appeal Based On Participant Ratings.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Highest					
Lowest					

4.3 SPATIAL PERCEPTION

Q1.3: "The spatial perception is clear and understandable with its colours."

It came to light those images with light colors helped the space's improved organization and clarity. It was found that the usage of these colors improved the clarity of functional spaces and helped with the creation of an open, simple to navigate environment. Light colors improve the way that space is perceived by reducing visual obstacles that might affect the

organization of functional spaces. Contrarily, the results showed that using dark colors may make it difficult to differentiate between functional spaces, which would lessen the clarity of the space's overall layout. As a result, using dark colors had the opposite effect on the clarity of the space, as shown in Table 4.3.

Table 4.3: Influence of Colors on Spatial Perception Based On Participant Ratings.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Highest					
Lowest					

4.4 ATMOSPHERE

Q_{1.4}: "The space provides a warm and inviting atmosphere with its colors."

In terms of creating a warm and comfortable ambiance, light coloured images received positive evaluations. As per the participants' responses, these colors fostered a positive environment that valued comfort and openness. On the other hand, participants felt that using dark colors repeatedly could result in a chilly or unpleasant mood, which is why they ranked them worse, as shown in Table 4.4.

Table 4.4: Influence of Color on Atmosphere And Comfort Based On Participant Ratings.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Highest					
Lowest					

4.5 FUNCTIONAL EFFECTIVENESS

Q1.5: "The space is functionally effective with its colors."

A space's functional clarity is improved by visuals with light colors. In addition to helping to create an environment that is efficient and well organized, participants discovered that light colors make it simpler to comprehend how functional spaces are organized. Darker colors, on the other hand, made it harder for participants to figure out the space's intended function, as shown in Table 4.5.

Table 4.5: Influence of Colors on Functional Clarity And Usability Based On Participant Ratings.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Highest					
Lowest					

5. VISUAL HARMONY AND DISTRIBUTION OF COLORS

One of the most essential elements that improve the aesthetic appeal and functionality of any interior space is color distribution and harmony. In space design, color harmony is the harmonious use of color in a balanced way to improve the overall aesthetics and establish a visually pleasing space. This chapter includes participant assessments of their reactions to different colors to examine how color harmony and color distribution affect the quality of an interior space. (In the Appendix tables with photos provided) .

5.1 COLOR HARMONY

Q2.1: " The color harmony (distribution) within the interior is good." (In the Appendix link for results and charts provided). The participants gave the best ranks to the images that showed the most constancy in color harmony. A space that was calm and well balanced was created by the thoughtful use of light colors. The use of uniform and related colors, which produced a visually comfortable and harmonious mood in the space, received praise by the participants. On the other hand, images with a contrasting design and darker colors rated low for color harmony. It was argued that these colors lost balance and were random, giving the space an untamed aspect and several visual gaps, as shown in Table 5.1.

Table 5.1: Influence of Colors Harmony On Visual Coherence And Aesthetic Appeal Based On Participant Ratings.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Highest					
Lowest					

5.2 COLOR INTENSITY BALANCE

Q_{2.2}: " The color intensities in the interior are balanced."

High rated images had the optimum amount of color intensity, using light and medium colors selectively and uniformly. As not one of the colors overly dominated the scene, participants' replies suggested that these colors helped to create a serene and relaxing mood for the eye. Low-rated images included an unbalanced use of color, with a lot of dark colors causing the space to appear small. The subjects experienced discomfort and visual fatigue because of the excessive usage of colourful colors, as shown in Table 5. 2.

Table 5.2: Influence of Color Intensity on Visual Atmosphere And Comfort Based On Participant Ratings.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Highest					
Lowest					

5.3 CONSISTENCY OF COLORS

Q₂₃: " Colors are used consistently throughout space."

Images with high color consistency received high ratings, adding to a well-rounded and consistent visual experience. The participants discovered that the area had a harmonious and visually quality design since the colors were evenly dispersed throughout the spaces.

Low consistency images, on the other hand, were considered for lack of unity, with colors appearing disconnected and connected. The space felt cluttered and irregular because of the inconsistent use of color, as shown in Table 5. 3.

Table 5.3: Influence of Colors Consistency on Visual Cohesion and Design Flow Based On Participant Ratings.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Highest					
Lowest					

5.4 CREATIVITY AND IMPACT

Q2.4: " The use of colors is creative and impactful (Color-Architectural quality relationship)."

The highly scored images displayed color innovation, combining small splashes of bright color with lighter colors to brighten the whole composition and give it more visual depth. Participants observed that the colors improved the overall harmony without detracting from the visual quality.

Darker colors were utilized in an unbalanced design in the images that scored lower, giving the space an uninspired aspect. This lack of creativity in choosing colors was evident in these spaces, as shown in Table 5. 4.

Table 5.4: Influence of Creative Color Use on Visual Interest And Aesthetic Appeal Based On Participant Ratings.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Highest	 	 	 	 	 
Lowest	 	 	 	 	 

5.5 SPATIAL AND COLOR SCHEME HARMONY

Q2.5: " The spatial arrangement and color scheme are harmonious (Positional and visual relation)."

Images that received high scores showed a definite harmony between the colors and space organization. Light colors increased visual quality and made it easier to navigate between spaces, according to responses from participants on how they improved the space's flow and harmony between various aspects. Particularly dark colors, on the other hand, were rated low by participants, who felt that they had broken up the visual flow of the image and made it appear as though there was a disconnect between the various items, as shown in Table 5.5.

Table 5.5: Influence of Colors on Spatial Harmony And Visual Flow Based On Participant Ratings.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Highest	 	 	 	 	 
Lowest	 	 	 	 	 

6. RESULTS AND DISCUSSION

The color dominance and perception findings of user surveys and color analysis are presented in this chapter, which assesses the visual quality of interior spaces. Both major components of the results are separated. A quantitative K-means clustering analysis of color dominance and distribution is performed first. User surveys were utilized to gather qualitative input. These findings are combined in this chapter to deduce how the arrangement and dominating colors impact the investigated spaces' aesthetic and practical qualities, as shown in Table 6.1.

6.1 RESULTS OF THE VISUAL PERCEPTION QUESTIONS

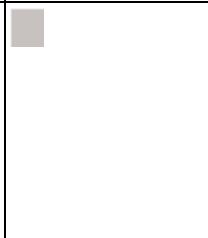
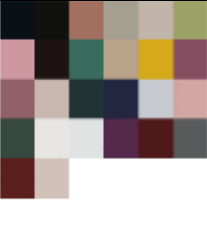
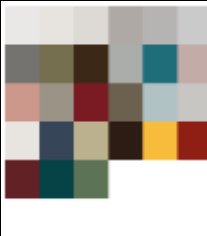
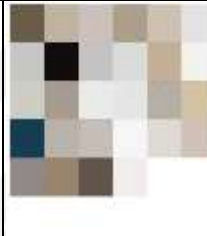
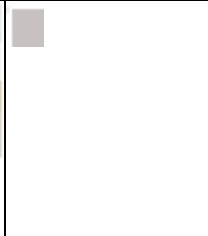
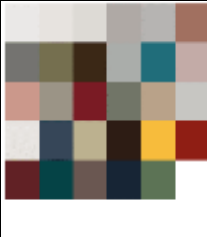
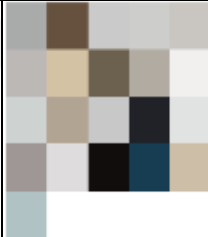
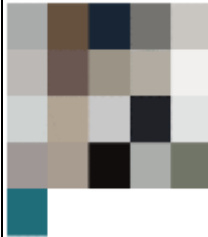
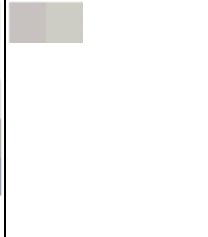
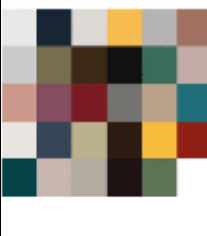
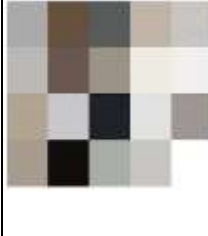
The results of this section give the participants' opinions on the influence of colours on perceived comfort, attractiveness, perceived space, mood, and utility of space. The data was collected based on the survey with questions which evaluate these elements.

Furthermore, because of the participants' beliefs that increased light color enhances human health and comfort, the results denoted a predisposition towards lighter colours in institutional spaces. Use of lighter colors enhance the natural light coming, and as a result soil the environment to be comfortable and welcoming. The respondents who strongly felt a positive attitude towards. Low light colour suggestion mentioned that low colour intensity gave out a sense of freedom and relaxation. On the other hand, the dark colors were rated uncomfortable in spaces. These colors negatively affected the feelings of comfort as the space seems to be even less, crowded. The outcome revealed that colours used least are most popular as they create the impression of modernity.

Different participants noted that use of light colours promotes harmony and balance on interiors. Still, some participants had concerns about light colored clothes, saying that looking uninspired and less bright was a possible problem. Test results in general for dark shades were also inconsistent. Hence it would seem that dark colors may in some cases create a perception of depth, but those same colors may literally dominate and encroach on the space and be too forceful. Also, it is ascertained that differentiation of the interiors in lighter color range improves user's perception of space making functional zones extraordinarily clear and easier to navigate. Use of light colors clears up a place as it has minimum limits to the visibility of the area. On the other hand, darker colors made the space less

comprehensible because, as participants noted it becomes difficult to distinguish between functional areas, hence the design of the space makes more sense.

Table 6.1: Results for Visual Perception Questions.

Group 1	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Q _{1.1}					
Q _{1.2}					
Q _{1.3}					
Q _{1.4}					
Q _{1.5}					

All the outcomes have revealed the fact that light colors would help to design an open and comfortable environment. It was pointed out by participants that these colors enable the development of an environment that is unrestrictive. Drawbacks such as shift of colors to

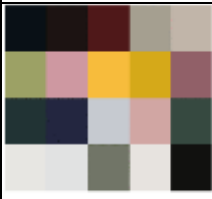
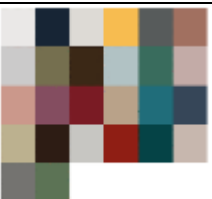
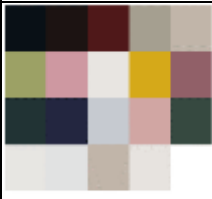
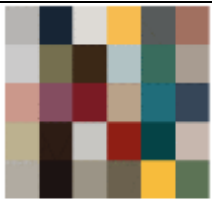
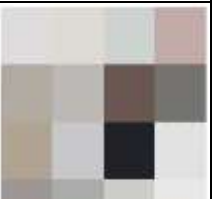
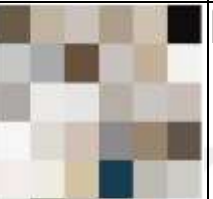
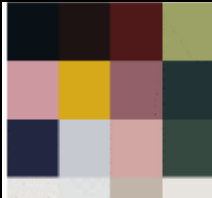
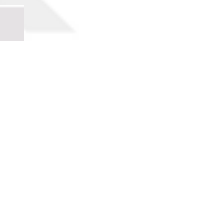
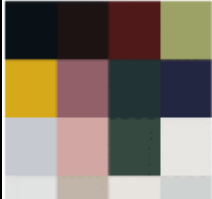
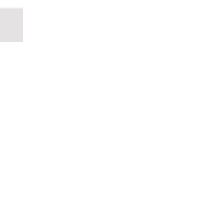
warmer ones, which introduced comfort and warmth into what was doing were noted that the colours appeared to be heavy sometimes. Since respondents were able to comprehend the pattern of placing functional zones, light colours emerged once more as the leaders in enhancing the functional utility of the space. Participants, however, observed that darker palettes made it hard for the spaces to be deemed functional, thus an impact on functional utility.

6.2 ANALYZING COLOR HARMONY AND DISTRIBUTION VISUALLY

Since as participants, participants were able to comprehend how the functional spaces were arranged, light colors continued to assert their role in enhancing the functional suitability for the room. However, darkness was discovered to impair functional efficiency in that the potential functionality of spaces was likely to be ignored due to their colour. According to the participants' answers related to the harmony and distribution of colors in interiors, the findings were divided into five major sections, which are presented in Table 6.2. The findings demonstrated that contented subjects are in environments that establish pleasant graphics with balanced colours. Luminous and low interference shades were used to upgrade the entire area of the house. Formerly there was much more criticism of contrasted colors which were said to be out of harmony. Because of the color's pastel and harmony, areas with an appropriate level of color saturation were rated highly. On the other hand, dark and unbalanced color schemes were considered difficult to look at and had perceived lower participant comfort.

Also, before translating to the actual space, the outcomes realised the theoretical schedules by showing that the balance and uniformity of colours in the area can combine coherently, to generate a thoroughly balanced visual image. Color differentiation also served the objective of enhancing the cohesiveness and aesthetic quality of the design. The spaces that attracted the participants and made them want to get more information were creative use of color especially when using light color combined with the dark shade. On the other hand, environments with a poor choice of color had unattractive designs, this meant that creativity was also poor. Increased in the levels of light colours provided ease of movement in the space as well as the different sections as was revealed by the findings. Contrast with black rounded square shapes violated continuity and made the atmosphere of the room in a sense disjointed.

Table 6.2: Results for Visual Harmony Questions.

Group 2	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Q _{2.1}					
Q _{2.2}					
Q _{2.3}					
Q _{2.4}					
Q _{2.5}					

6.3 DISCUSSION

The findings of this work indicate that light colours positively influence ways of visual perception of space and comfort. Using lesser coats of paint also assists in increasing reflection of natural light and gives the room a look of spaciousness accompanied by a feeling of openness. It has the desirable effect of enhancing the structure and organizational

integrity of a space, so that the space itself can be better comprehended and organized. As for dark colors they can shape how a place feels because they reduce the perceived size and obscure the edges making it oppressive and confining when it comes to the feelings a place elicits. As for the lectures, again the results are presented, indicating that participants such as light colours that make the space look more contemporary and orderly. Applying light colors indicates that respondents require easy, smooth color schemes and help maintain order and symmetry in interior design. Dark colours are known by some people to give a negative balance in balance the optic, which could cause dissimilar opinions. In its findings on the competence of colour within appealing environment, light colours enhances the appealing environment. Light colours and onset make the comfortable environment and appealing, while on the other hand dark colours make the environment, heavy, uncomfortable and decrease the quality of the space.

The results stress the significance of maintaining colors in a balanced consistent manner when it comes to the concern of visual harmony. The resultant aesthetic features positives matched and balanced tones make a picture harmonic and comfortable to look at while contrast or dark colors are likely to make a picture uncomfortable and awkward to view. Besides making sure that the visual quality of the space is coherent, this coherence enhances the aesthetic value of the design. Beauty of the combination also helps to reach a comfortable level of comfort in the eyes. This is in harmony with the reasoning that beauty promotes esthetic equilibrium so that it creates an open beautiful environment that augments the aesthetics. This is because, in addition to the need for color harmony to enhance visual comfort, color harmony must be attained to enhance visual comfort.

Illustrates how equalizing, the dramatic saturation of color enhances the comfort of vision and reduces the fatigue If used recklessly, strong shades of similar colors could be particularly fatigue. Hence, the studies demonstrated that the more colour is used within the design, the more internal coordination and design attractiveness are enhanced. It also allows forging a uniform visual appearance of the product. This implies that attention grabbing colors attracts more attention, stressing on colour design creativity for effective result. The value of invention and creativity in design was also strengthening the value of innovation and creativity in the design.

All in all, precisely, they get light colors function effectively than the dark colors to enhance a certain region's comfort, beauty, and aesthetics. Light colours enhance perceptions and overall comfort because they offer probabilities of tidy spaces that are conducive to good interaction with the room interior. Such colors obscure the ability to see image quality and the visual experience in general. Thus, when being integrated into interiors, these formations should be applied carefully and occasionally.



7. CONCLUSIONS

7.1 CONCLUSIONS

This thesis employed a mixed methods approach to understand the role that color plays on the visual value of interior spaces. It integrated an objective methodological technique of K-means clustering with the simple subjectivity of the users. With data acquired from 100 different color images and having received answers from 87 participants, the study helped to investigate the impact of the dominant colours and colour placement on the comfort, aesthetics and practicality of such spaces. From the results it was evident that colour harmony and distribution was very significance in enhancing not only the aesthetic value of a space but also the functionality of that space as well. Balanced colours and graduate transitions were always rated higher to create better coherent overall visual appeal of the spaces. On the other hand, the deserted and inharmonious environment was perceived as uninteresting and isolated. The study also established the fact that appropriate distribution of colour assists in enhancing visibility and use to enhance order and usefulness of spaces.

The study proves that colour decisions influence the aesthetic properties and use of a space as well as psychologic properties. Hypotheses such as the use of light and neutral colors worked well in the openings and management of comfort as it bounces off light and appears enlarged and adaptive. On the other hand, darker shades should be placed in right proportion with lighter shades as they can be very useful in giving the design depth and would look some variety.

Thus, the present paper confirms the significance of understanding the role of color in designing interior spaces. When knowing how colors operating on both psychological and visual aspect, it would allow the designers to construct comfortable and enhance the users' experience. Also, the application of dominant color clustering and the responses of users in this research should benefit the interior design field. It implies that color reconciliation and innovation in the usage of colors go a long way in enhancing the aesthetic value interior themes. Future work may extend from these results by investigating high, dynamic color systems that provide personalized experience to spatial environments.

7.2 RECOMMENDATIONS

Taking the observations made in the course of this study into consideration the following recommendations have been provided to enhance quality of interior design using color.

- a. **Choosing Colors to Improve User Experience:** Large areas with great spacing to help create maximal comfort are best decorated with light and neutral colors to further achieve the best user experience possible. When selecting colours, one should aim at increasing the differentiation of the sensory qualities in the space occupied, and how freely one can navigate through it.
- b. **Achieving Balance and Harmony Between Colors:** As a result, recommendations to obtain both the objective and subjective aspects of visual comfort are made when using dark and powder colors in interior design. For the similar reason, dark colors have high visual quality, and they make a viewer comfortable, but only if used with lighter colors that may cause discomfort. Designers must also try as much as possible to have good transition of the colors they use in order to enhance the general look of the design.
- c. **Use Colors Creatively:** According to research it is advised that color should be used imaginatively, suggested uses being harmonious colour or color gradations, thus making the colors appeal and seem to have depth without obliterating the visual quality of the design.
- d. **Take User Experience into Account:** While choosing colors, one needs to define, how these can enhance the user experience with the given area in terms of aesthetics and usability. This means that sole considerations for the appropriate choice of the space's color should be aimed to enhance comfort and movements.
- e. **To Improve Color Analysis:** In this context, the study recommends the application of complex technologies, such as clustering algorithms or digital image analysis. These tools can add another level of understanding for choosing the right shades of colors for specific areas; thus, allowing a designer to make a better decision.

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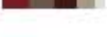
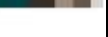
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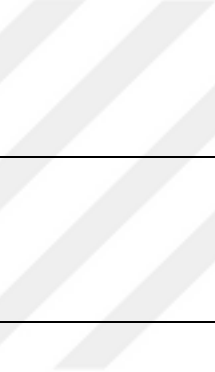
APPENDIX A

Findings for Chapters 4 - 5: The tables presenting the findings of participant answers from Chapters 4 - 5 are provided. These tables play ranks for all image included in the survey.

COMFORT OF THE SPACE

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
 Disagree (100%)	 Disagree (100%)	 Disagree (100%)	 Disagree (100%)	 Disagree (100%)
 Disagree (100%)	 Disagree (100%)	 Disagree (100%)	 Disagree (100%)	
 Disagree (100%)	 Disagree (100%)	 Disagree (100%)	 Disagree (100%)	
 Disagree (100%)	 Disagree (100%)	 Disagree (100%)	 Disagree (100%)	
 Disagree (100%)	 Disagree (100%)	 Disagree (100%)	 Disagree (100%)	
 Disagree (100%)	 Disagree (100%)	 Disagree (100%)	 Disagree (100%)	
 Disagree (100%)	 Disagree (100%)	 Disagree (100%)	 Disagree (100%)	
 Disagree (100%)	 Disagree (100%)	 Disagree (100%)	 Disagree (100%)	

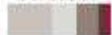
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
 	 	 	 	
 	 	 	 	
 	 	 	 	
 	 	 	 	
 	 	 	 	
 	 	 	 	
 	 	 	 	
 	 	 	 	
 	 		 	
 	 		 	

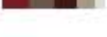
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
 	 		 	
 	 		 	
 	 		 	
 	 		 	
 	 		 	
 	 		 	
 	 		 	
	 		 	
	 		 	
	 		 	

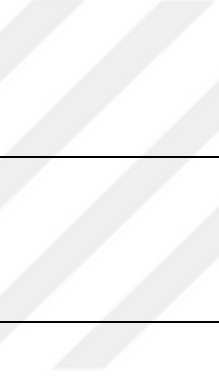
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
			 	
			 	



AESTHETIC APPEAL

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Bedroom  Color Scheme: 1903 	Living Room  Color Scheme: 180303 	Living Room  Color Scheme: 180303 	Living Room  Color Scheme: 180303 	Living Room  Color Scheme: 180303 
Bedroom  Color Scheme: 180303 	Living Room  Color Scheme: 180303 	Living Room  Color Scheme: 180303 	Living Room  Color Scheme: 180303 	
Bedroom  Color Scheme: 180303 	Living Room  Color Scheme: 180303 	Living Room  Color Scheme: 180303 	Living Room  Color Scheme: 180303 	
Bedroom  Color Scheme: 180303 	Living Room  Color Scheme: 180303 	Living Room  Color Scheme: 180303 	Living Room  Color Scheme: 180303 	
Bedroom  Color Scheme: 180303 	Living Room  Color Scheme: 180303 	Living Room  Color Scheme: 180303 	Living Room  Color Scheme: 180303 	
Bedroom  Color Scheme: 180303 	Living Room  Color Scheme: 180303 	Living Room  Color Scheme: 180303 	Living Room  Color Scheme: 180303 	
Bedroom  Color Scheme: 180303 	Living Room  Color Scheme: 180303 	Living Room  Color Scheme: 180303 	Living Room  Color Scheme: 180303 	
Bedroom  Color Scheme: 180303 	Living Room  Color Scheme: 180303 	Living Room  Color Scheme: 180303 	Living Room  Color Scheme: 180303 	

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
 	 	 	 	
 	 	 	 	
 	 	 	 	
 	 	 	 	
 	 	 	 	
 	 	 	 	
 	 	 	 	
 	 	 	 	
 	 	 	 	
 	 		 	

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
 	 		 	
 	 		 	
 	 		 	
 	 		 	
 	 		 	
 	 		 	
 	 		 	
 	 		 	
	 		 	

SPATIAL PERCEPTION

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
 Color Scheme 1 (100%)	 Color Scheme 2 (100%)	 Color Scheme 3 (100%)	 Color Scheme 4 (100%)	 Color Scheme 5 (100%)
 Color Scheme 6 (100%)	 Color Scheme 7 (100%)	 Color Scheme 8 (100%)	 Color Scheme 9 (100%)	 Color Scheme 10 (100%)
 Color Scheme 11 (100%)	 Color Scheme 12 (100%)	 Color Scheme 13 (100%)	 Color Scheme 14 (100%)	 Color Scheme 15 (100%)
 Color Scheme 16 (100%)	 Color Scheme 17 (100%)	 Color Scheme 18 (100%)	 Color Scheme 19 (100%)	 Color Scheme 20 (100%)
 Color Scheme 21 (100%)	 Color Scheme 22 (100%)	 Color Scheme 23 (100%)	 Color Scheme 24 (100%)	 Color Scheme 25 (100%)
 Color Scheme 26 (100%)	 Color Scheme 27 (100%)	 Color Scheme 28 (100%)	 Color Scheme 29 (100%)	 Color Scheme 30 (100%)
 Color Scheme 31 (100%)	 Color Scheme 32 (100%)	 Color Scheme 33 (100%)	 Color Scheme 34 (100%)	 Color Scheme 35 (100%)
 Color Scheme 36 (100%)	 Color Scheme 37 (100%)	 Color Scheme 38 (100%)	 Color Scheme 39 (100%)	 Color Scheme 40 (100%)
 Color Scheme 41 (100%)	 Color Scheme 42 (100%)	 Color Scheme 43 (100%)	 Color Scheme 44 (100%)	 Color Scheme 45 (100%)
 Color Scheme 46 (100%)	 Color Scheme 47 (100%)	 Color Scheme 48 (100%)	 Color Scheme 49 (100%)	 Color Scheme 50 (100%)
 Color Scheme 51 (100%)	 Color Scheme 52 (100%)	 Color Scheme 53 (100%)	 Color Scheme 54 (100%)	 Color Scheme 55 (100%)
 Color Scheme 56 (100%)	 Color Scheme 57 (100%)	 Color Scheme 58 (100%)	 Color Scheme 59 (100%)	 Color Scheme 60 (100%)
 Color Scheme 61 (100%)	 Color Scheme 62 (100%)	 Color Scheme 63 (100%)	 Color Scheme 64 (100%)	 Color Scheme 65 (100%)
 Color Scheme 66 (100%)	 Color Scheme 67 (100%)	 Color Scheme 68 (100%)	 Color Scheme 69 (100%)	 Color Scheme 70 (100%)
 Color Scheme 71 (100%)	 Color Scheme 72 (100%)	 Color Scheme 73 (100%)	 Color Scheme 74 (100%)	 Color Scheme 75 (100%)
 Color Scheme 76 (100%)	 Color Scheme 77 (100%)	 Color Scheme 78 (100%)	 Color Scheme 79 (100%)	 Color Scheme 80 (100%)
 Color Scheme 81 (100%)	 Color Scheme 82 (100%)	 Color Scheme 83 (100%)	 Color Scheme 84 (100%)	 Color Scheme 85 (100%)
 Color Scheme 86 (100%)	 Color Scheme 87 (100%)	 Color Scheme 88 (100%)	 Color Scheme 89 (100%)	 Color Scheme 90 (100%)
 Color Scheme 91 (100%)	 Color Scheme 92 (100%)	 Color Scheme 93 (100%)	 Color Scheme 94 (100%)	 Color Scheme 95 (100%)
 Color Scheme 96 (100%)	 Color Scheme 97 (100%)	 Color Scheme 98 (100%)	 Color Scheme 99 (100%)	 Color Scheme 100 (100%)

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
 Living room (R1) (R1) (R1) (R1) (R1)	 Living room (R2) (R2) (R2) (R2) (R2)	 Living room (R3) (R3) (R3) (R3) (R3)	 Living room (R4) (R4) (R4) (R4) (R4)	
 Living room (R5) (R5) (R5) (R5) (R5)	 Living room (R6) (R6) (R6) (R6) (R6)	 Living room (R7) (R7) (R7) (R7) (R7)	 Living room (R8) (R8) (R8) (R8) (R8)	
 Living room (R9) (R9) (R9) (R9) (R9)	 Living room (R10) (R10) (R10) (R10) (R10)	 Living room (R11) (R11) (R11) (R11) (R11)	 Living room (R12) (R12) (R12) (R12) (R12)	
 Living room (R13) (R13) (R13) (R13) (R13)	 Living room (R14) (R14) (R14) (R14) (R14)	 Living room (R15) (R15) (R15) (R15) (R15)	 Living room (R16) (R16) (R16) (R16) (R16)	
 Living room (R17) (R17) (R17) (R17) (R17)	 Living room (R18) (R18) (R18) (R18) (R18)	 Living room (R19) (R19) (R19) (R19) (R19)	 Living room (R20) (R20) (R20) (R20) (R20)	
 Living room (R21) (R21) (R21) (R21) (R21)	 Living room (R22) (R22) (R22) (R22) (R22)	 Living room (R23) (R23) (R23) (R23) (R23)	 Living room (R24) (R24) (R24) (R24) (R24)	
 Living room (R25) (R25) (R25) (R25) (R25)	 Living room (R26) (R26) (R26) (R26) (R26)	 Living room (R27) (R27) (R27) (R27) (R27)	 Living room (R28) (R28) (R28) (R28) (R28)	
 Living room (R29) (R29) (R29) (R29) (R29)	 Living room (R30) (R30) (R30) (R30) (R30)	 Living room (R31) (R31) (R31) (R31) (R31)	 Living room (R32) (R32) (R32) (R32) (R32)	
 Living room (R33) (R33) (R33) (R33) (R33)	 Living room (R34) (R34) (R34) (R34) (R34)	 Living room (R35) (R35) (R35) (R35) (R35)	 Living room (R36) (R36) (R36) (R36) (R36)	
 Living room (R37) (R37) (R37) (R37) (R37)	 Living room (R38) (R38) (R38) (R38) (R38)	 Living room (R39) (R39) (R39) (R39) (R39)	 Living room (R40) (R40) (R40) (R40) (R40)	

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
 Living room with vibrant, multi-colored furniture and walls.	 Living room with bright yellow walls and furniture.	 Living room with blue walls and furniture.	 Living room with neutral tones and a large sofa.	
 Living room with blue walls and a patterned rug.	 Living room with grey walls and a large sofa.	 Living room with dark grey walls and furniture.	 Living room with green walls and a large sofa.	
 Living room with orange walls and a large sofa.	 Living room with red walls and a large sofa.	 Living room with teal walls and a large sofa.	 Living room with brown walls and a large sofa.	
 Living room with purple walls and a large sofa.	 Living room with blue walls and a large sofa.		 Living room with white walls and a large sofa.	
	 Living room with yellow walls and a large sofa.		 Living room with blue walls and a large sofa.	
	 Living room with orange walls and a large sofa.		 Living room with white walls and a large sofa.	
	 Living room with teal walls and a large sofa.		 Living room with brown walls and a large sofa.	
	 Living room with blue walls and a large sofa.			
	 Living room with red walls and a large sofa.			
	 Living room with dark red walls and a large sofa.			

ATMOSPHERE

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
 	 	 	 	 
 	 	 	 	 
 	 	 	 	
 	 	 	 	
 	 	 	 	
 	 	 	 	
 	 	 	 	
 	 	 	 	

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
 Living room Color palette: teal, light blue, white, grey	 Living room Color palette: yellow, gold, brown, grey	 Living room Color palette: grey, white, brown, green	 Living room Color palette: orange, white, brown, grey	
 Living room Color palette: red, white, brown, grey	 Living room Color palette: orange, red, brown, grey	 Living room Color palette: grey, white, brown, green	 Living room Color palette: orange, white, brown, grey	
 Living room Color palette: yellow, white, brown, grey	 Living room Color palette: green, red, brown, grey	 Living room Color palette: grey, white, brown, green	 Living room Color palette: orange, white, brown, grey	
 Living room Color palette: purple, white, brown, grey	 Living room Color palette: pink, white, brown, grey	 Living room Color palette: yellow, white, brown, grey	 Living room Color palette: blue, white, brown, grey	
 Living room Color palette: orange, white, brown, grey	 Living room Color palette: green, white, brown, grey	 Living room Color palette: grey, white, brown, green	 Living room Color palette: yellow, white, brown, grey	
 Living room Color palette: blue, white, brown, grey	 Living room Color palette: pink, white, brown, grey	 Living room Color palette: grey, white, brown, green	 Living room Color palette: blue, white, brown, grey	
 Living room Color palette: colorful, white, brown, grey	 Living room Color palette: purple, white, brown, grey	 Living room Color palette: grey, white, brown, green	 Living room Color palette: blue, white, brown, grey	
 Living room Color palette: blue, white, brown, grey	 Living room Color palette: red, white, brown, grey	 Living room Color palette: orange, white, brown, grey	 Living room Color palette: white, wood, brown, grey	
 Living room Color palette: colorful, white, brown, grey	 Living room Color palette: grey, white, brown, green	 Living room Color palette: red, white, brown, grey	 Living room Color palette: green, white, brown, grey	
 Living room Color palette: colorful, white, brown, grey	 Living room Color palette: grey, white, brown, green	 Living room Color palette: blue, white, brown, grey	 Living room Color palette: blue, white, brown, grey	

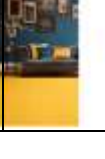
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
 	 	 	 	
 	 	 	 	
	 	 	 	
	 		 	
	 		 	
	 		 	
	 		 	
	 		 	
	 		 	
			 	

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
				
				



FUNCTIONAL EFFECTIVENESS

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
 No Color Scheme (100%)	 No Color Scheme (100%)	 No Color Scheme (100%)	 No Color Scheme (100%)	
 No Color Scheme (100%)	 No Color Scheme (100%)	 No Color Scheme (100%)	 No Color Scheme (100%)	
 No Color Scheme (100%)	 No Color Scheme (100%)	 No Color Scheme (100%)	 No Color Scheme (100%)	
 No Color Scheme (100%)	 No Color Scheme (100%)	 No Color Scheme (100%)	 No Color Scheme (100%)	
 No Color Scheme (100%)	 No Color Scheme (100%)	 No Color Scheme (100%)	 No Color Scheme (100%)	
 No Color Scheme (100%)	 No Color Scheme (100%)	 No Color Scheme (100%)	 No Color Scheme (100%)	
 No Color Scheme (100%)	 No Color Scheme (100%)	 No Color Scheme (100%)	 No Color Scheme (100%)	
 No Color Scheme (100%)	 No Color Scheme (100%)	 No Color Scheme (100%)	 No Color Scheme (100%)	

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
 Living room Color palette: #4682B4, #ADD8E6, #B0E0E6, #E0F7FA	 Living room Color palette: #FFD700, #FFA500, #FF8C00, #FF4500	 Living room Color palette: #FF8C00, #FFD700, #FFA500, #FF4500	 Living room Color palette: #A9A9A9, #D3D3D3, #F5F5F5, #FFFFFF	
 Living room Color palette: #DC143C, #DC143C, #DC143C, #DC143C	 Living room Color palette: #DC143C, #DC143C, #DC143C, #DC143C	 Living room Color palette: #A9A9A9, #D3D3D3, #F5F5F5, #FFFFFF	 Living room Color palette: #A9A9A9, #D3D3D3, #F5F5F5, #FFFFFF	
 Living room Color palette: #FFD700, #FFD700, #FFD700, #FFD700	 Living room Color palette: #DC143C, #008000, #DC143C, #DC143C	 Living room Color palette: #FF8C00, #FFD700, #FFA500, #FF4500	 Living room Color palette: #A9A9A9, #D3D3D3, #F5F5F5, #FFFFFF	
 Living room Color palette: #800080, #800080, #800080, #800080	 Living room Color palette: #FF69B4, #FF69B4, #FF69B4, #FF69B4	 Living room Color palette: #FFD700, #FFD700, #FFD700, #FFD700	 Living room Color palette: #4169E1, #4169E1, #4169E1, #4169E1	
 Living room Color palette: #FF8C00, #FF8C00, #FF8C00, #FF8C00	 Living room Color palette: #008000, #008000, #008000, #008000	 Living room Color palette: #A9A9A9, #D3D3D3, #F5F5F5, #FFFFFF	 Living room Color palette: #FFD700, #FFD700, #FFD700, #FFD700	
 Living room Color palette: #FF0000, #00FF00, #0000FF, #FF00FF, #00FFFF, #FFFF00	 Living room Color palette: #4169E1, #4169E1, #4169E1, #4169E1	 Living room Color palette: #A9A9A9, #D3D3D3, #F5F5F5, #FFFFFF	 Living room Color palette: #4169E1, #4169E1, #4169E1, #4169E1	
 Living room Color palette: #FF0000, #00FF00, #0000FF, #FF00FF, #00FFFF, #FFFF00	 Living room Color palette: #800080, #800080, #800080, #800080	 Living room Color palette: #A9A9A9, #D3D3D3, #F5F5F5, #FFFFFF	 Living room Color palette: #4169E1, #4169E1, #4169E1, #4169E1	
 Living room Color palette: #4169E1, #4169E1, #4169E1, #4169E1	 Living room Color palette: #DC143C, #DC143C, #DC143C, #DC143C	 Living room Color palette: #FF8C00, #FF8C00, #FF8C00, #FF8C00	 Living room Color palette: #A9A9A9, #D3D3D3, #F5F5F5, #FFFFFF	
 Living room Color palette: #FF0000, #00FF00, #0000FF, #FF00FF, #00FFFF, #FFFF00	 Living room Color palette: #A9A9A9, #D3D3D3, #F5F5F5, #FFFFFF	 Living room Color palette: #DC143C, #DC143C, #DC143C, #DC143C	 Living room Color palette: #008000, #008000, #008000, #008000	
 Living room Color palette: #FF0000, #00FF00, #0000FF, #FF00FF, #00FFFF, #FFFF00	 Living room Color palette: #FFD700, #FFD700, #FFD700, #FFD700	 Living room Color palette: #4169E1, #4169E1, #4169E1, #4169E1	 Living room Color palette: #4169E1, #4169E1, #4169E1, #4169E1	

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	 	 	 	
	 		 	
	 		 	
	 		 	
	 		 	
	 		 	
	 		 	
	 		 	
	 		 	
	 		 	

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	 		 	
	 		 	
			 	
			 	
			 	

COLOR HARMONY

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
 Living Room (Blue)	 Living Room (Blue)	 Living Room (Blue)	 Living Room (Blue)	 Living Room (Blue)
 Living Room (Orange)	 Living Room (Orange)	 Living Room (Orange)	 Living Room (Orange)	 Living Room (Orange)
 Living Room (Red)	 Living Room (Red)	 Living Room (Red)	 Living Room (Red)	
 Living Room (Green)	 Living Room (Green)	 Living Room (Green)	 Living Room (Green)	
 Living Room (Blue)	 Living Room (Blue)	 Living Room (Blue)	 Living Room (Blue)	
 Living Room (Green)	 Living Room (Green)	 Living Room (Green)	 Living Room (Green)	
 Living Room (Pink)	 Living Room (Pink)	 Living Room (Pink)	 Living Room (Pink)	
 Living Room (Blue)	 Living Room (Blue)	 Living Room (Blue)	 Living Room (Blue)	

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
 Living room 	 Living room 	 Living room 	 Living room 	
 Living room 	 Living room 	 Living room 	 Living room 	
	 Living room 		 Living room 	
	 Living room 		 Living room 	
	 Living room 		 Living room 	
	 Living room 		 Living room 	
	 Living room 		 Living room 	
	 Living room 		 Living room 	
	 Living room 		 Living room 	
			 Living room 	

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
				
				
				

COLOR INTENSITY BALANCE

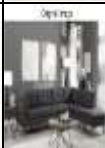
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
 Living Room (2023)	 Living Room (2023)	 Living Room (2023)	 Living Room (2023)	 Living Room (2023)
 Living Room (2023)	 Living Room (2023)	 Living Room (2023)	 Living Room (2023)	
 Living Room (2023)	 Living Room (2023)	 Living Room (2023)	 Living Room (2023)	
 Living Room (2023)	 Living Room (2023)	 Living Room (2023)	 Living Room (2023)	
 Living Room (2023)	 Living Room (2023)	 Living Room (2023)	 Living Room (2023)	
 Living Room (2023)	 Living Room (2023)	 Living Room (2023)	 Living Room (2023)	
 Living Room (2023)	 Living Room (2023)	 Living Room (2023)	 Living Room (2023)	
 Living Room (2023)	 Living Room (2023)	 Living Room (2023)	 Living Room (2023)	

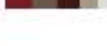
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
 	 	 	 	
 	 	 	 	
 	 	 	 	
 	 	 	 	
 	 	 	 	
 	 	 	 	
 	 	 	 	
 	 	 	 	
 	 		 	
 	 		 	

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
 	 		 	
	 		 	
	 		 	
	 		 	
	 		 	
	 		 	
	 		 	
	 		 	
	 		 	
	 		 	

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	 		 	
	 		 	
			 	
			 	
			 	
			 	

CONSISTENCY OF COLORS

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
 	 	 	 	 
 	 	 	 	
 	 	 	 	
 	 	 	 	
 	 	 	 	
 	 	 	 	
 	 	 	 	
 	 	 	 	

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
 	 	 	 	
 	 	 	 	
 	 	 	 	
 	 	 	 	
 	 	 	 	
 	 	 	 	
 	 	 	 	
 	 	 	 	
	 	 	 	
	 	 	 	

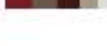
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	 	 	 	
	 	 	 	
	 	 	 	
	 	 	 	
	 	 	 	
	 		 	
	 		 	
	 		 	
	 		 	
	 		 	

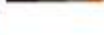
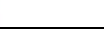
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	 		 	
	 		 	



CREATIVITY AND IMPACT

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
 Living Room Design 12345	 Living Room Design 67890	 Living Room Design 10111	 Living Room Design 21222	 Living Room Design 31333
 Living Room Design 41444	 Living Room Design 51555	 Living Room Design 61666	 Living Room Design 71777	
 Living Room Design 81888	 Living Room Design 91999	 Living Room Design 01000	 Living Room Design 11111	
 Living Room Design 21222	 Living Room Design 31333	 Living Room Design 41444	 Living Room Design 51555	
 Living Room Design 61666	 Living Room Design 71777	 Living Room Design 81888	 Living Room Design 91999	
 Living Room Design 01000	 Living Room Design 11111	 Living Room Design 21222	 Living Room Design 31333	
 Living Room Design 41444	 Living Room Design 51555	 Living Room Design 61666	 Living Room Design 71777	
 Living Room Design 81888	 Living Room Design 91999	 Living Room Design 01000	 Living Room Design 11111	

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
 	 	 	 	
 	 	 	 	
 	 	 	 	
 	 	 	 	
 	 	 	 	
 	 	 	 	
 	 	 	 	
 	 	 	 	
 	 	 	 	
 	 	 	 	

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	 	 	 	
	 	 	 	
	 	 	 	
	 	 	 	
	 	 	 	
	 	 	 	
	 	 	 	
	 	 	 	
	 			
	 			

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
				
				



SPATIAL AND COLOR SCHEME HARMONY

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
 	 	 	 	 
 	 	 	 	
 	 	 	 	
 	 	 	 	
 	 	 	 	
 	 	 	 	
 	 	 	 	
 	 	 	 	

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
 	 	 	 	
 	 	 	 	
 	 	 	 	
 	 	 	 	
 	 	 	 	
 	 	 	 	
 	 	 	 	
 	 	 	 	
	 	 	 	
	 	 	 	

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	 	 	 	
	 	 	 	
	 	 	 	
	 	 	 	
	 	 	 	
	 	 	 	
	 	 	 	
	 	 	 	
	 	 		
	 	 		

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
				



APPENDIX B

Links for Images Utilized in the Study

The links to the images for used analysing dominant colors and evaluating the visual quality of interior areas provided. These images showcase a set of interior designs that were analysed using color clustering techniques (K-means) and were used in the survey. all images can be play in the link.

https://drive.google.com/file/d/1kDVNpYhhhyP4xiPYpVk1yTInf6O-xg1e/view?usp=drive_link,
https://drive.google.com/file/d/1yAeUTvLs41qgKc4q1lc2ZeQY6MvJ9Gnv/view?usp=drive_link,
https://drive.google.com/file/d/1n5nerfbvTbo9mo77Z3wl3S8XqrV9EIWN/view?usp=drive_link,
https://drive.google.com/file/d/1MleIPgzdf0Xnfv1-VZ_12M2XKsUkH_AH/view?usp=drive_link,
https://drive.google.com/file/d/1QPnbunNeN5OGmSPn0a2WpRehxFECCXdb/view?usp=drive_link,
https://drive.google.com/file/d/1CSZI8-mpvfQP19gn2LxB07lyzNeTAljt/view?usp=drive_link,
https://drive.google.com/file/d/1q4ysp01P9770OI5hfArgTddBsBgaiqnd/view?usp=drive_link
, https://drive.google.com/file/d/1emz-A4YfnOxYjjVzQE7Rix9qls48LmU6/view?usp=drive_link,
https://drive.google.com/file/d/1O09FEIS6kpKzy6v7NP2pD31INEB2JITg/view?usp=drive_link,
https://drive.google.com/file/d/1iHn6I0g4wmyc_5IB2qlRyA5By6wPFPeY/view?usp=drive_link,
https://drive.google.com/file/d/1Z7DD8Hu0InsF_zlamjDIWz8bJ2fojg5V/view?usp=drive_link
, https://drive.google.com/file/d/1Q87jnuKBIE-CqMJBjJwOAchFMYqR5W6J/view?usp=drive_link,
https://drive.google.com/file/d/1zW7g6RKJWP1Stuq5p3AKDmjbv1n0HoSyy/view?usp=drive_link,
https://drive.google.com/file/d/1spPZ8ezkhFQhZ7T6zG4yarJRmLBoEwwt/view?usp=drive_link,
https://drive.google.com/file/d/12FDDluttQTFyjk4-aFSs6A7IErSSDpIX/view?usp=drive_link,
https://drive.google.com/file/d/1V65EZGP4zcEmv-uLwYEoa0INBi71zitO/view?usp=drive_link,
https://drive.google.com/file/d/1kiklRRKHrDK_jhBxPihS9zA5aZtcbTom/view?usp=drive_link,
https://drive.google.com/file/d/1hc8qnGThNgjAsT4SGTmBnp7b-3SEVFRu/view?usp=drive_link,
https://drive.google.com/file/d/12qfxEYF6YegxrbR706_AWY4764jTkO-d/view?usp=drive_link,
https://drive.google.com/file/d/1NBAI1enpsYRCfqnUWWHUsmVp0usYQklj/view?usp=drive_link,
https://drive.google.com/file/d/1t9Ks49ThzH8UYHaM_yWbGNG_DmrGpyiM/view?usp=drive_link,
https://drive.google.com/file/d/1VMCy55nxB-ss01RI_al2-Vb5EsfzbKcC/view?usp=drive_link,

https://drive.google.com/file/d/16xkGdUNP3nasytr8-sU0Y1g6qk7SDZK/view?usp=drive_link,
https://drive.google.com/file/d/1SIWZHP25gn3ii2XjDR9SBn0WYPdwNxyu/view?usp=drive_link,
https://drive.google.com/file/d/17Ncfn4TmBcdQS5oo9hP_LZX0iRQSBMxq/view?usp=drive_link,
https://drive.google.com/file/d/1zj9Hkoq_y9sh2c7OJ_kBzqSuWHC7kcqj/view?usp=drive_link,
https://drive.google.com/file/d/1IE6632_RvPmEiHdekVsWTETTo_yuZ3fZW/view?usp=drive_link,
https://drive.google.com/file/d/1OWCN6rKqtLCSJFdd_I_4U42s0fy8p0wf/view?usp=drive_link,
https://drive.google.com/file/d/1qk6U7UTE0RPAuprYEFa0-rwnl6_DAEHM/view?usp=drive_link,
https://drive.google.com/file/d/1Y-QBfSXJrr0A3T3vn1cnSYM0Y2Qp18Au/view?usp=drive_link,
https://drive.google.com/file/d/1oGloxN4ZoN79YmqSQ-UrloyH9o7U76jD/view?usp=drive_link,
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https://drive.google.com/file/d/1HGurL-94Kn-9OxDZBptcm1-7-mEOjZ9u/view?usp=drive_link,
https://drive.google.com/file/d/1qodtvHMiMp0fFpbcvQeI8QhNFE-fRASW/view?usp=drive_link,
https://drive.google.com/file/d/1_b6r0b0l001-CY_D0CAF5OexF9Cg-i9z/view?usp=drive_link,
https://drive.google.com/file/d/1cEMgblv1kx5Cc4gkjp_v61xLlq9R3sDA/view?usp=drive_link,
https://drive.google.com/file/d/1YWryPr1VWkAY9poAMcWUzfv866MtQE/_view?usp=drive_link,
https://drive.google.com/file/d/1gyTfAqZI-4SzeNZH4Q7t0Qa8XbmHGI/_view?usp=drive_link,
https://drive.google.com/file/d/1bZxhuKHn3UhtduHxaEpL0U3UL6pMvbku/view?usp=drive_link,
https://drive.google.com/file/d/1Rikh9tsudyapVWBjM4mB-mM2omGyBaxD/view?usp=drive_link,
https://drive.google.com/file/d/1gQeQpxCmuUSDH245Z_Rw-6nyVDlceXof/view?usp=drive_link,
https://drive.google.com/file/d/1_YNB313iXB2Mka7TbRz0u78Km74VjIH1/view?usp=drive_link,
https://drive.google.com/file/d/1uY5j4ZKpgqCodSLpWRxjKq38CBZbodw2/view?usp=drive_link,
https://drive.google.com/file/d/1KDLDUAUczt__72hyCRj_MHdEYfepdjv0l/view?usp=drive_link,
https://drive.google.com/file/d/1Pn0MMqG-V-98x3pVfUeS7DFYewkWz0NE/view?usp=drive_link,
https://drive.google.com/file/d/1RMLdqz9JWvgFeZLYuejJ4b9ZB1h68SeV/view?usp=drive_link,
https://drive.google.com/file/d/1kmT8gDuci6Wz_4DtiYom9NiQvg6NnW-F/view?usp=drive_link,
https://drive.google.com/file/d/1tUujlkBVBjNj_vKdO_IDzCMGsu8b3GEx/view?usp=drive_link,
https://drive.google.com/file/d/16KpINRe6buh2FZgtB49xkqzrnjJ75cbN/view?usp=drive_link,
https://drive.google.com/file/d/19F2cw0twZFu3u5WP8ma5jQSKGC3m9O4L/view?usp=drive_link,
https://drive.google.com/file/d/1YzCJwRImRiAqmQF8T0ZNJf0SZjg3cr2Q/view?usp=drive_link,

https://drive.google.com/file/d/1uA5MPAuZe_TXZKjnUMGvEcehD9FGsg3k/view?usp=drive_link,
https://drive.google.com/file/d/1HGH-p8VdMMYwm5aGUZGI45-TGa4DtS5R/view?usp=drive_link,
https://drive.google.com/file/d/149Kzs5Gcc31twh2k8WY6ys055jgOFZDx/view?usp=drive_link,
https://drive.google.com/file/d/1www6c2i2bjOAJAXftJN3stMf6BY2FCkV/view?usp=drive_link,
https://drive.google.com/file/d/1ZJwdlxVjMfkWA3hoZC0JeB6chSuiF_AV/view?usp=drive_link,
https://drive.google.com/file/d/1A8U5AjLS1A-yzwFEYagSBrc5-vVNgIV/view?usp=drive_link,
https://drive.google.com/file/d/1yffenf4p_pEowzzR0RvqWoymeLr3BJdV/view?usp=drive_link,
https://drive.google.com/file/d/1olcwOp6c2-g_zx0wNCehSbphOFH9qjMQ/view?usp=drive_link,
https://drive.google.com/file/d/1jvsDohwWsWUc4H7NE0O5-rlsfQAJiBuL/view?usp=drive_link,
https://drive.google.com/file/d/1axvQJzQazJ8ZfEA50Hw32M_IFz0p37Rn/view?usp=drive_link,
https://drive.google.com/file/d/1eSsJtOeheE7_FKYBzY9Ud6_tLIANYqBl/view?usp=drive_link,
https://drive.google.com/file/d/1hIOIxCKJQTKdUemImCNAU0Js8rLCoMLe/view?usp=drive_link,
https://drive.google.com/file/d/1UfWVKL-ejaXhpfMLJA2VT9Ss8kEkneWZ/view?usp=drive_link,
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https://drive.google.com/file/d/1DJwO6IMc083Y5MCMOPp77gAV83ROft_H/view?usp=drive_link,
https://drive.google.com/file/d/1fDCLYQ_Xaa--g79KIIWaaUkAj3f2VnnC/view?usp=drive_link,
https://drive.google.com/file/d/1lxlixk0mxMuL0OfkNreEh4LyENx26p-a/view?usp=drive_link,
https://drive.google.com/file/d/1zcHyVVVsJoD4u1IAZP7LYq4gZsluLE2/view?usp=drive_link,
https://drive.google.com/file/d/1ly5mAtEvEzyYKjFGDM-UMD3LrpVUXVx/view?usp=drive_link,
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https://drive.google.com/file/d/14008ifiCF585T40xYbPkFZhju5vBrCr/view?usp=drive_link,
https://drive.google.com/file/d/1KOgleQ7-jGwHNbhyCIXG_CKHSbqvjj-f/view?usp=drive_link,
https://drive.google.com/file/d/19X71VI8X77Xeu84CyArPU5bw4MxUKLBy/view?usp=drive_link,
https://drive.google.com/file/d/1tFJhSMqZJaGFgjtJ5K4gOZeg3FF8-Vr/view?usp=drive_link,
https://drive.google.com/file/d/1iBDS-yXxU3r_0pSDA01BO3asdJ7sIFCc/view?usp=drive_link,
https://drive.google.com/file/d/1XhY_toWUU6HzOQMOY94DwTztXlaBR3J8/view?usp=drive_link,
https://drive.google.com/file/d/1wS3bf_u6aPNrcUaBO7mG7bUxGuGGG1Cn/view?usp=drive_link,

https://drive.google.com/file/d/1u8FdgRVunrMcV_WRnzsptEHwT9FeA7o-/view?usp=drive_link,
https://drive.google.com/file/d/1PHEpeEj1SBMPki2yTgZyQPEBaOwpl0Uz/view?usp=drive_link,
https://drive.google.com/file/d/1JODR_SoSUKYiOzXy-kORY5fvtGNupDG_/view?usp=drive_link,
https://drive.google.com/file/d/1ZsyxOWAGOCmsnpYSIc1P-nCJNZM9ia7q/view?usp=drive_link,
https://drive.google.com/file/d/1zd6SOqF8IRYRlVl8XBq9AuOvqvKOV95s/view?usp=drive_link,
https://drive.google.com/file/d/1QJePi1Wzqsv_bw8cgg-MIsu3IYtslHzB/view?usp=drive_link,
https://drive.google.com/file/d/1x951vB30w3iYOKGQcFGcGn8gWjslPJfi/view?usp=drive_link,
https://drive.google.com/file/d/1gj8TkN3jm9w4TeRFLab7rtnG0SncvB5b/view?usp=drive_link,
https://drive.google.com/file/d/16VYhddT-1UYi7Df_9VLrdz2TCtYFTJYl/view?usp=drive_link,
https://drive.google.com/file/d/13s66gF1cwturDL06HrOuXfrsDb529qkd/view?usp=drive_link,
https://drive.google.com/file/d/1yYweIL9amkahzWN5e8C8mtKVaqCSnfE-/view?usp=drive_link,
https://drive.google.com/file/d/1eMkRfIYYsqosoM0BLDoEAfV9IX4VnJwp/view?usp=drive_link,
https://drive.google.com/file/d/1B0xvuM6SowOI3HNVono1kmuo1zw--UbS/view?usp=drive_link,
https://drive.google.com/file/d/1ZsHa_Ptah6UBS7Hvjg5KCUtuhkyxny0f/view?usp=drive_link,
https://drive.google.com/file/d/1t9lQej4lx6U5hBcs_Pivkkl3LdwXVoI5/view?usp=drive_link,
https://drive.google.com/file/d/1rJH9lNOulwJamytDlrt7Er4R99Nni4ka/view?usp=drive_link,
https://drive.google.com/file/d/1lJ1l_235a-suqhkmj08q-AZVpv2AVtSL/view?usp=drive_link,
https://drive.google.com/file/d/1tljqnkU_flNWFup84VKVVYtMTrQ6rwuj/view?usp=drive_link,
https://drive.google.com/file/d/1MUqavzpB4jXDCPAx_6jGsTdoEmZmmjfK/view?usp=drive_link,
https://drive.google.com/file/d/1HWKYWEtgSwpUPAMMP6fxOV4BdZApou0p/view?usp=drive_link

APPENDIX C

Link for Survey

The link to the survey used for collected participant ranks is provided. The survey was designed to capture participants' perceptions of interior colors and their effect on visual quality. By accessing the link below, readers can view the complete survey tool used in this study.

Also, it links includes the results of the survey, along with charts showing participant responses. These charts visually represent the data collected and offer insights into how different colors affected participants' understanding of visual quality.

<https://hudashehan.questionpro.com/t/AbPjqZ3wBn>

Results and Charts:

This is link show the survey results, including detailed charts that show participant ranks on the different colors used in the study. These visual shows provide an overall overview of the results and support the analysis presented in the chapters of the thesis.

<https://questionpro.com/t/7BrpcmZ3wBn>

APPENDIX D

The Code Utilized for The Results:

The code utilized in the findings analysis is provided, including the steps of color clustering (K-means) and the analysis of dominant colors and their deals. The code schemes the mothed details and algorithms utilized to connect the dominant colors in the images and analyse their effect on the quality of interior layout.

```
import cv2
import numpy as np
from sklearn.cluster import KMeans
import matplotlib.pyplot as plt
from PIL import Image

def get_dominant_color(image, k=5):
    # Resize image to reduce the number of pixels
    image = cv2.resize(image, (64, 64), interpolation=cv2.INTER_AREA)

    # Reshape the image to be a list of pixels
    pixels = image.reshape((-1, 3))

    # Apply KMeans to find the dominant colors
    kmeans = KMeans(n_clusters=k, n_init=10, random_state=42)
    kmeans.fit(pixels)

    # Count the number of pixels in each cluster
    labels, counts = np.unique(kmeans.labels_, return_counts=True)

    # Sort the colors by frequency
    sorted_colors = colors[np.argsort(counts)][::-1]

    return sorted_colors.astype(int), counts[np.argsort(counts)][::-1]

def plot_dominant_color(image_path, k=5):
    # Load the image without any preprocessing
    image = cv2.imread(image_path)
    image = cv2.cvtColor(image, cv2.COLOR_BGR2RGB)

    # Get the dominant colors and their frequencies
    colors, counts = get_dominant_color(image, k)

    # Plot the original image
    plt.figure(figsize=(12, 6))
    plt.subplot(1, 2, 1)
    plt.imshow(image)
    plt.title("Original Image")
    plt.axis("off")

    # Plot the color bar
    plt.subplot(1, 2, 2)
    bar_height = 50
    bar_width = 300
    color_bar = np.zeros((bar_height, bar_width, 3), dtype="uint8")

    start_x = 0
    for i, color in enumerate(colors):
        end_x = start_x + (counts[i] / max(counts)) * bar_width
        cv2.rectangle(color_bar, (int(start_x), 0), (int(end_x), bar_height), color.tolist()
        start_x = end_x

    # Display the color bar with the dominant color indicated
    plt.imshow(color_bar)
    plt.title(f"Color Clusters (Dominant: {colors[0]})")
    plt.axis("off")

    plt.show()

# Use the function to plot the dominant colors without any preprocessing
plot_dominant_color("d41.jpg", k=5)
```