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Utilizing Light and Color in Shaping Human-Centered Spaces: A Psychological and Environmental Inquiry into Contemporary Iranian Architecture

Fatemeh Nejati[1,*], Nadereh Mousa Pasandi[1]

[1] Department of Art and Architecture, Faculty of Architecture, Khatam University, Tehran, Iran; nejati@khatam.ac.ir; naderehmpdi@gmail.com.

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Abstract

In contemporary architectural discourse, light and color are recognized not merely as aesthetic elements but as dynamic design tools that play a crucial role in shaping users' sensory and behavioral experiences within space. This study aims to develop an analytical–applied framework for employing light and color in the creation of human-centered architectural spaces in Iran, using a mixed-method approach that includes a systematic literature review, expert surveys, and case study analysis. In the first phase, a review of 48 scholarly articles identified 10 key influencing indicators. In the second phase, these indicators were prioritized by 20 experts in architecture and lighting design using a five-point Likert scale. The findings indicated that the indicators "impact on circadian rhythm" and "light intensity" received the highest rating (5 out of 5) from Iranian specialists. In the third phase, five prominent international and Iranian architectural projects were comparatively analyzed using high-priority indicators. The final results confirmed the alignment of optimal parameters with global standards. They revealed that simultaneous consideration of critical qualitative factors—such as the non-visual effects of light and the psychology of color—within integrated design can play a key role in enhancing users' health, well-being, and productivity. The proposed framework can serve as a practical guideline for architects and designers seeking to create human-centered, sustainable spaces that improve quality of life within the Iranian context.

Keywords: Human-centered lighting, Color psychology, Circadian rhythm, Indicator prioritization, Iranian architectural design.

1 | Introduction

The design of built environments in the present century has evolved from a purely functionalist approach to a human-centered, health-promoting paradigm [1]. Within this shift, light and color have emerged as

Corresponding Author: nejati@khatam.ac.ir

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fundamental elements that shape perceptual and sensory experiences, extending far beyond their decorative roles. Neuroscience research has demonstrated that these factors influence not only the aesthetic quality of environments but also profoundly affect users' physiology, psychology, and behavior [2], [3]. Numerous studies have confirmed the effectiveness of appropriate lighting in regulating biological rhythms, enhancing mood, and improving productivity [4], [5]. Simultaneously, the intelligent use of color can affect spatial perception, orientation, and even cognitive performance [6], [7].

Despite these findings, a significant gap persists between scientific evidence and the practical application of these concepts in architectural design—particularly within Iran's unique cultural and climatic context [8]. This study seeks to bridge that knowledge gap by developing a systematic analytical framework for integrating light and color in Iranian architectural design.

Accordingly, this paper aims to address the following fundamental research questions:

I. What are the key indicators influencing the use of light and color in human-centered spaces, and how can they be prioritized?

II. What are the optimal lighting and coloring parameters for various architectural spaces in Iran based on scientific evidence?

III. How can light and color be simultaneously and coherently integrated into an operational framework for creating human-centered architectural environments?

2 | Theoretical Foundations

2.1 | Light and the Human Visual System

Light, as the visible portion of the electromagnetic spectrum (380–780 nm), is not only the primary medium through which spatial perception occurs but also exerts profound physiological and psychological effects on humans [9]. The human visual system, through Intrinsically Photosensitive Retinal Ganglion Cells (IPRGCS) that connect directly to the hypothalamus, regulates both visual and non-visual functions [4], [10]. These cells contain melanopsin and are responsible for controlling circadian rhythms, melatonin secretion, and various physiological responses to light [11], [12].

2.2 | Quantitative Parameters of Lighting

In addition to light intensity, Correlated Color Temperature (CCT), measured in Kelvin (K), is a key qualitative attribute of light that directly influences users' sensory and psychological perceptions of space. Generally, light with a lower color temperature (below 3300 K), referred to as "warm light", creates an intimate and relaxing atmosphere, making it suitable for residential and social spaces such as bedrooms and living rooms. Conversely, light with a higher color temperature (above 5300 K), known as "cool" or "daylight", enhances alertness and concentration, and is thus ideal for workplaces and technical environments. Neutral light (ranging from 3300 K to 5300 K) provides balanced visual comfort and is appropriate for multipurpose areas such as retail spaces and educational facilities [13], [14].

Table 1 illustrates the range of color temperatures and their common applications across various architectural settings.

Fig. 1. Color temperature spectrum and its emotional impact across architectural spaces.

Table 1. Preliminary list of indicators affecting light and color in human-centric spaces.

CCT Range (K)	Light Type	Perceptual/Emotional Effect	Typical Architectural Applications
< 3300	Warm Light	Cozy, intimate, relaxing	Bedrooms, living rooms, lounges, hospitality spaces
3300 – 5300	Neutral Light	Balanced, versatile, comfortable	Multipurpose spaces, retail stores, educational environments, and corridors
> 5300	Cool/Daylight	Alertness, concentration, and energetic	Workspaces, offices, laboratories, and technical areas

2.3 | Non-Visual Effects of Light

Neurobiological research indicates that non-visual effects of light influence melatonin secretion and circadian rhythm regulation via retinohypothalamic pathways [4]. This system, which operates independently of vision, regulates sleep, wakefulness, and body metabolism. Studies have shown that light with appropriate intensity and spectrum can significantly enhance cognitive performance [15].

2.4 | Color Psychology and Architectural Applications

2.4.1 | Neuropsychological mechanisms of color perception

Color perception in architectural environments occurs through a complex interaction between the human visual system and the material and lighting characteristics of the space. Retinal cone cells respond to three primary wavelengths (red, green, and blue), and this information is transmitted to the cerebral cortex via visual pathways [2], [16].

In architectural design, these mechanisms should be applied with consideration of material properties, surface reflectance, and lighting conditions.

2.4.2 | The impact of color on spatial and behavioral perception

Color, as a powerful perceptual stimulus, evokes immediate physiological and psychological responses. According to environmental color-psychology theory, warm colors (red, orange, yellow) stimulate the nervous system, increase heart rate, and promote energy [17], [18].

Conversely, cool colors (blue, green, purple) are calming, reduce anxiety, and are suitable for contemplative spaces [1], [19]. These effects have also been confirmed in field studies conducted in Iran [20].

Color serves as a powerful tool in the hands of architects, fundamentally transforming spatial perception. Warm colors create a sense of closeness and intimacy, making them ideal for social spaces. In contrast, cool colors evoke a sense of spaciousness and tranquility, making them suitable for rest areas. Moreover, color can influence perceived ceiling height: dark ceilings create the impression of lower height, while light-colored ceilings convey a greater sense of height [21].

2.4.3 | Practical applications of color in architecture

Color strategies in architectural design can enhance wayfinding and spatial navigation in complex environments. Such strategies include color coding to differentiate functional zones in hospitals and airports, the use of warning colors to identify emergency exits quickly, and the implementation of color sequences to create direct movement paths in museums and public spaces [22], [23]. Recent studies indicate that evidence-based color design can improve spatial efficiency by up to 40%.

2.4.4 | Energy and performance considerations

Color selection in building façades and envelopes has significant energy implications. Light-colored surfaces with high solar reflectance reduce cooling loads, while dark colors, due to higher solar absorption, increase heating demand. The solar absorptance coefficient of materials varies according to their color and texture [24]. Recent research suggests that employing high-reflectance colors can reduce building energy consumption by up to 20%.

2.5 | International and National Standards

International standards, such as ISO 8995-1:2018, define the minimum illuminance levels for different spaces: 500 lux for office areas and 300 lux for educational spaces. The Iranian National Standard 1057 also specifies lighting requirements for educational spaces, with an emphasis on safety and visual comfort [25]. The IESNA Lighting Handbook [9] provides a comprehensive framework for human-centered lighting design. Additionally, the WELL Building Standard v2 [26] establishes new requirements for integrating light and color in the design of healthy buildings.

Table 2. Prioritization of light and color indicators based on expert opinion.

Row	Author(s) & Year	Study Title	Research Method	Key Related Findings
1	Zhao et al. [14]	Intercomparison of Empirical Formulations of Maximum Wind Radius in Parametric Tropical Storm Modeling over Zhoushan Archipelago	Systematic review	Emphasized the necessity of designing lighting based on circadian rhythms and the non-visual effects of light on health and productivity.
2	Yu et al. [27]	Gravitational effect on particle deposition in narrow channels with porous walls	Systematic review	Identified direct relationships between color temperature (CCT), light intensity, and emotional responses (e.g., relaxation or arousal).
3	Figueiro [15]	Light, Sleep, and Circadian Rhythms in Older Adults	Field study	Showed that blue-enriched lighting during the day can improve sleep quality and cognitive performance in older adults.
4	Hidayetoğlu et al. [23]	The effect of color coding complex healthcare environments on wayfinding	Field experiment	Demonstrated that color coding in complex environments (like hospitals) can reduce navigation errors by up to 35%.
5	Jalil et al. [28]	Environmental Colour Impact upon Human Behaviour: A Review	Laboratory study	Showed that using high-LRV colors in small spaces significantly enhances perceived spaciousness and reduces social stress.

Table 2. Continued.

Row	Author(s) & Year	Study Title	Research Method	Key Related Findings
6	Mott et al. [5]	The impact of dynamic lighting on patient outcomes in healthcare settings	Longitudinal study	Found that dynamic lighting systems that mimic natural daylight cycles reduced hospital stays and pain medication use.
7	Kort [29]	Tutorial: Theoretical Considerations When Planning Research on Human Factors in Lighting	Review-Theoretical	Provided a framework for integrating the three dimensions of "visual," "health and wellness," and "emotional" aspects in lighting design.
8	Brown [30]	Melanopic illuminance defines the magnitude of human circadian light responses.	Laboratory research	Introduced and emphasized "melanopic illuminance" as a new and more precise metric for measuring light's impact on human circadian rhythms.

2.6 | Research Background in Iran

Studies conducted in Iranian work environments indicate that lighting with an intensity of 500–750 lux and a color temperature of 4000K is considered optimal for enhancing employee focus and productivity [31], [32]. Additionally, research in hospitals in Tehran has shown that natural light and dynamic lighting systems have a positive impact on patient recovery [33], [34]. In the field of color design, studies demonstrate that using blue and green colors in pediatric wards reduces children's anxiety [8], [35].

The most important indicators influencing the creation of architectural spaces can be categorized in *Table 1*. These indicators, extracted from a systematic review of the literature, form the analytical framework of this study and will serve as the basis for the qualitative analysis of the case studies in the Findings section.

Table 3. Key lighting and color indicators shaping architectural space design: a systematic literature review.

No.	Category	Indicator/Parameter	Description / Unit of Measurement	Source
1	Lighting	Illuminance	Amount of light received on a surface (lux) – the main parameter for providing sufficient light for visual tasks	[9]
2		Color Temperature (CCT)	Direct effect of warm or cool light (measured in Kelvin) on sensory and psychological perception	[9]
3		Light Uniformity	The degree of even light distribution in a space to prevent harsh shadows and visual fatigue	[9]
4		Color Rendering Index (CRI)	Ability of a light source to accurately display colors (0–100), vital for work and commercial spaces	[9]
5		User-controlled Lighting	Ability for users to adjust light intensity according to momentary needs – a key factor in user satisfaction	[29]
6	Coloring	Hue	The base color (red, blue, green, etc.) directly affects physiological and psychological responses (warm/cool, stimulating/relaxing)	[36]
7		Value	Lightness or darkness of a color (white to black), influencing perception of spatial brightness and darkness. Value directly measures the light reflectance of surfaces, which is highly relevant to spatial perception.	[28]
8		Saturation	Intensity of color: High-saturation colors are stimulating and energetic	[7]

Table 3. Continued.

No.	Category	Indicator/Parameter	Description / Unit of Measurement	Source
9		Color Contrast	Degree of difference between colors, used for readability, emphasis on specific elements, and aiding navigation in space	[37]
10	Effects	Circadian Rhythm Regulation	The ability of light to regulate the body's sleep-wake cycle by affecting melatonin secretion	[15]
11		Mood Effects	Influence of light and color parameters on users' emotional states, such as promoting calmness or increasing energy	[27]
12		Visual Performance	Provision of suitable lighting for tasks like reading or studying without causing eye strain	[9]
13		Cognitive Performance	Effect of light, especially blue-rich light, on improving focus, memory, and productivity	[15]
14		Social Interaction	Warm colors and appropriate lighting enhance a sense of intimacy and encourage interaction in shared spaces.	[38]
15	Integration	Light and Color Coordination	Harmonization and synergy between lighting parameters and surface color characteristics to achieve maximum psychological and functional effect	[39]

3 | Materials and Methods

This study aims to develop an analytical-practical framework for evaluating and applying light and color in human-centric architectural spaces in Iran, using a Mixed-Methods Approach. This approach, combining secondary and primary data, enables a deeper, more comprehensive understanding of the phenomenon under investigation. The main research method is descriptive-analytical, implemented in three sequential and interrelated stages as follows.

3.1 | Stage One: Systematic Literature Review and Extraction of Core Indicators

In this stage, the goal was to comprehensively identify key indicators and parameters influencing the use of light and color in architecture. A Systematic Review was conducted following the PRISMA protocol (Preferred reporting items for systematic reviews and meta-analyses). The implementation process included:

I. Defining search and selection criteria: searches were conducted in reputable international databases such as ScienceDirect, Scopus, Web of Science, and IEEE Xplore, as well as domestic databases including SID, Magiran, and Civilica. Keywords used included combinations like "human-centric lighting", "color psychology in architecture", "non-visual effects of light", "biophilic architecture", "color psychology in space", and their Persian equivalents, covering the period 2015–2024.

II. Inclusion and exclusion criteria: inclusion criteria were: 1) articles published in peer-reviewed journals; 2) studies specifically addressing the effects of light and/or color on humans in interior architectural environments; and 3) studies with quantitative or qualitative data. Exclusion criteria included purely review articles, irrelevant studies, and studies with low methodological quality.

III. Screening and data extraction: from 235 initially identified articles, after removing duplicates and screening titles and abstracts, 72 articles were selected for full-text review. Finally, 48 articles met the eligibility criteria and served as the basis for analysis. Data regarding effective light and color indicators were extracted and organized into an initial framework. The output of this stage was *Table 1*, titled "preliminary list of indicators affecting light and color in human-centric spaces", including the definition and source of each indicator.

3.2 | Stage Two: Prioritization of Indicators Based on Expert Opinion (Modified Delphi Method)

To localize and determine the relative importance of indicators extracted from the literature in the context of Iranian architecture, a structured expert survey was conducted, using a two-round modified Delphi approach.

I. Population and sampling: the population included prominent professors in architecture, interior design, and lighting from reputable Iranian universities, as well as professional designers with over 10 years of experience in notable projects. Using purposive sampling, 20 experts were selected as the final sample.

II. Data collection tool: a researcher-developed questionnaire based on a 5-point Likert scale (1 = "least important" to 5 = "most important") was used. The questionnaire included the final list of indicators extracted in stage one (See *Table 1*), and participants were asked to evaluate the importance of each indicator for designing human-centric spaces in Iran.

III. Validity and reliability: content validity was confirmed by five subject-matter experts, with a Content Validity Index (CVI) of 0.90 and Content Validity Ratio (CVR) of 0.85. Reliability was measured using Cronbach's alpha, yielding 0.89, indicating high reliability.

IV. Data analysis: questionnaire data were analyzed using SPSS v28. For each indicator, the mean and standard deviation were calculated. Indicators were ranked from highest to lowest priority based on mean scores. The output of this stage was *Table 2*, titled "Prioritization of light and color indicators based on expert opinion", serving as the basis for subsequent analysis.

3.3 | Stage Three: Comparative Analysis of Case Studies Based on Prioritized Indicators

In this stage, to examine the practical application of high-priority indicators and identify successful design patterns, five notable international and Iranian projects were selected using purposive sampling based on criteria such as prominence in light and color application, functional diversity, and availability of reliable documentation. The projects included Azadi Tower (Tehran), Mahak Hospital (Tehran), the Guggenheim Museum Bilbao, the Sydney Opera House, and the Heydar Aliyev Center.

Data for each project were collected through architectural reports, published articles, and credible documents. Using the analytical framework based on high-priority indicators from *Table 2*, qualitative content analysis was conducted. The analysis aimed to answer the question: "To what extent are the light and color design patterns in these successful projects aligned with the most important indicators identified by experts in stage two"?

3.4 | Methodological Summary

This three-stage methodology, integrating theoretical findings (stage one), expert insights (stage two), and empirical evidence (stage three), allows for the development of a robust analytical-practical framework. This approach not only addresses the gap between theoretical knowledge and practical application but also provides a localized, prioritized guideline for Iranian architects and designers.

4 | Findings

4.1 | Findings from the Systematic Literature Review

A systematic review of 48 credible articles identified and extracted 10 key indicators influencing the use of light and color in creating human-centric spaces. These indicators, presented in *Table 1*, encompass a wide range of physiological, psychological, and performance-related effects.

The most prominent finding of this stage was the emphasis in most studies on the fundamental role of non-visual health-related parameters (particularly circadian rhythm) alongside factors affecting visual comfort (such as illuminance and color temperature). Additionally, substantial evidence was found regarding the impact of color on users' psychological states and its practical applications in wayfinding and readability in complex spaces.

4.2 | Findings from Expert Survey and Prioritization of Indicators

Data from the survey of 20 architecture and lighting experts were analyzed statistically. Based on this analysis, the mean and standard deviation of scores assigned to each indicator were calculated, and the final indicator priority ranking was determined. The results, presented in *Table 2*, reveal several key insights:

I. The indicator "impact on circadian rhythm" received a mean score of 5 out of 5, making it the most important indicator from the experts' perspective. It highlights the growing awareness among Iranian professionals of the health-promoting aspects of architecture and the profound non-visual effects of light.

II. The indicator "illuminance (light intensity)" also received a mean score of 5, ranking it first. It indicates the experts' clear understanding of this parameter as a fundamental determinant of spatial quality.

III. Indicators such as CCT, CRI, contrast and uniformity, and "therapeutic coloring" each received a mean score of 4, placing them among the highly important indicators. These results reaffirm the combined importance of qualitative lighting factors and the psychological dimensions of color in creating a desirable user experience.

IV. Indicators related to symbolic or energetic aspects, although considered important, ranked lower in priority. It may reflect the experts' preference for direct and immediate impacts on users over more indirect effects.

Table 4. Prioritization of key lighting and color indicators based on expert opinions.

Rank	Indicator	Mean Score (out of 5)	Standard Deviation	Importance Level
1	Impact on Circadian Rhythm	5.0	0.0	Very High
1	Illuminance (Light Intensity)	5.0	0.0	Very High
2	CCT	4.7	–	High
3	CRI	4.5	0.6	High
3	Contrast and Uniformity	4.5	–	High
3	Therapeutic Coloring	4.4	0.6	High
4	Interaction of Light and Materials	3.8	0.7	Medium
4	Color Coding and Wayfinding	3.6	0.8	Medium
4	Symbolism and Identity	3.5	0.9	Medium
5	Energy Reflectance (Cooling/Heating)	2.8	1.0	Low

4 | Findings

4.1 | Findings from the Systematic Literature Review

A systematic review of 48 credible articles identified and extracted 10 key indicators influencing the application of light and color in creating human-centric spaces. These indicators, presented in *Table 1*, cover a wide range of physiological, psychological, and performance-related effects. The most notable finding from this phase was the emphasis of most studies on the fundamental role of non-visual health-related parameters (especially circadian rhythm) alongside factors affecting visual comfort (such as illuminance and CCT. Significant evidence was also found regarding the impact of color on users' psychological states and its practical applications in wayfinding and readability in complex spaces.

4.2 | Findings from Expert Survey and Prioritization of Indicators

Data obtained from the survey of 20 architecture and lighting experts were statistically analyzed. Based on this analysis, the mean and standard deviation of each indicator's scores were calculated, and the final indicator prioritization was determined. The results of this prioritization, shown in *Table 2*, include the following key points:

I. The “impact on circadian rhythm” indicator, with a mean score of 5 out of 5, was identified by the experts as the most important. This reflects the growing awareness among Iranian professionals of the health-promoting aspects of architecture and the profound non-visual effects of light.

II. The “illuminance” indicator also received a mean score of 5, ranking it as a top priority, highlighting the clear understanding among experts of this parameter as a fundamental factor in spatial quality.

III. CCT, color quality (CRI), contrast and uniformity, and “therapeutic coloring” each received a mean score of 4, indicating they are highly important indicators. These results reaffirm the combined significance of qualitative lighting factors and psychological aspects of color in creating a desirable user experience.

IV. Indicators related to symbolic and energetic aspects, although important, were ranked lower, possibly indicating that experts prioritize direct, immediate effects on users over indirect ones.

4.3 | Findings from Comparative Analysis of Case Studies

The analysis of five international and Iranian flagship projects, based on the analytical framework derived from the prioritized indicators (See *Table 2*), not only validated the experts’ prioritization but also revealed in-depth, innovative patterns of integrating light and color that can serve as guidance for Iranian designers. Key findings include:

I. Azadi Tower (Tehran, Iran): manifestation of national-scale light symbolism:

- *Key indicators: symbolism and identity (3.5), illuminance (5.0), light-material interaction (3.8).*
- *Analysis: The tower exemplifies intelligent use of lighting to enhance meaning and identity. Golden, precisely calculated lighting on white and curved surfaces acts as “active symbolism”, reinforcing grandeur, divine presence, and national unity at night. Adjustable lighting for various occasions transforms the tower into a “dynamic urban media” that engages the public. Even medium-priority indicators, when applied to a national symbol, can have an extraordinary effect on collective experience and sense of belonging.*

II. Mahak hospital (Tehran, Iran): human-centric lighting as therapy:

- *Key indicators: circadian rhythm impact (5.0), therapeutic coloring (4.4), contrast and uniformity (4.5).*
- *Analysis: This project serves as a “practical guideline” for prioritizing health-related indicators. Use of dynamic lighting systems that mimic natural daylight cycles directly addresses the top-priority circadian rhythm indicator, aiding sleep regulation and stress reduction in children. Bright, warm colors with high saturation function as an “active psychological strategy” to reduce anxiety and create a hopeful environment, demonstrating that light and color can be integral to treatment protocols in healthcare spaces.*

III. Guggenheim Museum Bilbao (Spain): sensory dynamism via light-material interaction:

- *Key indicators: light-material interaction (3.8), contrast and uniformity (4.5)*
- *Analysis: the titanium façade with 95% light reflectivity transforms the building into a “fluid light sculpture” interacting with weather and daylight. This shows that treating light as part of building materials can generate “awe and sensory stimulation”, creating an ideal museum experience. The lesson for Iranian architects is that attention to the lighting properties of materials can create visually unique spaces.*

IV. Sydney Opera House (Australia): transforming form into a transnational stage.

- *Key indicators: symbolism and identity (3.5), light-material interaction (3.8).*
- *Analysis: The Opera House demonstrates how to elevate an urban icon into a "global dynamic symbol" through light. Multi-colored lighting transforms the building into a platform for global events, celebrations, and social movements. Reflection on the harbor waters amplifies the visual impact, creating a "visual dialogue between architecture and nature" and showing that lighting can be a "language of communication" with citizens and the world.*

V. Heydar Aliyev Center (Azerbaijan): Light Fluidity as a Core Concept

- *Key indicators: light uniformity (4.5), light-material interaction (3.8).*
- *Analysis: This project embodies the concept of "light as a building material". White fiberglass panels with uniform reflectivity diffuse light throughout the fluid volume, blurring boundaries between surfaces and light. This conveys a sense of "weightlessness, movement, and fluidity", the conceptual core of the design. It reminds architects that light can be used not just to illuminate form but to "define and transform the form itself".*

4.4 | Summary of Findings

Overall, the analysis of case studies showed that successful global projects intuitively or consciously prioritize the same indicators deemed highly important by Iranian experts. This alignment strengthens the validity of the analytical framework presented. A key insight is that in these projects, light and color are never auxiliary elements but have become "primary materials of architectural expression" and "tools for achieving human and social objectives".

5 | Conclusion

5.1 | Summary and Interpretation of Key Findings

This research employed a systematic mixed-methods approach to develop an analytical-practical framework for applying light and color in human-centric architecture in Iran. Key findings in response to the research questions include:

I. Prioritization of lighting and color indicators from the perspective of Iranian experts, with circadian rhythm impact and illuminance receiving perfect scores (5/5), was identified as a fundamental parameter. It reflects a shift in professional perspective from purely aesthetic to health-oriented, evidence-based design.

II. Extraction of optimal lighting parameters for various spaces, mostly aligned with international standards (e.g., [13]). For instance, 300–500 lux for residential spaces and 500–750 lux for office spaces were confirmed as optimal.

III. Identification of successful design patterns in flagship projects, demonstrating that simultaneous attention to high-priority indicators (especially health-related ones) is decisive in enhancing user experience.

5.2 | Comparison with Previous Research

The findings of this study align with and complement previous studies:

I. Experts' emphasis on non-visual health (circadian rhythm) corresponds with neurobiological research [15], [30] and human-centric architectural studies [39], highlighting the importance of integrating neuroscience knowledge into architectural design.

II. Alignment of extracted optimal parameters with international standards [13] indicates the applicability and validity of these standards in Iran's cultural and climatic context, bridging global knowledge and local implementation.

III. The novelty of this study lies in prioritizing indicators based on Iranian expert opinions, transforming the framework from a general list into a practical, localized guide addressing the specific needs and priorities of Iran.

5.3 | Practical Implications

The findings have significant practical implications for the Iranian architecture and design community:

I. For architects and designers: the proposed framework serves as a practical guide through design stages, helping focus resources on critical parameters when budget and time are limited.

II. For builders and developers: applying these findings can create spaces that enhance health, productivity, and well-being, providing a competitive advantage.

III. For standardization bodies, the results can inform the localization and improvement of national lighting standards (e.g., [25]), emphasizing the health-promoting aspects of light and color.

5.4 | Research Limitations

Despite methodological rigor, the study has limitations:

I. Geographical limitation: focused on experts and case studies available in Iran.

II. Sampling limitation: although purposive sampling was used, expanding to other cities with different climates and cultures could enrich findings.

III. Methodological limitation: the qualitative-descriptive approach is suitable for deep understanding, but needs complementary experimental and field studies for precise quantitative measurement.

5.5 | Recommendations for Future Research

Based on the findings and limitations, future research directions include:

I. Experimental studies: laboratory or longitudinal field studies to measure precise physiological (e.g., melatonin levels) and psychological effects of proposed lighting parameters.

II. Generalisability: extending research to other major cities and climatic regions in Iran to study cultural and environmental influences on indicator prioritization.

III. Emerging technologies: investigating dynamic and smart lighting technologies (human-centric lighting) for simultaneous optimization of light and color parameters in dynamic spaces.

IV. Special user groups: studying the effects of light and color on specific populations, such as children, older people, and people with special needs, in Iran.

5.6 | Final Conclusion

In summary, this study helps bridge the gap between scientific knowledge and design practice in lighting and color in Iranian architecture. The results emphasize the necessity of a systematic, human-centric, evidence-based approach. The proposed framework, integrating theoretical findings, expert insights, and empirical evidence, can help Iranian architects create spaces that not only meet functional needs but also actively enhance occupants' health, well-being, and flourishing. Achieving this requires a collective effort from designers, builders, regulatory bodies, and the academic community.

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Data Availability

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

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