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Exploring the Emotional Impact of Lighting on Reading Experience: An Experimental Study

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Abstract: This study examines the emotional impact of lighting on reading among 60 respondents aged 18 to 28. Using an Experimental Research Design, participants' perceptions were gathered through an interview schedule, focusing on their experiences under Warm White Light (3000K), Natural White Light (4000K), and Cool White Light (6500K). The Pleasure and Arousal Emotional Scale was utilized as the measurement tool. The results show distinct emotional responses: warm lighting creates a cozy atmosphere, natural lighting boosts alertness, and cool white lighting enhances productivity. While dim lighting is suited for leisure reading, it may cause eye strain over extended periods. Colorful lighting adds emotional depth, and task lighting improves visibility. Dynamic lighting allows for customization, though individual preferences, reading material, and context influence its overall effects. This study highlights the complex relationship between lighting ambiance and emotional states during reading, offering insights for optimizing reading environments to improve emotional engagement and well-being.

Keywords: *Emotional Impact, Lighting, Reading, Correlated Color Temperature (CCT).*

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I. INTRODUCTION

Lighting does more than just illuminate a space; it significantly influences human emotions, cognitive functions, and overall experiences. In the context of reading, lighting conditions play a crucial role in shaping a reader's mood, concentration, and engagement with the text. Warm, soft lighting can create a sense of comfort and relaxation, while harsh or inadequate lighting may lead to eye strain and decreased focus. This paper examines the emotional impact of lighting on reading, exploring how variations in brightness, color temperature, and contrast affect both psychological well-being and cognitive efficiency. Understanding these effects can contribute to the design of reading environments that enhance both comfort and performance.

A. Lighting and Emotional Stability

- *Warm Lighting and Coziness*

Warm lighting, typically associated with a yellow or amber hue, can have a comforting effect on individuals. This lighting type is commonly used in spaces meant for relaxation, such as living rooms or bedrooms. The psychological warmth of this lighting can evoke feelings of comfort and safety, potentially reducing stress levels and enhancing emotional well-being. Warm lighting is also often linked with lower levels of stimulation, which can help people unwind and feel more at ease.

- *Natural Light and Alertness*

Natural light, which contains a high concentration of blue wavelengths, is essential for regulating the body's circadian rhythms, which control sleep-wake cycles. Morning exposure to natural light has been shown to boost alertness, elevate mood, and enhance cognitive function. Research has also linked regular access to natural light with improved mental health, including a reduction in symptoms of anxiety and depression. In reading environments, natural light can promote focus and energy levels, making it particularly advantageous for spaces such as libraries and study areas.

- *Cool White Light and Productivity*

Cool white light, with its higher colour temperature and blue-tinted hue, is associated with increased productivity. This lighting type is common in office settings, as it can boost concentration, increase mental sharpness, and reduce fatigue. The stimulating nature of cool white light makes it ideal for workspaces where alertness and sustained focus are necessary. When used in reading environments, it can enhance the ability to process information quickly, making it suitable for tasks that require a high level of attention.

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➢ *Dim Lighting for Leisure Reading*

Dim lighting is often preferred for leisure reading, as it creates a relaxed and intimate atmosphere conducive to unwinding. However, prolonged exposure to low levels of light can lead to eye strain, especially if the contrast between the text and the surrounding light is insufficient. While dim lighting can enhance the reading experience by reducing overstimulation, it's important to balance comfort with adequate illumination to avoid discomfort and visual fatigue.

➢ *Colourful Lighting and Emotional Depth*

Coloured lighting, such as blue, red, or green hues, can evoke a range of emotional responses. Blue lighting is often calming, while red lighting can be energizing or even evoke passion. Green lighting is sometimes associated with tranquillity. The psychological impact of these colours can add emotional depth to a space, influencing how individuals feel and interact with their environment. In reading settings, colourful lighting can set the mood, enhance thematic elements, or create a unique aesthetic that enriches the reading experience.

➢ *Task Lighting for Improved Visibility*

Task lighting, including desk lamps and reading lights, offers targeted illumination for specific areas, improving visibility and minimizing eye strain. In reading and study spaces, effective task lighting is crucial, as it enables individuals to customize the brightness and direction of light to suit their requirements. By providing direct light on the reading material, task lighting can improve reading efficiency, reduce fatigue, and support a healthy visual environment, thereby positively impacting the reader's emotional stability and productivity.

The interplay between lighting and emotional stability is complex, with each type of lighting evoking distinct emotional responses and physiological effects. Optimal lighting design in reading environments considers these factors to create a balanced, supportive atmosphere that meets functional needs and enhances emotional well-being. Understanding how different lighting types influence mood and cognitive function can lead to more thoughtful design choices in spaces intended for both work and relaxation.

➢ *Statement of the Problem*

This study seeks to explore how lighting influences the emotional aspects of the reading experience.

➢ *Objectives of the Study*

- To capture the respondent's subjective experiences while exposed to Warm White Light (3000k), Natural White Light (4000k), and Cool White Light (6500k).
- To capture the respondent's emotional responses while exposed to Warm White Light (3000k), Natural White Light (4000k), and Cool White Light (6500k).

➢ *Delimitation of the Study*

- This study will be conducted exclusively in Vadodara city.
- The research will focus on individuals aged 18 to 28 years.
- The source of Direct lighting for the present study will be limited to three types of CCTs (Correlated colour temperature) of Direct Lighting Namely, Warm white light (3000k), Natural white light (4000k), and Cool white light (6500k).

II. REVIEW OF LITERATURE

The emotional impact of lighting on reading is multifaceted. Warm lighting fosters a cozy atmosphere, while natural light enhances alertness. Cool white lighting improves productivity. Dim lighting is suitable for leisure reading but may cause eye strain if used for extended periods. Colorful lighting adds emotional depth, and task lighting enhances visibility. Dynamic lighting allows for customization, though its effects vary depending on individual preferences, reading material, and context.

In 2020, Kim et al. conducted an experimental study examining brain activity changes based on video type and illuminance level. Their data showed that respondents' scenic visual stimulation varied with video type, influenced by illuminance levels during viewing.

Mandala's 2019 study combined experimental and case study methods to investigate lighting quality in an Architecture Design Studio. Despite illumination levels below standard, respondents rated the lighting quality positively. Key factors impacting room quality included lighting techniques, light intensity, color, room reflection, and daylighting contribution. Notably, respondents perceived visual comfort more strongly than room atmosphere.

Castilla et al. (2018) investigated how lighting in university classrooms influences students' emotional perceptions by comparing their responses to two different types of lamps. The study found notable differences in students' assessments, indicating that both symbolic and functional attributes could play a role in shaping perceptions of lighting effectiveness in comparative research.

Odabaşioğlu and Olguntürk's 2015 experiment on colored lighting's effects on interior space perception demonstrated that the hue of light significantly shaped spatial perception across evaluative criteria.

Amin (2015) conducted a descriptive study on LED lighting in residential and commercial settings, finding a significant relationship between respondents' satisfaction levels and their use of LEDs.

Rim et al. (2012) studied the cognitive effects of lighting on spatial satisfaction and psychological comfort, revealing that direct exposure to light sources reduced visual comfort. For enhanced spatial satisfaction, lighting should minimize distractions, maintain appropriate illuminance, and use preferred colors. Lower satisfaction was associated with direct lighting, underscoring its impact on overall comfort.

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In 2005, Banu's experimental study on office lighting examined the impact of color temperature and illuminance on subjective impressions. Results indicated significant effects on perceived brightness, color saturation, comfort, relaxation, and spaciousness. Optimal conditions were 2000 lx for overall impressions and a color temperature of 4000 K for comfort and spaciousness.

Subiask and Bernecker (1993) conducted an experimental study on psychological preferences for industrial lighting. They found that higher room surface luminance elicited positive responses, highlighting the need for luminaires that provide adequate light and surface reflectance in industrial settings.

III. METHODS AND PROCEDURES

The study was conducted in a carefully controlled environment to investigate how different lighting conditions impact subjective and emotional responses during reading. A dark room was used to simulate an isolated setting, where a table lamp with adjustable Correlated Color Temperature (CCT) served as the only light source. A Syska Smart Pumpkin Wi-Fi 9W bulb, capable of providing lighting in three distinct CCT settings 3000K (Warm White), 4000K (Natural White), and 6500K (Cool White) was selected for this purpose. To eliminate interference from external light, the room's windows were covered with black paper, ensuring consistent lighting throughout the experiment.

Participants were screened for color vision deficiencies using the Ishihara color blindness test before participating, to ensure accurate perception of the lighting variations. The reading task was conducted under each of the three lighting conditions, with the order of exposure randomized to avoid bias. Between each lighting condition, participants were given a 60-second break, allowing their eyes and emotional responses to reset before experiencing the next setting. During this interval, the lighting was adjusted to the upcoming CCT.

After each reading session, participants' emotional and physical responses were recorded using a structured interview schedule. This included questions addressing comfort, alertness, relaxation, and engagement, as well as any physical effects like eye strain. Emotional states were measured using the Pleasure and Arousal Emotional Scale, which captures both the positivity of the emotional response (pleasure) and its intensity (arousal), allowing for a nuanced assessment of each lighting condition. By maintaining strict control over lighting, environment, and reading materials, the study aimed to identify the specific emotional impacts of different lighting temperatures on the reading experience.

IV. METHODOLOGY

This study employed an experimental research design. The interview schedule consisted of five sections: the first section collected respondents' demographic and background information relevant to the study. The second section focused on general aspects of visual discomfort related to reading under different lighting conditions. Sections three, four, and five assessed emotional stability while reading under three different correlated colour temperatures (CCT) of direct lighting—Warm White Light (3000K), Natural White Light (4000K), and Cool White Light (6500K). Emotional stability was evaluated using a set of standardized statements tailored to each lighting condition. To analyse participants' responses, pleasure ratings and arousal ratings were measured for each of the three lighting conditions. The pleasure rating scale included five categories: Pleasant, Pleased, Neutral, Unsatisfied, and Unpleasant. The arousal rating scale also comprised five levels: Excited, Wide Awake, Neutral, Dull, and Calm.

V. RESULT

- *Background Information of Respondents*

The respondents in this study were aged between 18 and 28 years, with an average age of 21.09 years. The sample consisted predominantly of female participants (65.57%), and the majority of respondents (91.80%) were students.

Regarding eyesight, 39.34% of the respondents reported wearing either contact lenses or prescription glasses. Among them, 50% had a prescription ranging from -0.1 to -2.4 diopters for the right eye and -2.5 to -5 diopters for the left eye, indicating varying degrees of myopia. Additionally, 58.33% of respondents used tinted glasses or lenses, while 37.5% reported using UV-protected eyewear, suggesting a considerable level of awareness regarding eye protection from harmful light exposure.

To assess participants' ability to perceive colors accurately, the Ishihara color-blindness test was conducted. The results showed that 93.44% of the respondents had normal color vision, indicating that the majority of participants did not experience any form of color deficiency that could impact their visual perception under different lighting conditions.

- *Extent of General Visual Discomfort while Reading*

Visual discomfort in this study was defined as the general unease experienced by respondents while reading under different lighting conditions. This was assessed through an interview schedule designed to capture common symptoms associated with reading discomfort.

The findings revealed that 54.09% of the participants reported experiencing headaches due to light sensitivity, suggesting that certain lighting conditions may contribute to strain and discomfort. Additionally, 57.37% of respondents noted unintentionally re-reading the same line while reading, indicating potential difficulties in maintaining visual focus. Furthermore, 49.18% reported losing focus on the page, which could be attributed to inadequate lighting or an improper balance of brightness and contrast.

Other symptoms, such as dry, watery, or red eyes, were reported less frequently, suggesting that while discomfort was present, it did not manifest in severe physiological symptoms for most participants. Overall, the results indicated that 24.59% of respondents experienced a moderate level of visual

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discomfort, while the majority (75.40%) reported a low level of visual discomfort, indicating that while some participants faced minor challenges, severe discomfort was relatively uncommon.

- *Emotional Stability while Reading in Three Different CCTs of Direct Lighting*

Participants' emotional responses to reading under different Correlated Color Temperatures (CCTs) of direct lighting varied significantly, highlighting the influence of lighting conditions on emotional stability and reading comfort.

Among the three lighting conditions, Natural White Light (4000K) was rated as the most pleasant, with 47.54% of participants expressing a positive emotional response. This suggests that a balanced color temperature provides optimal comfort and enhances the reading experience, making it the most preferred lighting condition. The relatively neutral tone of 4000K lighting may have contributed to reduced strain while maintaining sufficient brightness for readability, leading to a more pleasant and stable emotional state among participants.

In contrast, Warm White Light (3000K) elicited a more energized and alert reaction, suggesting that warmer lighting may stimulate cognitive engagement or create a sense of focus. This could be due to its similarity to natural evening light, which is often associated with relaxation yet can also enhance attentiveness in reading environments. However, this effect may vary based on individual sensitivity to warmer tones.

Cool White Light (6500K) had a more balanced emotional effect, with 39.34% of participants reporting a neutral response. This suggests that while cool lighting did not strongly enhance or hinder emotional stability, it maintained a steady and stable state. Given its resemblance to daylight, 6500K lighting may have contributed to a neutral or slightly calming influence, neither significantly increasing alertness nor causing discomfort.

These findings underscore the role of CCT in influencing emotional stability and reading comfort. The results indicate that Natural White Light (4000K) provides the most favorable balance between comfort and readability, making it the preferred lighting choice for sustained reading tasks. Meanwhile, 3000K lighting may be beneficial for tasks requiring heightened alertness, while 6500K lighting offers a more neutral experience.

VI. CONCLUSION

The findings underscore the significant influence of lighting conditions on individuals' emotional well-being and arousal levels during reading. Specifically, natural white light, at a color temperature of approximately 4000K, has been identified as particularly beneficial, with nearly half of participants (47.54%) rating it as pleasant. This suggests that natural white light can foster a calm and agreeable atmosphere that supports a comfortable reading experience without overstimulating or causing fatigue. In contrast, warm white light generates a more intense emotional response, with participants reporting feeling more awake and energized. This type of light, which typically has a color temperature around 2700K to 3000K, may activate psychological alertness and excitement, potentially enhancing focus or engagement with the reading material. However, the heightened arousal level associated with warm white light may also be less conducive to prolonged, relaxed reading sessions compared to the more neutral effects of natural white light. Cool white light, usually at a color temperature of 5000K or above, was found to have a balanced impact on participants' emotional states, with 39.34% feeling neutral. This suggests that cool white light does not elicit strong positive or negative emotional reactions, making it a potentially versatile choice that supports both alertness and emotional neutrality. This neutrality could benefit activities that require focus but without the heightened emotional stimulation of warm white light. Overall, these findings highlight the importance of tailoring lighting conditions to the desired emotional and cognitive state during reading, whether for relaxation, alertness, or sustained focus.

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