



Light as a tool of emphasis in the interior of residential buildings

Anthony Dornubari Enwin ^{1*}, Tamunoikuronbo Dawaye Ikiriko ², Okafor Chukwuemeka G ³

¹⁻³ Faculty of Environmental Sciences, Rivers State University, Port Harcourt, Rivers State, Nigeria

* Corresponding Author: **Anthony Dornubari Enwin**

Article Info

ISSN (online): 2582-7138

Volume: 05

Issue: 01

January-February 2024

Received: 20-10-2023

Accepted: 23-11-2023

Page No: 142-147

Abstract

This paper examines the interaction between architecture and lighting, highlighting their cooperative connection in creating captivating experiences within interior spaces. The study is based on a qualitative research approach and explores three interconnected themes, which are 'Light as a Tool of Emphasis, the Dynamic Emphasis of Daylight, and the Appeal of the Flexibility of Lighting in Emphasis'. When examining the various aspects of lighting in architecture, the initial theme is its significant influence on the way users perceive and behave. Examining both qualitative and quantitative elements, this theme explores the factors of visibility, colour rendering, and emotional reactions elicited by various lighting designs. This theme also emphasizes the use of modern lighting design in homes, with fixtures that fulfil both practical and visual purposes. In addition to its traditional relationship with energy efficiency, the second theme looks into the dynamic role of daylight in architectural spaces. With this theme, architects can evaluate the qualitative characteristics of daylight by utilizing a matrix consisting of 10 shades, which provides them with a conceptual framework. This theme also highlights the interaction between natural and artificial lighting, demonstrating how they collectively impact visibility, aesthetics, and energy efficiency. The third theme emphasizes the importance of the flexibility of lighting design, enabling it to adapt to various spatial roles. Lighting that is focused on human needs can be adjusted in intensity and colour temperature to promote flexibility in the use of space, enhance the well-being of inhabitants, and utilise for a range of aesthetic possibilities. Integration of smart lighting augments adaptability and intelligence in architectural lighting. Synthesizing these concepts, the discussion section of this paper highlights lighting's dynamic narrative role, transcending utilitarian approaches. It presents architects and designers as storytellers constructing experiences through sophisticated light utilization, resonating with the human condition. Acknowledging its qualitative nature, the study recommends further research avenues. It suggests quantitative investigations into the psychological and physiological implications of distinct lighting schemes and advocates refining typologies for diverse architectural situations. In conclusion, this paper improves lighting design's status as a dynamic, integrated architectural story component. Architects are taught to embrace their position as architects of engaging stories through the skilful instrumentation of light.

DOI: <https://doi.org/10.54660/IJMRGE.2024.5.1.142-147>

Keywords: Architecture, lighting design, emphasis, visibility, daylight, interior spaces, human-centric lighting, aesthetic versatility

1. Introduction

The relationship between architecture and lighting is described as co-dependent, working together to convey a story and create a holistic experience. Lighting is an intrinsic component of interior design and architecture that extends beyond its basic functions to become a transformative element in interior spaces, with its psychological effects on user impression and behaviour (Flynn, Spencer Martyniuk & Hendrick, 1973) ^[7]. It involves a convergence of art, design, and technology, incorporating various fields such as physics, engineering, and the psychological effects of light Montjoy (2022) ^[14].

The exploration of the emphatic quality of lighting and its impact on the mood and perception of a space underscores its multifaceted role in architecture. From enabling visibility and safety to influencing the mood and perception of a space and selectively emphasizing features, effective lighting design goes beyond the technical aspects, becoming a nuanced art that shapes how we experience and interact with our built environments. Lighting in interior design includes the use of both artificial as well as natural sources. Specific types of architectural lighting fixtures such as cove lighting, uplighting, linear recessed lighting, accent lighting, surface and suspended lighting etc. are applied in the context of their aesthetic qualities, functionality, and suitability for different spaces; geared towards the broader aspect of emphasis.

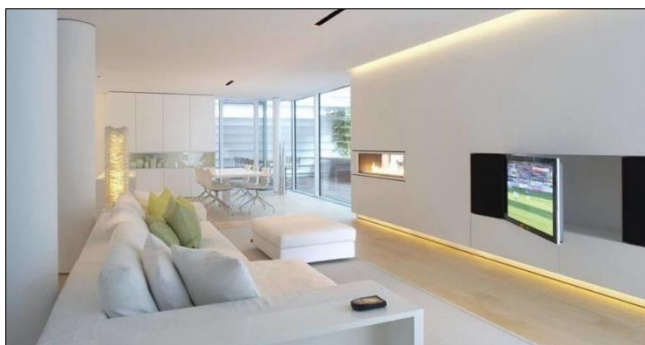
As the academic paper unfolds, the narrative journey delves into the specific themes, unpacking the significance of light as a tool of emphasis, the dynamic role of daylight, and the appeal in the flexibility of lighting design.

2. Literature Review

2.1 Light as a Tool of Emphasis

Lighting plays a pivotal role in interior design, acting as a powerful tool to emphasize specific features within residential buildings. This discussion explored the significance of light as a tool of emphasis, drawing insights from reputable sources in the field. According to Gellings (2009) [3], the measurement of illumination is expressed in footcandles or lux. However, assessing the quantity of illumination involves more than simply turning on the lights. It's essential to understand that the eye perceives brightness, not just illumination. This reflected light is termed brightness and is measured in foot-lamberts (or candela per square meter).

According to Cadena, Poli, Košir, Lobaccaro, Mainini & Speroni (2022) [2], the indoor luminous environment is shaped by the interplay between the building's surrounding context and the strategic measures incorporated during the design phase. Enhanced visibility and/or clarity and its influence on the mood and perception of a space are critical aspects of effective lighting design (Gemelli, Shiratuddin & Kemp, 2013) [9]. Flynn *et al.*, (1973) [7] highlight the influence of light on some overt behaviours such as circulation pattern, seat selection pattern, posture, comments, gestures, facial expressions, etc., They further emphasize the nature of the activity in the occupied space as being the corresponding factor to it. In the context of architecture and interior design, visibility goes beyond mere illumination; it encompasses the deliberate use of light to reveal the features and characteristics of a space, as shown in Fig 2.1 below.

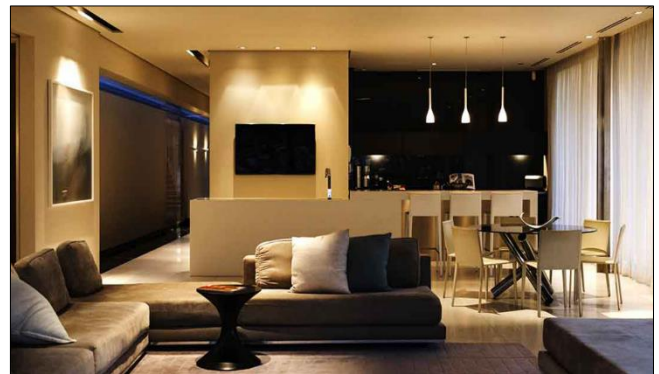


Source: Home Stratosphere (2023)

Fig 1: Bright light in a Living Room

Gemelli *et al.*, (2013) [9] emphasise that visibility is not just about making a space brighter, but creating an environment that evokes clarity, spaciousness, relaxation, privacy, pleasantness, and order; where every element is seen and appreciated. This heightened visibility is not just about the quantitative aspect of lighting but also the qualitative (how light interacts with surfaces, creating shadows and highlights that define the spatial characteristics).

According to Durak, Olguntürk, Yener, Güvenç & Gürçınar (2007) [5], the organization of lighting, in connection with the colour temperature of light, the kinds and positions of light sources are factors associated with the qualitative elements of lighting, which impacts the mood, as it elicits distinct impressions through the utilization of various lighting setups at varying levels of illumination as illustrated in figure below.



Source: Big Pockets Real Estate, (2019)

Fig 2: Indoor Luminous Environment Shaped by Lighting Design

Gellings (2009) [3], asserts that when defining lighting needs, it is essential to ascertain the nature of expected activities, their duration, the density of people, and their specific locations. In essence, whenever there is a concentration of people such that the tasks are not separated, it is usually reasonable to light such an area with a uniform lighting system. However, the concept of filling a space with uniform light levels may often be an inefficient lighting approach, as the nuances of visibility extend beyond mere clarity (Gemelli *et al.*, 2013) [9]. The conventional understanding of a visual task encompasses the entirety of elements requiring visibility at a given moment and its effects on user impression and behaviour (Flynn *et al.*, 1973) [7].

With the nature of a visual task changing from one moment to the next, it can be much more productive to graduate illumination as required by the task at hand and to keep the surroundings in appropriate balance; providing adequate lighting for the seeing tasks with less light on surrounding non-working areas such as corridors, storage, and pedestrian or vehicular areas (Gellings, 2009) [3]. Flynn and Spencer (2013) [7] emphasise on the distinct emotional responses evoked by different lighting schemes, from warm and soft to cool and bright. Highlighting a cosy and intimate atmosphere, often associated with the lower colour temperatures of warm lighting. Conversely, cooler lighting tends to open up a space, giving it a more expansive and refreshing feel.

Understanding the importance of the colour rendering properties of different light sources cannot be over-emphasised, as the colour temperature of light can influence the perceived colours of architectural materials by significantly influencing spatial perception; enhancing or diminishing the depth perception and interest in a space,

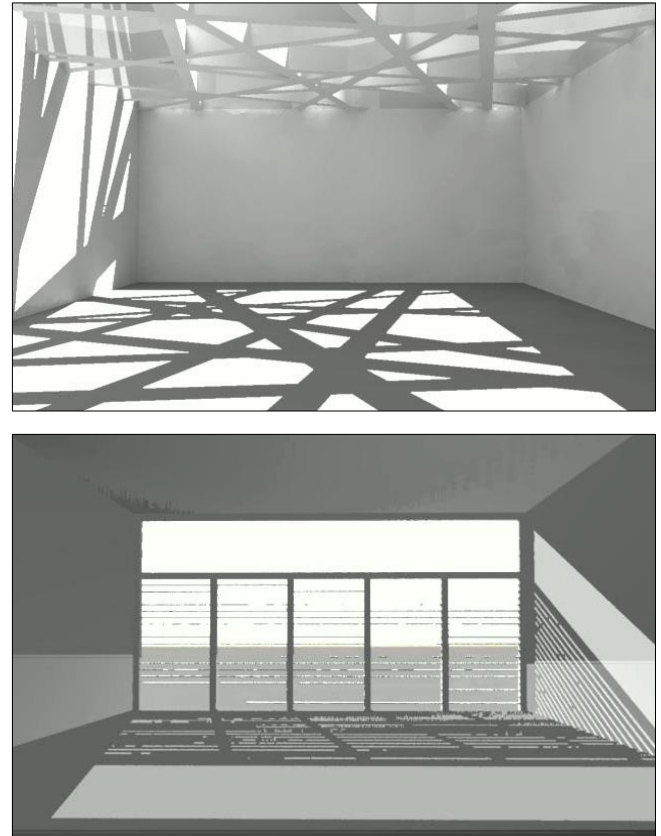
thereby contributing to the overall emphasis on certain aspects of a space (Enwin, Ikiriko & Jonathan-Ihua, 2023) ^[6]. The colour rendering index, CRI of a light source serves as a metric for gauging how closely the colours of objects illuminated by a test source align with those of the same objects illuminated by a standard source, like an incandescent light source (Wyszecki & Styles, 1982) ^[20]. Narendran and Deng (2002) ^[15] highlighted the varying opinions of different authors on the inadequacies of the CRI metric, concluding that CRI does not correlate with peoples' colour preferences. However, Yizhong (1984) ^[21] experimented to measure the acuity of distinct lighting sources with different colour rendering properties to illuminate two kinds of visual tasks. It was discovered that increased colour contrast significantly advanced the visual acuity of the light sources. Thus, the varying degrees of reflectivity of different materials can contribute to a brighter ambience within a space as opposed to a different mood created with materials that absorb light. Yizhong (1984) ^[21] elucidated the value of high-pressure sodium lamps as the best lighting source for raising visual acuity and saving electric energy despite their lower colour rendering properties. As such, it is advised to use low-pressure sodium lamps for improved colour rendering in interior spaces. This insight is crucial for architects aiming to emphasize specific colour palettes or material textures, to curate specific emotional experiences within different areas of a building. Flynn *et al.*, (1973) ^[7] and Gemelli *et al.*, 2013 ^[9] talk about the psychological aspect of lighting in influencing the perception of a space. In essence, by cleverly designing lighting, attention can be drawn to specific areas as focal points, as well as altering the perceived size of a room. Together with shadows and highlights, carefully orchestrated through lighting choices, visual hierarchy can be achieved as a deliberate way of guiding occupants through the spaces. Visibility and/or clarity should not have to be uniform but can be selectively enhanced to draw attention to specific elements (Gemelli *et al.*, 2013) ^[9]. This can include architectural features, artworks, or design elements. The integration of contemporary lighting design in residential settings is highlighted, with a focus on achieving desired effects based on the type of space. Montjoy (2022) ^[14] in 'When Light Tells a Building's Story: What is Architectural Lighting?' provides an understanding of how different types of lighting can be strategically employed to emphasize architectural elements and contribute to the overall design. Distinguishing architectural lighting from general lighting design by its focus on architectural elements, aiming to showcase, accentuate, or emphasize a building's aesthetic, history, and purpose. This nuanced approach to visibility is integral to the principle that not every corner of a space needs the same level of illumination (Flynn *et al.*, 1973) ^[7].

Decorative fixtures, beyond their utilitarian function, can serve as design elements in their own right, contributing to the overall design scheme (Montjoy, 2022) ^[14]. Chandeliers, pendant lights, or unique sculptural fixtures can become focal points within a space, contributing to the overall aesthetic, emphasising specific design features and contributing to the visual narrative of a space.

2.2 The Dynamic Significance of Daylight

Sunlight plays a significant impact in defining the dynamic settings within architecture, going beyond its conventional use for energy efficiency (Lam, 1985 as referenced in Schielke, 2023) ^[18]. The interaction of natural light as a

dynamic and variable source of emphasis highlights its ever-changing characteristics, which may be utilized to accentuate different features throughout different times of the day. The attention is directed towards the qualitative characteristics of daylight, namely the variations in space and time, as investigated by Siobhan Rockcastle and Marilyne Andersen at École Polytechnique Fédérale de Lausanne (EPFL) in Lausanne. They introduce a matrix consisting of 10 different shades of sunshine (Schielke, 2023) ^[18], as depicted below.



Source: Schielke, (2023) ^[18]

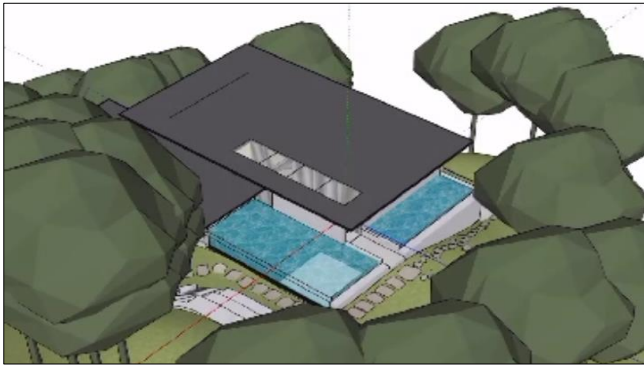
Fig 3: Display of Two out of the 10 Shades of Daylight

Introducing a matrix with 10 shades of daylight, capturing the extremes of direct sunlight and the diffuse overcast sky; direct sunlight provides strong modelling with hard shadows, while cloudy skies bring about a subdued condition of uniformity and tranquility. The typology established by Rockcastle and Andersen emphasizes on daylight as a spatial dimension, stressing its dynamic impact beyond energy measures. The classification, based on the criteria of contrast and dynamic impact, offers architects a useful framework. It enables them to have a rapid understanding of the project's concept during the first stage and facilitates a more thorough assessment throughout the latter stages of advanced design processes (Schielke, 2023) ^[18].

Again, the dramatic significance of daylight in constructing dynamic environments in interior spaces can be observed in the interplay between the inherent unpredictability of sunshine and the reflected character of water, creating a dynamic quality to architectural spaces. Pallasmaa (2012) ^[16] states in *The Eyes of the Skin: Architecture and the Senses* that architecture allows us to comprehend and appreciate the interplay between enduring qualities and transformations, to establish our presence in the environment, and to position ourselves within the ongoing development of culture and

history. This concept explores the intricate connection between two opposing forces or concepts, namely permanence and change. It is exemplified through the fluctuating nature of daylight, which enables us to comprehend and value the intricate interplay between elements that remain constant over time (permanence, such as a building) and those that undergo alteration (change, such as the shifting emphasis and evolution throughout the day or over time).

Lee (2023) ^[4] demonstrates this concept through a modern design, employing refractive pictures from a water surface to accentuate the enduring nature of architecture and solidify the concept of the passage of time. The refraction of the water on the wall enhances the initial encounter, stimulating the imagination to contemplate the juxtaposition of the past and the future. This depicts the optical phenomenon of the refractive nature of the water, by disguising its actual depth and, in doing so, produces the illusion of a second hidden world, implying the existence of both the projected visible surface world and the concealed underwater world, as seen below.



Source: Lee, (2023) ^[4]

Fig 4: Indoor Luminous Environment Shaped by Lighting Design

In essence, stresses the transforming effects of the inherent fluctuation of daylight. This natural fluctuation lends a dynamic dimension to architectural spaces, allowing focus to move and evolve over the course of the day, ranging from the daylight patterns categorized from direct accentuated patterns to indirect and diffuse spaces as illustrated in figure below.



Source: Lee, (2023) ^[4]

Fig 5: Refracted Image on the Concrete Wall

The integration of natural light as a vital factor in visibility and focus, harnessed through well-designed windows and

skylights, offers dynamic aspects to a space as emphasized in Schielke (2023) ^[18]. However the mix of natural light with artificial lighting promotes visibility in a way that is both visually beautiful and energy-efficient which accords with contemporary design ideas that emphasize sustainability and the connection to the natural environment (HMC Architects, 2018) ^[10].

The examination of the dramatic quality of lighting and its impact on the atmosphere and perception of a space underlines the complex significance of lighting in architecture. From setting the tone to selecting emphasizing details, effective lighting design extends beyond the technical aspects, becoming a sophisticated art that impacts how the built environment is experienced and engaged with.

2.3 The Appeal of the Flexibility of Lighting in Emphasis

Flexibility in lighting design allows architects and designers to adapt to various functions within a space, from focused work to social gatherings, enhancing the versatility of a space as shown below.



Source: Houseome, (2021) ^[11]

Fig 6: Task light in a Kitchen space

The importance of human-centric lighting is directly proportional to the emphasis on interior space it depicts; allowing for adjustments in intensity and colour temperature, aligning with circadian rhythms, and supporting occupants' well-being by mimicking natural light conditions throughout the day. It also offers aesthetic versatility by modifying lighting schemes, allowing designers to create different atmospheres, moods, and visual experiences within a space. This is particularly crucial in architectural projects where diverse aesthetics are desired, as adjustable lighting can highlight architectural features, guide movement within a space, and create a sense of drama or intimacy. This dynamic quality is crucial in modern architectural designs that aim for engaging environments.

Also, future-proofing lighting ensures that a space remains relevant based on the original design framework, and functional as needs evolve. Given the advancements in lighting technology, flexibility enables the integration of smart lighting equipped with the RIC® (remote intelligent control) systems; with an energy-efficient LED light source with daylight-dimming capabilities (Walton, 2023) ^[19]. These systems can be controlled remotely, programmed for specific scenarios, and even respond to environmental factors, enhancing the overall intelligence of a building's lighting.

3. Research Methodology

The study employs a qualitative research approach to

comprehensively explore the use of light as an emphasis in interior design as well as the dynamic relationship between architecture and lighting design. The methodology consists of a literature review, synthesizing existing knowledge from reputable sources in the field. The foundation of this study is built upon an extensive review of the existing literature. Relevant articles, research papers, and books were consulted to understand the multifaceted role of lighting in architecture. To ensure a comprehensive understanding, the study integrates insights from various authors and researchers. The inclusion of diverse perspectives allows for a holistic exploration of the subject matter; going beyond theoretical exploration by applying concepts to practical scenarios to bridge theoretical knowledge with real-world implications.

4. Discussion

The comprehensive exploration of light as a tool of emphasis is vital for architects and designers seeking to create environments that are not only visually appealing but also emotionally resonant. The symbiotic relationship between architecture and lighting, as expounded in this study, transcends the conventional discourse primarily centred around energy efficiency. William M.C. Lam (1924-2012), a pioneer in lighting design, has stressed the multifaceted nature of daylight, emphasizing its role as a form giver in architectural spaces (Schielke, 2023; Lam, 1977; Lam, 1985)^[18]. Siobhan Rockcastle and Marilyne Andersen's qualitative approach (Rockcastle and Andersen, 2013)^[17], epitomized by the matrix of 10 shades of daylight, introduces a paradigm shift in the analysis of spatial and temporal diversity. Their framework delineates a spectrum ranging from direct, exaggerated patterns to subtle, diffuse spaces. The typology not only provides architects with a conceptual overview but also a nuanced evaluation tool for advanced design processes. The exploration of lighting's emphatic quality unravels its transformative potential within architecture. Flynn *et al.* (1973)^[7] psychological insights underscore that lighting surpasses its basic functions, delving into the realm of user impression and behaviour. Architectural lighting design, as an interdisciplinary field, converges art, design, and technology, redefining interior spaces beyond mere utilitarian considerations.

The application of specific architectural lighting fixtures, strategically chosen for their aesthetic qualities and functionality, emerges as a key theme. From cove lighting to linear recessed lighting, each fixture becomes an artistic tool, contributing to the broader emphasis of architectural spaces. The discussion of the variability of light extends beyond artificial lighting, delving into the dynamic emphasis provided by natural light. Daylight, categorized by its spatial and temporal diversity, acts as a transformative force. The typology developed by Rockcastle and Andersen (2013)^[17] becomes a valuable framework, guiding architects in harnessing the dynamic qualities of daylight beyond energy-centric metrics. Lee (2023)^[4] contemporary design, using water's refractive surface, introduces a metaphorical layer to the discussion. The optical illusion becomes a poignant reflection of architecture's dialectics (balancing permanence and change). Daylight, as an ever-evolving force, breathes life into architectural spaces, creating a continuum that resonates with cultural and temporal shifts.

The additional perspective on flexibility in lighting design accentuates the adaptability required for diverse functions within a space. The interplay of focused work and social

gatherings underscores the importance of human-centric lighting, aligning with circadian rhythms for occupants' well-being. Aesthetic versatility, achieved through adjustments in intensity and colour temperature, empowers designers to create diverse atmospheres, moods, and visual experiences within a space. This dynamic quality becomes particularly crucial in modern architectural designs that aim for engaging environments.

5. Limitations and future directions

Although this research thoroughly looks into the dramatic character of sunshine in architecture, it's vital to understand distinct restrictions. The emphasis largely lays in qualitative features, generating a need for deeper quantitative inquiries into the psychological and physiological repercussions of diverse lighting arrangements. Moreover, while Rockcastle and Andersen (2013)^[17] typology is enlightening, it beckons for future refinements and additions to embrace a greater spectrum of architectural scenarios.

6. Conclusion

This discourse advances the understanding of lighting design as a dynamic force in architectural narratives. The interplay of natural and artificial light, guided by qualitative typologies, illuminates the spatial nuances that extend beyond the traditional metrics of energy efficiency. Architects, armed with this nuanced understanding, are poised not merely as designers but as storytellers, crafting epics in light that resonate with the human experience.

7. References

1. Big Pockets Real Estate (BPRES). Environment Friendly Interiors; c2018. [Online]. Available at: <https://bigpocketsre.com/sobha-dubai-properties-one-park-avenue>
2. Cadena JDB, Poli T, Košir M, Lobaccaro G, Mainini AG, Speroni A. Current Trajectories and New Challenges for Visual Comfort Assessment in Building Design and Operation: A Critical Review. *Applied Sciences*. 2022;12(6):3018. <http://dx.doi.org/10.3390/app12063018>
3. Gellings CW. Efficient Use of Electricity Through Demand-Side Management. *Efficient Use and Conservation of Energy*. 2009;2:168.
4. Lee D (Damileearch). Video: Water can be very Deep; c2022. [Online]. Available at: [https://www.instagram.com/reel/CvXZXhaOQcq/?utm_source=ig_web_copy_link&igshid=MzRlODBiNWFlZA \(31st July, 2023\)](https://www.instagram.com/reel/CvXZXhaOQcq/?utm_source=ig_web_copy_link&igshid=MzRlODBiNWFlZA (31st July, 2023)).
5. Durak A, Olguntürk NC, Yener C, Güvenç D, Gürçınar Y. Impact of lighting arrangements and illuminances on different impressions of a room. *Building and Environment*. 2007;42(10):3476-3482.
6. Enwin AD, Ikiriko TD, Jonathan-Ihua GO. The role of colours in interior design of liveable spaces. *European Journal of Theoretical and Applied Sciences*. 2023;1(4):242-262.
7. Flynn JE, Spencer TJ, Martyniuk O, Hendrick C. Interim study of procedures for investigating the effect of light

- on impression and behaviour. *Journal of the Illuminating Engineering Society*; c1973.
8. Flynn J, Spencer T. The Effects of Light Source Color on User Impression and Satisfaction. *Journal of the Illuminating Engineering Society*. 2013;6(3):167-179. <http://dx.doi.org/10.1080/00994480.1977.10747811>
 9. Gemelli A, Shiratuddin MF, Kemp D. The impact of lighting on impressions of interior space. *The International Journal of Designed Objects*. 2013;6(2):19. <http://dx.doi.org/10.18848/2325-1379/CGP/v06i02/38653>
 10. Feria M, Amado M. Architectural design: Sustainability in the decision-making process. *Buildings*. 2019;9(5):135.
 11. Blitzer D, Mackay T. *Kitchen and bath lighting: Concept, design, light*. John Wiley & Sons; c2015.
 12. Lam WMC. *Éclairage et architecture*. McGraw-Hill, New York; c1977.
 13. Lam WMC. *Sunlighting as formgiver for architecture*. United States: N.p.; c1985. <https://www.osti.gov/biblio/5638673>
 14. Livingston J. *Designing with light: The art, science, and practice of architectural lighting design*. John Wiley & Sons; c2021.
 15. Narendran N, Deng L. Color rendering properties of LED light sources. *Proceedings of SPIE. The International Society for Optical Engineering*. 2002;4776:61-67. <http://dx.doi.org/10.1117/12.452574>
 16. Pallasmaa J. *The eyes of the skin: Architecture and the senses*. John Wiley & Sons; c2012.
 17. Rockcastle SF, Andersen M. Celebrating contrast and daylight variability in contemporary architectural design: A typological approach (No. CONF); c2013.
 18. Schielke T. *The language of lighting: applying semiotics in the evaluation of lighting design*. Leukos; c2019.
 19. Fantozzi F, Leccese F, Salvadori G, Rocca M, Garofalo M. LED lighting for indoor sports facilities: Can its use be considered as sustainable solution from a techno-economic standpoint?. *Sustainability*. 2016;8(7):618.
 20. Wyszecki G, Styles WS. *Color Science: Concepts and Methods, Quantitative Data and Formulae*. (2ndEd.). New York: John Wiley & Sons; c1982.
 21. Yizhong Z. The effect of colour-rendering properties of light sources on visual acuity. *Acta Psychologica Sinica*; c1984.