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The Aesthetics of Light and Shadow in Islamic Architecture: A Comparative Analytical Study

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ABSTRACT

Light and shadow play a central aesthetic role in Islamic architecture, shaping spatial harmony, visual depth, and the symbolic atmosphere of built environments. Rooted in Islamic cultural and spiritual traditions, light represents divine presence, while shadow introduces balance, rhythm, and contemplative calmness. This study investigates how architectural elements—such as courtyards, iwans, arcades, domes, and wooden screens—organize natural illumination to generate visually rich and emotionally expressive compositions. Using a descriptive–analytical approach supported by photographic documentation and digital light simulations, the research examines four key case studies representing different Islamic periods: the Umayyad Mosque in Damascus, the Mustansiriya School in Baghdad, Al-Azhar Mosque in Cairo, and the Suleymaniye Mosque in Istanbul. The findings show that the interplay of light and shadow functions as a deliberate artistic tool that enhances material expression, reinforces spiritual symbolism, and animates architectural forms throughout the day. The study highlights the enduring aesthetic value of traditional Islamic approaches to illumination and demonstrates their relevance for contemporary architectural design seeking deeper sensory and symbolic engagement.

Keywords: Islamic architecture; light and shadow; aesthetics; spiritual symbolism.

INTRODUCTION

Light and shadow hold a distinct aesthetic and symbolic significance in Islamic architecture, extending far beyond their physical properties. Light operates as an artistic medium that reveals form and shapes spatial character (Ching, 2014, p.123), while shadow enriches depth, contrast, and contemplative rhythm (Rasmussen, 1962, p.41). Islamic thought deepens these meanings through Qur'anic symbolism, where light represents divine presence [al-Nūr: 35] and shadow signifies tranquility and protection [al-Furqān: 45]. This spiritual dimension, further elaborated by Al-Ghazali (2004, p.41), guided Muslim architects in employing illumination as a deliberate design tool that enhances visual hierarchy and emotional resonance.

Architectural elements such as courtyards, iwans, arcades, domes, and mashrabiyas were thus shaped to orchestrate the movement of natural light, generating shifting patterns that strengthen harmony and perceptual depth (Bakr, 2022, p.44). This temporal interaction between sunlight and form produces a dynamic visual experience that deepens spatial perception (Fathy, 1986, p.46).

This study examines these aesthetic dimensions through four representative examples—the Umayyad Mosque in Damascus, the Mustansiriya School in Baghdad, Al-Azhar Mosque in Cairo, and the Süleymaniye Mosque in

Istanbul. Using photographic documentation and digital simulations, eight aesthetic indicators—such as balance, rhythm, depth, contrast, unity, and spiritual ambience—are applied to assess how light and shadow operate across different façades and times of day.

The analysis confirms that light and shadow in Islamic architecture constitute an intentional aesthetic language. Through their integration with architectural composition, they generate visual clarity, emotional depth, and spiritual meaning, forming one of the defining features of the Islamic architectural experience.

LITERATURE REVIEW

Studies on the aesthetics of light and shadow in Islamic architecture agree that illumination and shade constitute an intentional visual system rather than decorative by-products. Research by **Ibrahim et al. (2011)** and **Goda &Elkalshy (2021)** shows that contrast, filtered light, and gradual shading enhance spatial clarity, depth, and visual harmony. Aesthetic and spiritual interpretations further enrich this understanding: **Bakr (2022)** and **Salama (2019)** highlight the symbolic role of light as a medium of transcendence and emotional connection, while **Okasha (1986)** and **Alzahrani (2021)** emphasize harmony, balance, and sensory integration as core components of Islamic beauty.

Broader theories in architectural perception reinforce these insights. **Rasmussen (1962)** stresses the importance of shadow in revealing form and texture, whereas **Ching (2014)** explains how light directs visual emphasis and structures space. Meanwhile, **Lobell (1979)** and **Kahn (2003)** underscore the emotional and spiritual impact of illumination as an experiential dimension.

Collectively, these contributions demonstrate that the aesthetic value of light and shadow in Islamic architecture emerges from their dynamic interaction, which generates depth, balance, rhythm, and spiritual atmosphere. This forms the conceptual basis for the present study, which applies eight analytical indicators to examine selected architectural case studies.

Research Problem

Although light and shadow are essential components of Islamic architecture, their aesthetic role has not been systematically analyzed beyond functional or climatic perspectives. Existing studies seldom clarify how illumination and shade generate visual beauty, symbolic meaning, or spiritual depth. This study addresses the lack of an integrated aesthetic framework capable of explaining these roles across different Islamic architectural traditions.

Research Questions: This study addresses the following questions:

1. How do light and shadow contribute to aesthetic meaning and symbolic expression in Islamic architecture?
2. How do they generate perceptual qualities such as depth, rhythm, balance, and spiritual ambience?
3. What aesthetic principles from historical Islamic architecture can guide contemporary design?

Research Objectives: The study aims to:

1. Analyze the aesthetic and symbolic functions of light and shadow in selected Islamic buildings.
2. Clarify how natural illumination enhances perceptual experience, harmony, and spiritual depth.
3. Extract aesthetic principles from historical precedents to guide contemporary architectural design.

Research Methodology: A Descriptive–Analytical Comparative Method is employed, combining:

- ***Aesthetic Analysis:*** assessment of contrast, depth, rhythm, unity, and spiritual ambience.
- ***Perceptual Analysis:*** documentation of temporal changes in illumination using photography and SketchUp simulations.

Case Selection: Four architectural models were selected to represent major Islamic periods and diverse aesthetic traditions: the Umayyad Mosque in Damascus, characterized by strong contrast and rhythmic façade composition; the Mustansiriya School in Baghdad, noted for its decorative depth and symmetrical shadow patterns; Al-Azhar Mosque in Cairo, distinguished by its filtered light and ornamental shading; and the Süleymaniye Mosque in Istanbul, renowned for its refined dome lighting and spiritually oriented visual effects.

Research Hypothesis: The study hypothesizes that light and shadow form an intentional aesthetic language in Islamic architecture, where symbolic and perceptual meanings are generated through their spatial interaction and temporal variation.

The Dynamics of Light and Shadow in Islamic Architecture:

The relationship between light and shadow in Islamic architecture is inherently dynamic, shaping aesthetic expression and enhancing the perceptual depth of space. Light functions not only as a medium of visibility but as an active agent that reveals form, defines spatial relationships, and enriches the emotional and spiritual atmosphere of architecture (Ching, 2014, p.123). Within Islamic thought, light carries symbolic significance associated with divine presence and spiritual illumination, granting architectural space a metaphysical dimension that extends beyond its physical properties.

Shadow, as the natural counterpart to light, reinforces visual composition by generating contrast, depth, and rhythmic variation. Classical and contemporary definitions describe shadow as the result of partial or complete obstruction of light, producing gradations that animate surfaces and introduce perceptual nuance (Ibrahim et al., 2011, p.610). In Islamic architecture, shadow is intentionally employed as an aesthetic tool; elements such as mashrabiyas, arcades, and domes are designed to modulate light and generate layered shadow patterns that enhance visual harmony and perceptual richness (Rasmussen, 1962, p.41).

Together, light and shadow form a dynamic visual system that infuses architecture with constant movement and renewed beauty, transforming Islamic spaces into living environments whose aesthetic qualities shift throughout the day.

Philosophical Perspectives on Light and Shadow

a. ***Classical Thought:*** Classical philosophy treated light and shadow as fundamental to perception. Plato viewed light as the path to truth and shadow as a distorted image of reality (Plato, 1992). Aristotle defined shadow as the natural result of obstructed light and essential for visual clarity (Aristotle, 1931). Vitruvius emphasized orienting buildings toward sunlight for balanced illumination (Vitruvius, 1960).
b. ***Islamic Philosophical and Cultural Views:*** Islamic thought assigned deeper spiritual meaning to light and shadow. The Qur'an describes light as divine guidance [al-Nūr: 35] and shadow as protection and repose [al-Furqān: 45]. Al-Ghazali interpreted physical light as a symbol of higher truth (Al-Ghazali, 2004), while Ibn al-Haytham established the scientific basis of vision through reflected light (Ibn al-Haytham, 1983). In Islamic culture, light conveys knowledge and transcendence, whereas shadow reflects human perceptual limits (Goda&Elkalshy, 2021).
c. ***Modern and Contemporary Approaches:*** Modern theorists reinforced the centrality of illumination: Le Corbusier described architecture as shaped by light (Le Corbusier, 1986), and Kahn emphasized the mutual presence of light and shadow (Kahn, 2003). Contemporary architects such as Tadao Ando use their interplay to create meditative spaces with heightened perceptual depth (Ando, 1990).

Light and Shadow in Islamic Architecture

In Islamic architecture, light and shadow form a unified aesthetic language that shapes spiritual experience, perceptual clarity, and architectural beauty. Although these elements also fulfill important environmental and functional roles, the present study focuses primarily on their **aesthetic and perceptual dimensions**, while functional references are included only to provide broader architectural context. Light is closely tied to notions of divine presence and inner illumination, as reflected in the Qur'anic declaration that "Allah is the Light of the heavens and the earth" [al-Nūr: 35], while shadow evokes tranquility and subtlety, echoing the verse describing how God "extends the shadow" [al-Furqān: 45]. Islamic architects translated these symbolic concepts into spatial experience by directing light toward visually and spiritually significant elements such as the mihrab and central domes, and by using shadow to create contemplative zones that enhance emotional calmness (Abou El-Magd et al., 2020, p.59; Bakr, 2022, p.44). Architectural devices such as courtyards, arcades, and mashrabiyas moderated intense sunlight while also introducing layers of filtered illumination that enriched sensory perception, demonstrating how environmental responsiveness and aesthetic refinement merged within Islamic design (Ibrahim et al., 2011, p.610). The interplay of brightness and shade articulated geometric forms, emphasized contrasts between solids and voids, and produced shifting visual rhythms that evolved throughout the day. Through this dynamic interaction, light and shadow emerged as expressive tools that animated architectural surfaces and cultivated deep spiritual and aesthetic resonance within the built environment.

Architectural Strategies for Shaping Light and Shadow in Islamic Design

Islamic architecture developed a sophisticated set of architectural strategies to modulate light and shadow, transforming illumination into an expressive aesthetic tool. Although many of these elements also fulfilled environmental needs, their role in shaping visual harmony, depth, and symbolic meaning is central to this study. Courtyards introduced open, bright spaces framed by shaded arcades, generating gentle transitions between sunlight and shadow that enriched spatial perception and produced calm, visually balanced environments (Creswell, 1989, p.115; Fathy, 1986, p.46). Mashrabiyas and ornamental windows filtered daylight through intricate wooden patterns, producing delicate shadow screens that animated interior surfaces and enhanced visual intimacy (Al-Suwaikha, 2019, p.40). Similarly, arcades and iwans created deep shaded zones that guided movement and constructed perceptual thresholds between light and darkness, reinforcing the rhythmic character of Islamic spatial design (Ibrahim et al., 2011, p.610). Domes and arches played a further role in orchestrating illumination: clerestory openings introduced soft, elevated light symbolically associated with the celestial realm, while the curvature of domes generated shifting shadows that imbued sacred spaces with depth and spiritual resonance (Creswell, 1989, p.135; Frishman&Khan, 2002, p.98). Even material textures contributed to this visual choreography, as rough

surfaces produced fine shadow patterns that revealed depth, whereas smooth surfaces reflected uniform light with minimal expression (Rasmussen, 1962, p.145). Through these interconnected devices, Muslim architects crafted a design language in which light and shadow worked together to articulate form, enrich perception, and create atmospheres that blend beauty, symbolism, and serenity.

The Aesthetic and Perceptual Impact of Light and Shadow in Islamic Architecture

Light and shadow in Islamic architecture create a rich aesthetic and perceptual system that shapes spatial experience. Their impact can be summarized through eight key indicators:

1. ***Emphasis of Principal Elements:*** Light highlights main architectural features—such as domes or the mihrab—while shadow recedes secondary elements, reinforcing visual hierarchy and directing the viewer's gaze.
2. ***Visual Balance between Mass and Void:*** The deliberate distribution of illumination and shade creates equilibrium, softening heavy masses with light while grounding space through shadow.
3. ***Creation of Visual and Spatial Depth:*** Shadows cast by arches, domes, and mashrabiyas generate three-dimensional depth, adding drama and layered perception that shifts with time.
4. ***Visual Rhythm and Repetition:*** The alternation of light and shadow across arcades and colonnades produces rhythmic sequences that strengthen compositional unity.
5. ***Spiritual and Emotional Atmosphere:*** Light symbolizes transcendence and revelation, whereas shadow evokes calmness and introspection, together forming a spiritually resonant environment.
6. ***Light–Shadow Contrast:*** Variations in brightness clarify textures, highlight material qualities, and create a dynamic tension between clarity and mystery.
7. ***Visual Unity:*** When illuminated and shaded parts form a cohesive whole, the composition is perceived as an integrated spatial entity rather than separate fragments.
8. ***Overall Harmony:*** All indicators together produce a holistic experience in which light and shadow unify form, perception, and meaning, shaping the distinctive aesthetic identity of Islamic architecture.

The eight indicators collectively demonstrate that light and shadow in Islamic architecture operate as an integrated perceptual system rather than isolated visual phenomena. The first three indicators relate to direct visual perception, shaping how observers recognize architectural elements, spatial depth, and relationships within the built environment. The fourth and sixth indicators highlight the dynamic and temporal nature of sunlight, revealing how movement and changing illumination generate visual rhythm and animate architectural forms. The fifth, seventh, and eighth indicators address the emotional and spiritual layers of perception, where light becomes a symbol of transcendence and shadow evokes calmness, unity, and contemplative depth.

Together, these indicators affirm that light and shadow function as a deliberate aesthetic language in Islamic architecture—one that merges sensory, symbolic, and spatial experience. Through their integration, architectural space becomes a cohesive composition in which beauty, meaning, and perception intersect, reflecting the core Islamic aesthetic principle that purposeful design is the foundation of beauty. Based on these findings, the practical analysis in this study will apply the eight aesthetic indicators as the primary framework for evaluating the selected architectural case studies.

Practical Study

In its practical dimension, this research adopts an aesthetic–perceptual analytical approach to examine how light and shadow shape visual experience in selected Islamic architectural examples. The analysis relies on photographic documentation and digital sunlight simulations to evaluate eight aesthetic indicators describing visual, perceptual, and symbolic effects throughout the day. Although light and shadow have functional roles, the focus here is on their aesthetic and experiential impact.

To ensure reliability, the evaluation of the indicators was validated through triangulation by three expert academic architects. A qualitative–quantitative scale was used, where each indicator was graded as strong, moderate, or weak and converted into numerical values (3, 2, 1) to allow systematic comparison across façades and time periods. This scale forms the methodological basis for the case study analysis, clarifying how temporal changes in sunlight generate balance, depth, rhythm, unity, and spiritual perception within Islamic architectural composition.

Table (1): Aesthetic evaluation scale for the eight indicators of light and shadow in architectural facades.

Description	Evaluation/Numerical Degree	Indicator	
No clear emphasis.	(1): Weak	**Emphasizing the Principal Element in Design**	
Visible but not highlighted.	(2): Moderate		
Strong focus on main element.	(3): Strong		
Dominance of light or shadow.	(1): Weak		

Partial balance.	(2): Moderate	**Achieving Visual Balance between Mass and Void**	
Harmonious distribution.	(3): Strong		
Flat appearance.	(1): Weak	**Creating Visual and Three-Dimensional Depth**	
Some depth.	(2): Moderate		
Clear depth through contrast.	(3): Strong		
No rhythmic order.	(1): Weak	**Visual Rhythm and Repetition**	
Partial repetition.	(2): Moderate		
Consistent rhythmic pattern.	(3): Strong		
No emotional effect.	(1): Weak	**Enhancing Spiritual Dimension and Sense of Transcendence**	
Some tranquility.	(2): Moderate		
Deep spiritual impact.	(3): Strong		
Low contrast	(1): Weak	**Light Contrast**	
Moderate contrast.	(2): Moderate		
Strong contrast revealing texture.	(3): Strong		
Weak cohesion.	(1): Weak	**Visual Unity**	
Partial unity.	(2): Moderate		
Integrated visual coherence.	(3): Strong		
Limited harmony.	(1): Weak	**Overall Harmony**	
Partial harmony.	(2): Moderate		
Complete aesthetic harmony.	(3): Strong		

[1] ***Note:*** The numerical scale (1–3) represents the qualitative evaluation levels (weak, moderate, strong) used in analyzing the simulation images and architectural façades across different times of the day.

In this study, the analysis focuses on the southern and western façades, as these two orientations display the strongest visual interaction with sunlight in the Northern Hemisphere. The southern façade receives continuous illumination, producing clear contrasts and dynamic shadows that enhance depth and highlight key architectural elements. The western façade becomes visually expressive in the late afternoon, when low-angle sunlight generates strong horizontal shadows and intensifies the perception of form. While the eastern façade shows its aesthetic value mainly at sunrise, and the northern façade remains largely in diffuse light, the southern and western façades offer the richest aesthetic variation. For this reason, they represent the primary focus for examining how light and shadow shape visual balance, rhythm, and spatial harmony in the selected case studies.

Table (2): Aesthetic impact of sunlight on the four principal façades (Northern Hemisphere

Facade	Period of Sun Exposure	Intensity of Light-Shadow Interaction	Aesthetic Remarks
East	Morning (sunrise → noon)	Medium–High	Oblique morning rays highlight textures and fine architectural details; visual effect gradually decreases toward noon.
South	Morning → afternoon (longest exposure	Very High	Longest illumination period; produces strong contrasts and dynamic shadow movement that enhances depth and visual clarity.
West	Afternoon → sunset	Medium–High	Low-angle afternoon light creates dramatic horizontal shadows and intensifies perceptual contrast at sunset.
North	Mostly shaded all day	Very Weak	R eceives diffuse or reflected light only; minimal shadow variation and limited aesthetic effect.

The relationship between the Sun's movement and the four principal facades can be illustrated by the following diagram.

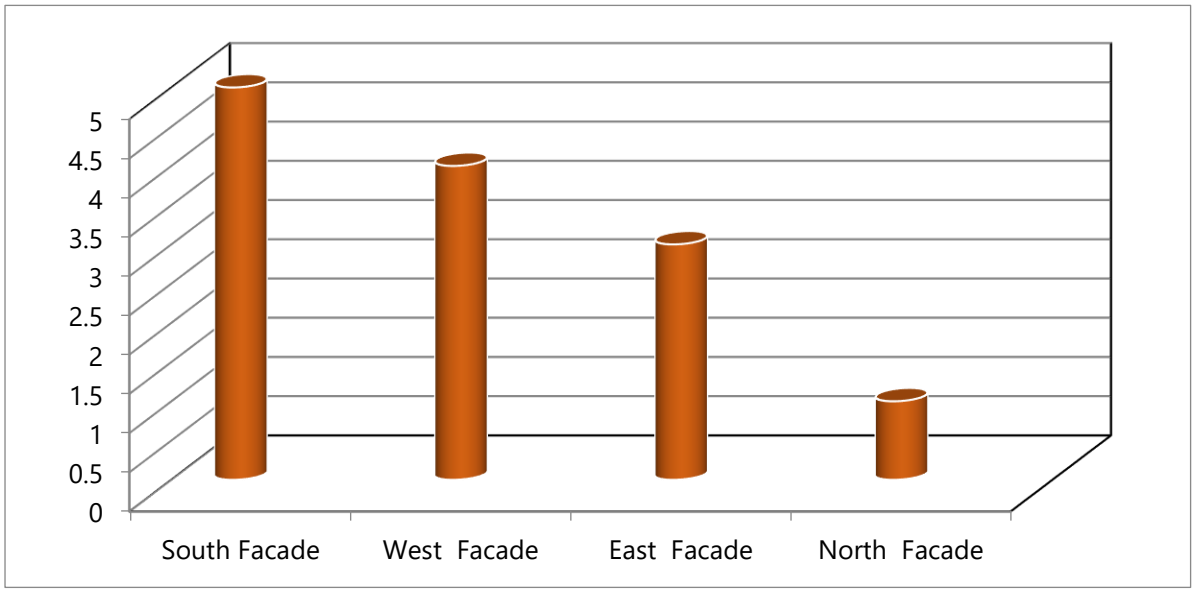


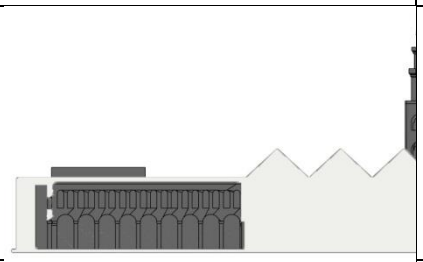
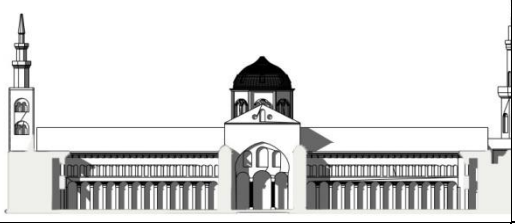
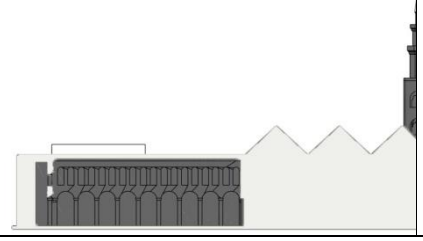
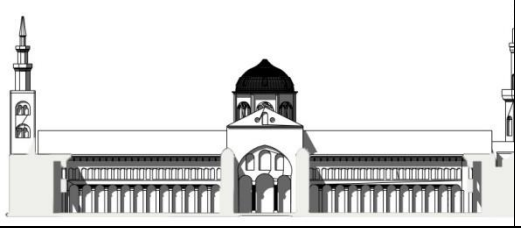
Figure. 1: Intensity of light and shadow effects on the four façades

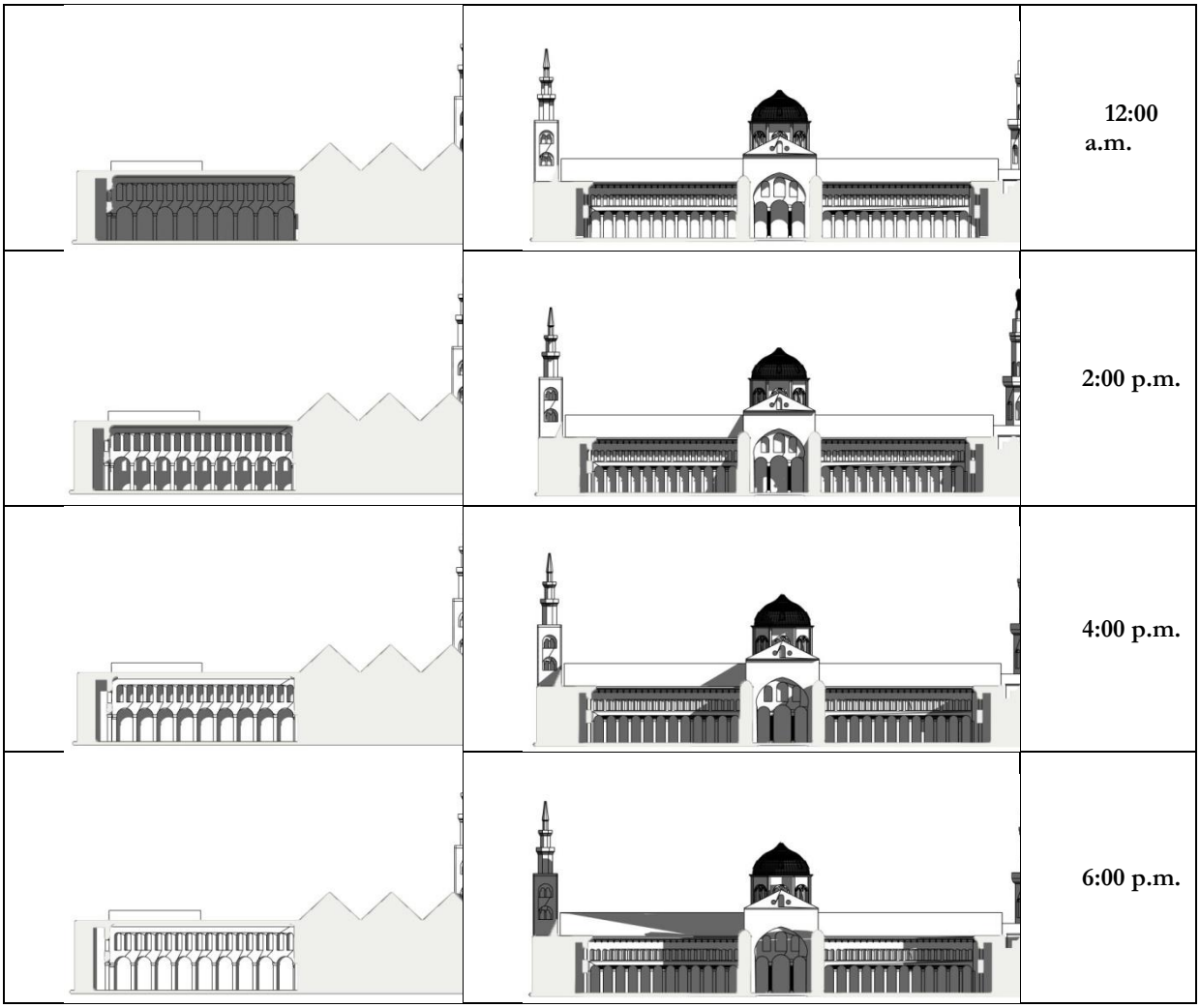
The chart illustrates the varying intensity of light–shadow interaction on the four principal façades in the Northern Hemisphere. The southern façade exhibits the strongest impact (5/5), followed by the western façade (4/5) in the afternoon and the eastern façade (3/5) at sunrise, while the northern façade remains the least affected (1/5). This distribution shows that light and shadow were intentionally employed in Islamic architecture as aesthetic tools shaping visual contrast, spatial depth, and rhythmic shadow patterns across different orientations.

For this reason, the present study focuses on the southern and western façades, as they offer the richest aesthetic variation throughout the day. The southern façade reveals the most pronounced shifts in shadow intensity, whereas the western façade displays strong contrasts produced by low-angle afternoon light. Together, these orientations provide a clear understanding of how light and shadow operate as dynamic visual elements in Islamic architectural composition.

The Umayyad Mosque (Damascus): Built in 715 CE under Caliph al-Walid ibn ʿAbd al-Malik, the Umayyad Mosque is one of the earliest monumental mosques in Islamic history. Its vast courtyard and surrounding arcades create a dynamic play of light and extended shadows that emphasize depth and rhythm. Clerestory windows diffuse light softly into the prayer hall, enhancing its contemplative atmosphere. Through these elements, the mosque demonstrates an early mastery of light and shadow as aesthetic tools shaping spiritual space.

Figure 2: Change in shadow direction in the Umayyad Mosque (Damascus).

Western Facade	Southern Facade	Time (h)
		**8:00a.m.**
		**10:00 a.m.**



The aesthetic analysis of light and shadow on the southern and western façades of the Umayyad Mosque demonstrates a clear variation in illumination intensity and shadow orientation throughout the day. These shifts, driven by the changing angle of the sun, noticeably influence the visual composition, depth, and overall aesthetic character of each façade. Table (3) provides a numerical assessment of the eight aesthetic indicators across the observed time intervals, derived from the lighting simulations presented in Fig. (2).

Table (3): Numerical evaluation of eight aesthetic indicators (M1-M2) for the southern and western facades of the Umayyad Mosque throughout the day.

M8	M7	M6	M5	M4	M3	M2	M1	Facade	Time
3	3	3	3	3	3	3	3	Southern	8:00 a.m.
1	1	1	1	1	1	1	1	Western	
3	3	3	3	3	3	3	3	Southern	10:00 a.m.
1	1	1	1	1	1	1	1	Western	
3	3	3	3	3	3	3	3	Southern	12:00 p.m.
2	2	2	2	2	2	2	2	Western	
2	2	2	2	2	2	2	2	Southern	2:00 p.m.
3	3	3	3	3	3	3	3	Western	
1	1	1	1	1	1	1	1	Southern	4:00 p.m.
3	3	3	3	3	3	3	3	Western	
2	2	1	2	1	1	1	1	Southern	6:00 p.m.
3	3	3	3	3	3	3	3	Western	

Note: M1–M8 refer to the eight aesthetic indicators used in the visual and comparative analysis.

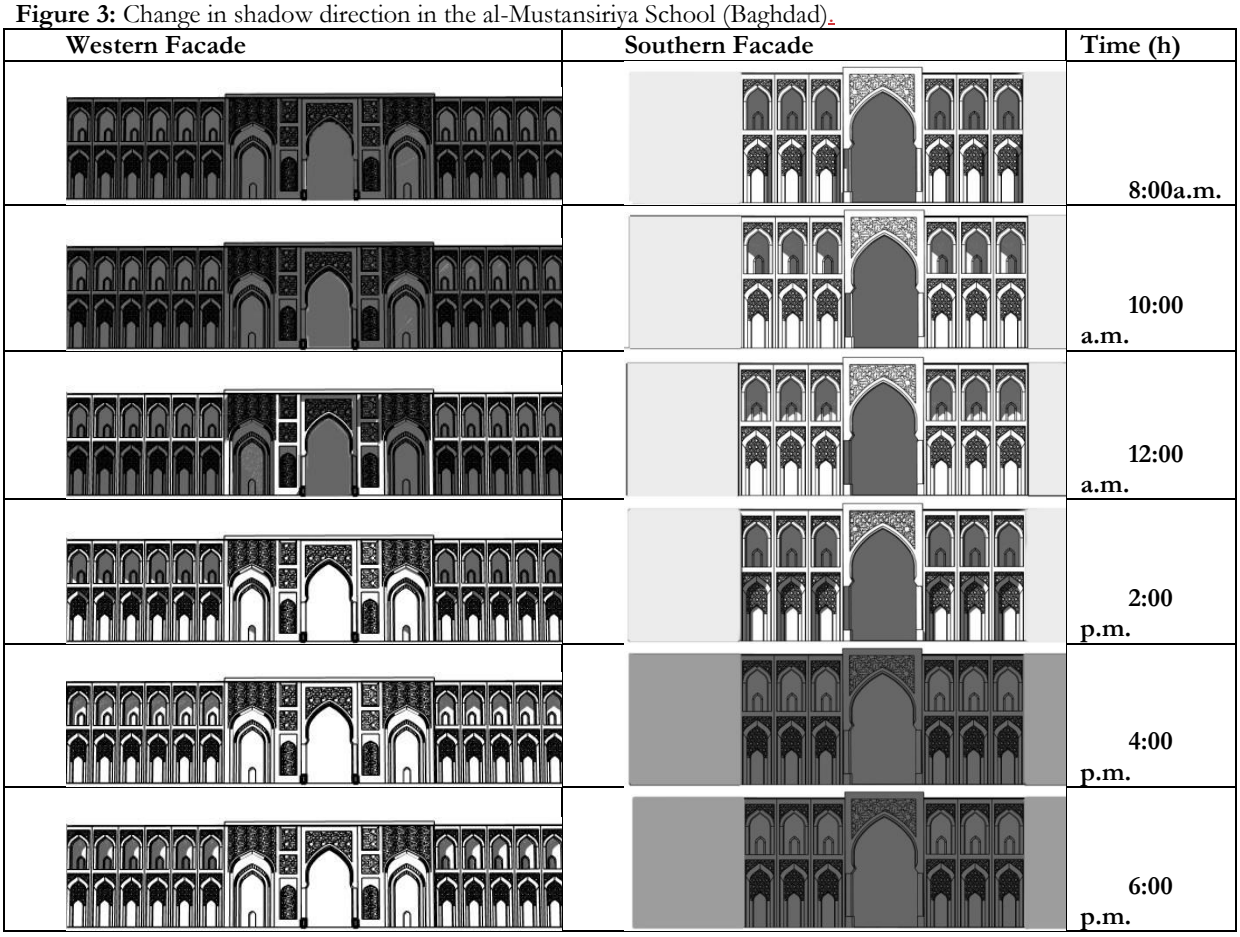
General Visual Conclusion—Umayyad Mosque: The temporal simulation of the Umayyad Mosque reveals a clear aesthetic progression shaped by the sun's movement and the orientation of the southern and western façades. In the morning, the southern façade receives strong direct light that enhances contrast, clarifies architectural details, and elevates the indicators of focal emphasis (M1), depth (M3), rhythm (M4), and spiritual value (M5), reaching its visual peak around noon.

As sunlight begins to decline toward early afternoon, shadow intensifies at the base of the columns, reducing contrast and softening visual clarity. Meanwhile, the western façade gradually becomes illuminated by oblique afternoon light, which strengthens its values in depth (M3), rhythm (M4), balance (M2), and harmony (M8). By 4:00 p.m., the western façade reaches its aesthetic climax, where long slanting rays create rich tonal shadows that enhance both vertical and horizontal visual rhythms.

At sunset, the diminishing light produces warm, layered shadows that impart a contemplative and serene atmosphere, affirming the mosque's spiritual presence and visual harmony. This daily sequence demonstrates that light and shadow were intentionally used not to achieve static illumination but to create a dynamic aesthetic transformation—one where light reveals, shadow completes, and both together articulate the essence of Islamic architectural beauty.

The Mustansiriya School (Baghdad): The Mustansiriya School (1233 CE / 631 AH), founded by the Abbasid Caliph al-Mustansir, is one of Baghdad's most distinguished educational institutions. Its design revolves around a central courtyard enclosed by arcades and teaching rooms, forming a climate-responsive arrangement suitable for Baghdad's hot environment. The open courtyard provided daylight and ventilation, while the shaded arcades offered cooler circulation spaces. This spatial organization reflects an early architectural awareness of how light and shadow can shape aesthetic perception in educational settings

Figure 3: Change in shadow direction in the al-Mustansiriya School (Baghdad).



The temporal simulation of light and shadow on the southern and western facades of the al-Mustansiriyya School shows a distinct variation in visual performance linked to the building's symmetrical decorative composition. Due to Baghdad's latitude (33°N), the southern façade receives strong direct light from morning until about 2:00 p.m., while the western façade gradually illuminates afterward, reaching its visual peak near sunset. Table (4) summarizes the numerical evaluation of the eight aesthetic indicators for both façades based on the simulation results shown in Fig. (3).

Table (4): Numerical evaluation of eight aesthetic indicators (M1-M2) for the southern and western facades of the Al-Mustansiriya School Throughout the Day.

M8	M7	M6	M5	M4	M3	M2	M1	Facade	Time
3	3	3	3	3	3	3	3	Southern	
1	1	1	1	1	1	1	1	Western	8:00 a.m.
3	3	3	3	3	3	3	3	Southern	
1	1	1	1	1	1	1	1	Western	10:00 a.m.
3	3	2	3	3	3	3	3	Southern	
2	2	2	2	2	2	2	2	Western	12:00 p.m.
2	2	2	2	2	2	2	2	Southern	
3	3	3	3	3	3	3	3	Western	2:00 p.m.
2	2	1	1	1	1	1	1	Southern	
3	3	3	3	3	3	3	3	Western	4:00 p.m.
1	1	1	1	1	1	1	1	Southern	
3	3	3	3	3	3	3	3	Western	6:00 p.m.

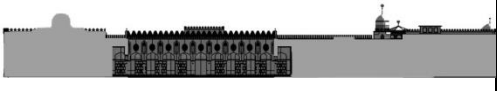
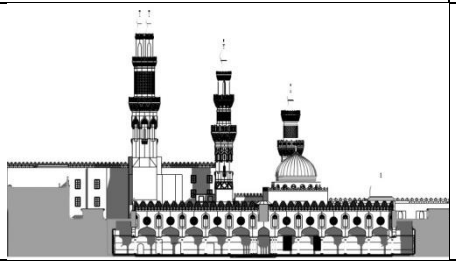
General Visual Conclusion—Mustansiriya School: The aesthetic analysis of the al-Mustansiriyya School shows a clear temporal progression shaped by the sun's movement across the southern and western façades. In the morning, the southern façade receives strong direct light that sharply reveals the arches, inscriptions, and decorative motifs, raising the values of focal emphasis (M1), depth (M3), and contrast (M6), with the visual peak occurring around 10:00 a.m. As noon approaches, shadows extend downward along the façade, softening the scene and reducing the indicators to moderate levels.

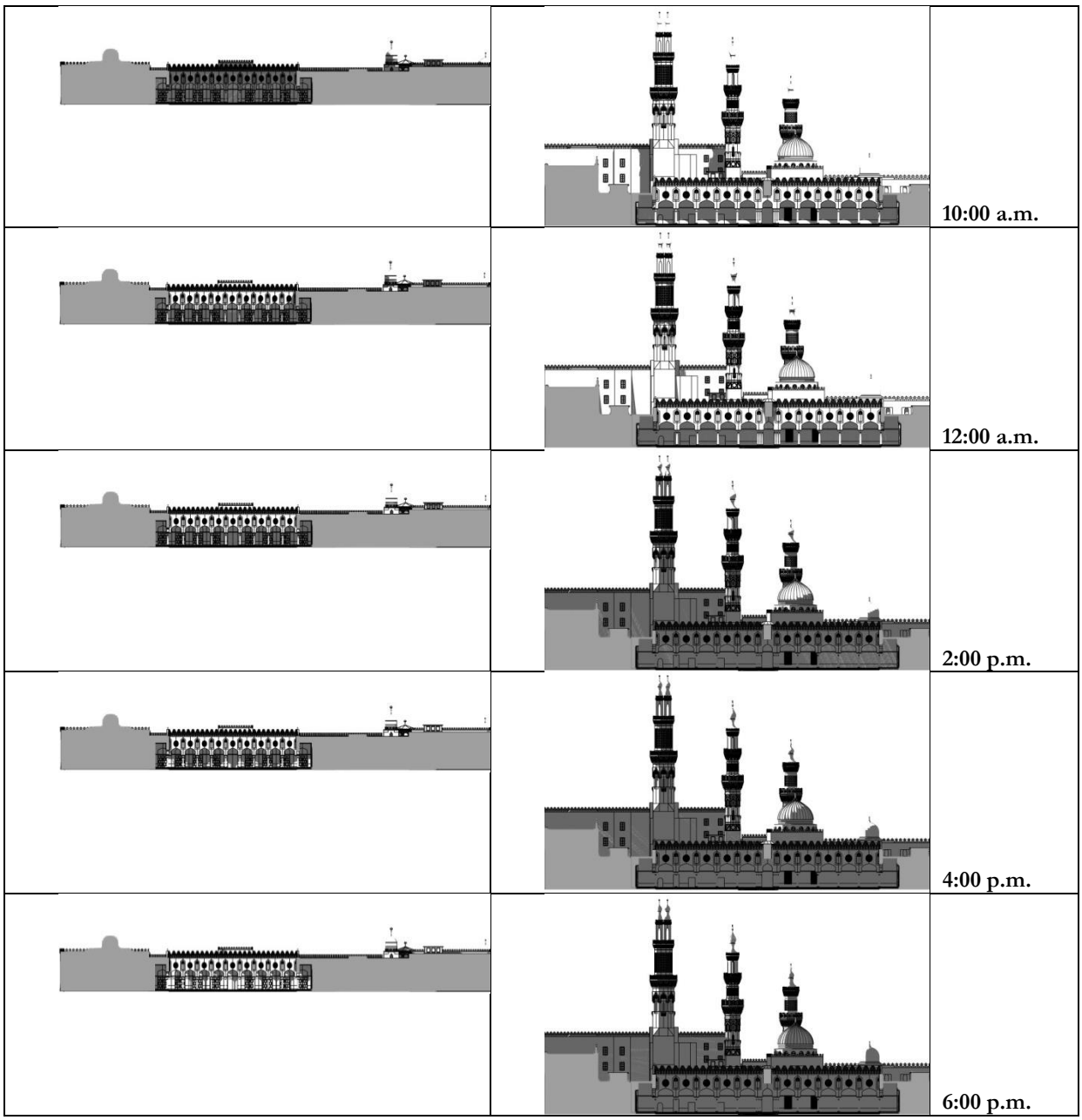
From early afternoon, illumination shifts toward the western façade, whose aesthetic performance increases as oblique southwest light produces deeper shadows and a more pronounced visual rhythm. Between 4:00 and 6:00 p.m., the façade reaches its highest aesthetic values, particularly in rhythm (M4), spiritual effect (M5), and harmony (M8), as elongated shadows form orderly patterns that enhance compositional unity. Toward evening, light gradually fades and most indicators decline, though unity and harmony persist due to the coherent geometry of the façade.

Overall, the school presents a balanced visual sequence between morning brightness and evening shadow, demonstrating the intentional use of natural light as an aesthetic and spiritual medium. Here, light is not merely illumination but a perceptual tool that shapes depth, rhythm, and contemplative atmosphere—capturing the essence of Islamic architectural expression

Al-Azhar Mosque (Cairo): Founded in 970 CE under the Fatimid Caliph al-Muʿizz li-Dīn Allāh, Al-Azhar Mosque developed through successive Mamluk, Ottoman, and modern expansions, resulting in a multi-layered architectural ensemble (Behrens-Abouseif, 1992, p. 87). Its spacious courtyard, arcades, domes, and minarets demonstrate how Cairo's evolving architectural vocabulary relied on the interplay of light and shadow. These elements collectively create shifting visual patterns that highlight structural depth and express the mosque's historical and aesthetic continuity.

Fig.4: Change in shadow direction in Al-Azhar Mosque (Cairo).

Western Facade	Southern Facade	Time (h)
		8:00a.m.



Al-Azhar Mosque exhibits a dynamic daily pattern: the southern façade improves gradually from morning to its peak at noon, while the western façade increases steadily in aesthetic performance during afternoon hours as angled sunlight enriches depth and shadow rhythm. Table (5) presents the numerical results derived from the simulation in Fig. (4).

Table (5): Numerical evaluation of eight aesthetic indicators (M1-M2) for the southern and western facades of the Al-Azhar Mosque Throughout the Day

M8	M7	M6	M5	M4	M3	M2	M1	Facade	Time
3	3	3	3	3	3	3	3	Southern	
1	1	1	1	1	1	1	1	Western	8:00 a.m.
3	3	3	3	3	3	3	3	Southern	
1	1	1	1	1	1	1	1	Western	10:00 a.m.
3	3	2	3	3	3	3	3	Southern	
2	2	2	2	2	2	2	2	Western	12:00 p.m.
2	2	2	2	2	2	2	2	Southern	
3	3	3	3	3	3	3	3	Western	2:00 p.m.
2	2	1	1	1	1	1	1	Southern	
3	3	3	3	3	3	3	3	Western	4:00 p.m.

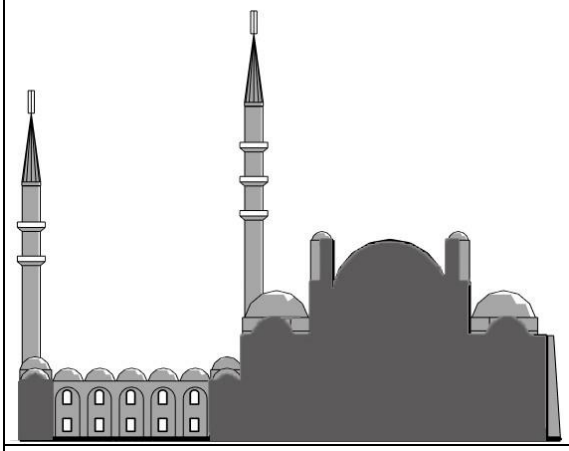
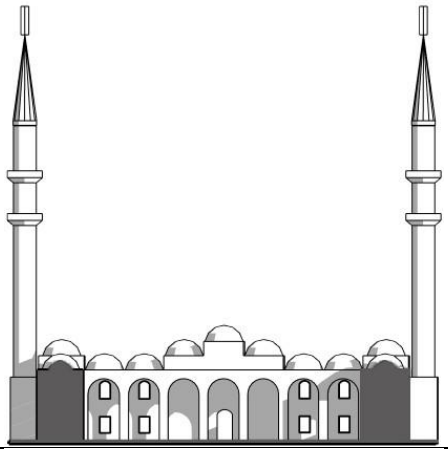
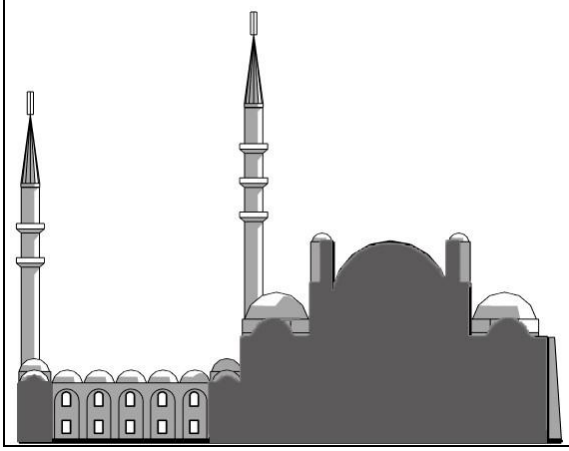
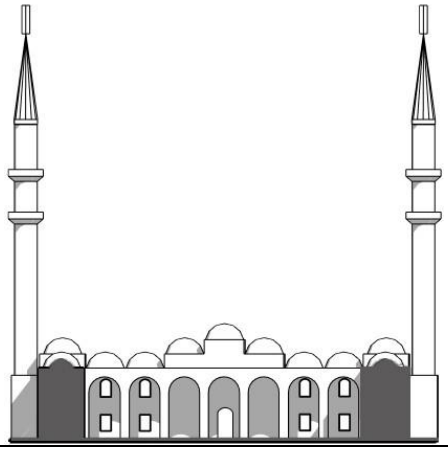
1	1	1	1	1	1	1	1	Southern	
3	3	3	3	3	3	3	3	Western	6:00 p.m.

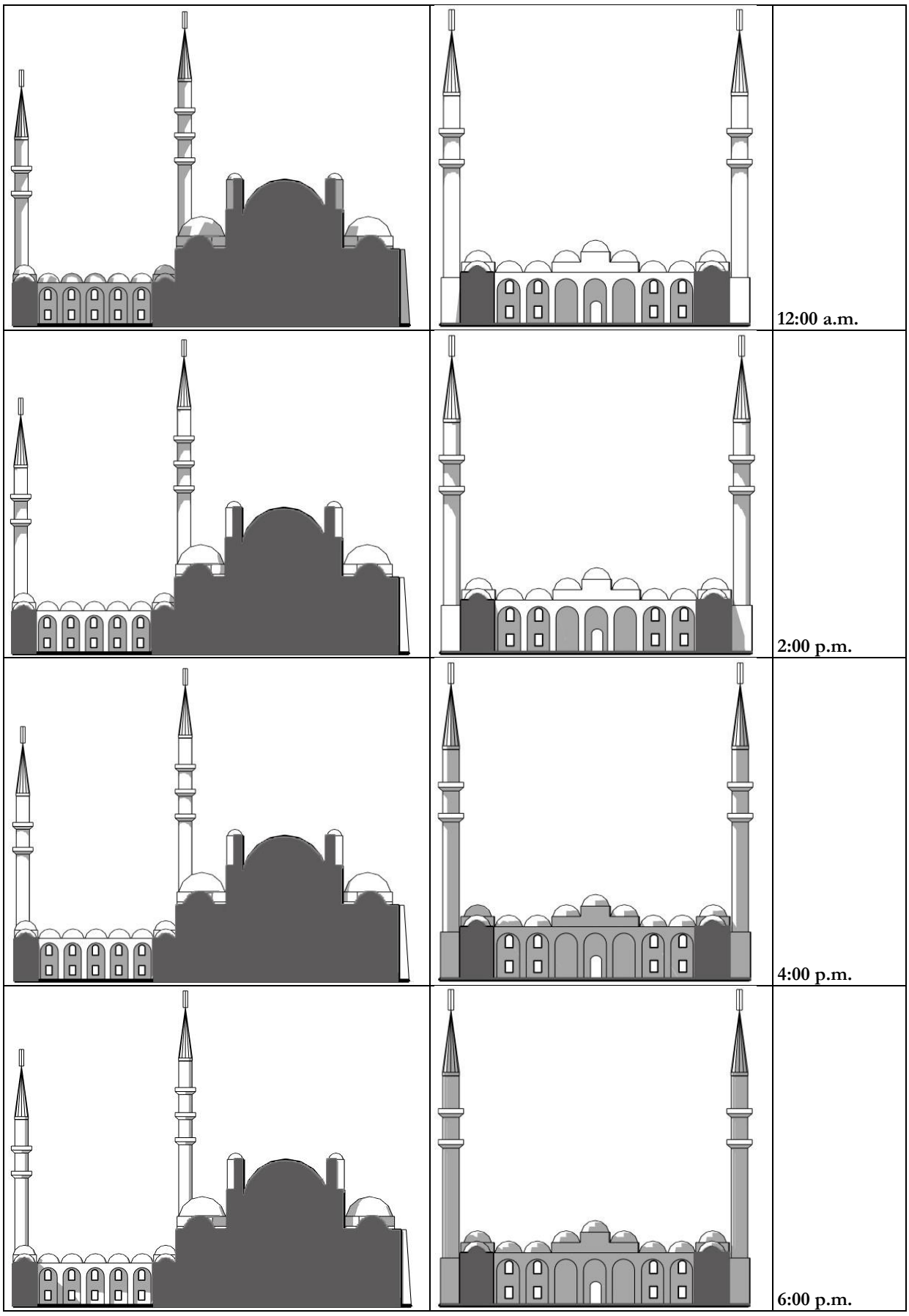
General Visual Conclusion—Al-Azhar Mosque: The visual simulation of al-Azhar Mosque shows a clear aesthetic progression shaped by the sun's movement across its southern and western façades. In the morning, the southern façade receives strong direct light that sharply reveals the minarets, arches, and decorative stucco, producing high values in focal emphasis (M1), depth (M3), and contrast (M6). By noon, balanced illumination enhances unity and spiritual presence, marking the façade's visual peak.

As the light recedes after 2:00 p.m., the southern façade gradually loses contrast while the western façade begins to activate visually under oblique afternoon rays. Between 4:00 and 6:00 p.m., the western façade reaches its highest aesthetic performance, as slanting sunlight generates layered shadows on the minaret and mashrabiyas, strengthening depth (M3), rhythm (M4), and spiritual value (M5). By evening, most indicators decline, yet unity (M7) and harmony (M8) remain perceptible due to the overall coherence of the architectural composition.

The Süleymaniye Mosque (Istanbul): Constructed between 1550–1557 CE during the reign of Sultan Süleyman the Magnificent and designed by Sinan, the Süleymaniye Mosque stands as a masterpiece of classical Ottoman architecture. Its monumental dome—approximately 53 meters high—along with clerestory windows, arcades, and a large courtyard, forms a setting in which Sinan meticulously controlled illumination. The subtle transitions between light and shadow emphasize the dome's centrality and produce a serene spiritual ambience within the interior (Necipoğlu, 2005, p. 212).

Figure. 5: Change in shadow direction in the Süleymaniye Mosque.

Western Facade	Southern Facade	Time (h)
		8:00 a.m.
		10:00 a.m.



The Süleymaniye Mosque reveals a soft visual harmony shaped by its balanced masses and domes. Morning light enhances clarity on the southern façade, whereas evening shadows deepen spatial and spiritual perception on the western façade. Table (6) provides the aesthetic indicator values based on the simulation in Fig. (5).

Table (6): Numerical evaluation of eight aesthetic indicators (M1-M2) for the southern and western facades of the Süleymaniye Mosque Throughout the Day

M8	M7	M6	M5	M4	M3	M2	M1	Facade	Time
3	3	3	3	3	3	3	3	Southern	
1	1	1	1	1	1	1	1	Western	8:00 a.m.
3	3	3	3	3	3	3	3	Southern	
1	1	1	1	1	1	1	1	Western	10:00 a.m.
3	3	2	3	3	3	3	3	Southern	
2	2	2	2	2	2	2	2	Western	12:00 p.m.
2	2	2	2	2	2	2	2	Southern	
3	3	3	3	3	3	3	3	Western	2:00 p.m.
2	2	1	1	1	1	1	1	Southern	
3	3	3	3	3	3	3	3	Western	4:00 p.m.
2	2	1	2	1	1	1	1	Southern	
3	3	3	3	3	3	3	3	Western	6:00 p.m.

General Visual Conclusion—Süleymaniye Mosque: The temporal simulation of the Süleymaniye Mosque reveals a smooth and balanced visual transition shaped by Istanbul's moderate light conditions. In the morning, the southern façade receives direct sunlight that sharply highlights the domes, arches, and structural proportions, producing high values in focal emphasis (M1), balance (M2), depth (M3), and contrast (M6), while reinforcing the spiritual character of the composition.

At midday, illumination becomes evenly distributed, creating perceptual stability across the façade without diminishing unity or depth. In the afternoon, the western façade gradually becomes illuminated by soft oblique light, which accentuates the layered domes, minarets, and vertical alignments through gentle shadow gradients. Between 4:00 and 6:00 p.m., the façade reaches its visual peak, with rhythm (M4), unity (M7), and harmony (M8) rising to their highest levels as elongated shadows enrich the spiritual atmosphere.

By sunset, the southern façade falls almost fully into shade while the western façade maintains its compositional coherence through its orderly geometry and harmonic massing. Overall, the mosque demonstrates the Ottoman mastery of light and shadow as complementary aesthetic forces—morning light clarifies form and detail, while evening light fosters depth, tranquility, and spiritual contemplation.

Comparative Case Study Analysis and Discussion: A comparative reading of the four case studies—Umayyad, Mustansiriya, Al-Azhar, and Süleymaniye—shows that the aesthetic behavior of light and shadow in Islamic architecture is shaped by the interplay between local climatic conditions and the architect's perceptual design strategy. The eight aesthetic indicators reveal distinct yet coherent visual patterns across the models:

1. ***Highlighting the Main Element (M1):*** The Umayyad and Süleymaniye achieve their strongest emphasis on the southern façades during morning hours, where direct illumination foregrounds the primary mass and minarets. In Al-Azhar and Mustansiriya, the peak occurs at midday due to diffuse lighting and reduced contrast.
2. ***Achieving Balance (M2):*** All four buildings display visual balance around noon when shadows become evenly distributed. This balance appears axial in the Umayyad, rhythmic in Al-Azhar, and more dynamic in the Süleymaniye due to its tiered domes.
3. ***Visual Depth (M3):*** Depth intensifies on the western facades of the Mustansiriya and Al-Azhar during evening hours through oblique light that forms longitudinal shadows. In contrast, the Umayyad and Süleymaniye achieve depth through vertical gradations between domes and minarets.
4. ***Rhythm (M4):*** Clear rhythmic performance appears in Al-Azhar and the Süleymaniye through structured repetition of arches and domes. The Mustansiriya reflects a linear academic rhythm, while in the Umayyad, rhythm emerges through shadow movement along interior arcades.
5. ***Spiritual Values (M5):*** Spiritual perception peaks at sunset in the Umayyad and Süleymaniye, where warm oblique light enhances contemplative mood. In Al-Azhar, spiritual elevation appears at noon; in Mustansiriya, it emerges during transitions between light and shade.

6. ***Contrast (M6):*** Contrast is strongest on the southern façades of the Umayyad and Al-Azhar in the morning, while the Süleymaniye maintains a softer graduated contrast. The Mustansiriya shows sharper differentiation due to its vertical façade articulation.
7. ***Unity (M7):*** All models exhibit unity rooted in different architectural logics: axial order in the Umayyad, rhythmic openings in Al-Azhar, dome hierarchy in the Süleymaniye, and courtyard-centered organization in the Mustansiriya.
8. ***Overall Harmony (M8):*** The Süleymaniye and Umayyad show the highest harmony due to dynamic light transitions from south to west. In Al-Azhar and Mustansiriya, harmony stems primarily from stable repetition and decorative regularity.

Light and shadow in these four examples operate as a unified perceptual system that expresses time, spatial coherence, and spiritual meaning. While monumental mosques such as the Umayyad and Süleymaniye articulate a luminous progression that transforms visual perception throughout the day, institutional complexes like the Mustansiriya and Al-Azhar foreground stability, order, and rhythmic clarity. Together, the eight indicators reveal an integrated aesthetic language in which light embodies meaning and shadow articulates structure—ultimately forming a living architectural scene shaped by perception, contemplation, and temporal transformation.

Table (7): Comparative evaluation of the eight aesthetic indicators (M1–M8) for light–shadow performance in the four architectural modls.

M8	M7	M6	M5	M4	M3	M2	M1	Model
3	3	3	3	3	3	3	3	Umayyad
2	2	3	3	2	3	3	3	Mustansiriya
3	3	2	3	3	3	3	3	Al-Azhar
3	3	3	3	3	3	3	3	Süleymaniye
2.75	2.75	2.75	3.0	2.75	3.0	3.0	3.0	Average Score
Umayyad&Süleymaniye	Al-Azhar&Süleymaniye	Umayyad&Süleymaniye	All models	Al-Azhar&Süleymaniye	All models	All models	Umayyad&Süleymaniye	Best-Performing Model per Indicator

A Brief Analytical Reading of Table (7): Table (7) indicates that the four models share strong aesthetic performance across the eight indicators, with notable distinctions in how each building organizes the relationship between light and shadow. The Umayyad and Süleymaniye Mosques show the highest overall integration, particularly in emphasis (M1), depth (M3), contrast (M6), and harmony (M8), reflecting their balanced massing and clear axial or hierarchical compositions.

Al-Azhar demonstrates rhythmic clarity and perceptual unity through its repeated arches and bright courtyard illumination, while the Mustansiriya is characterized by a more restrained and academic rhythm with moderate harmony levels. Despite these variations, all models exhibit strong unity (M7) and consistent spiritual impact (M5), confirming that light in Islamic architecture functions not only as illumination but as a structured aesthetic language shaping volume, rhythm, and contemplative experience.

COMPARATIVE FINDINGS

The results of this study show that light and shadow in Islamic architecture operate as a deliberate aesthetic system that shapes visual hierarchy, depth, rhythm, and spiritual ambience across different periods and regions. In all four case studies—the Umayyad Mosque, the Mustansiriya School, Al-Azhar Mosque, and the Süleymaniye Mosque—the eight aesthetic indicators (M1–M8) recorded consistently high values, with variations reflecting local climate, function, and architectural vocabulary. The Umayyad and Süleymaniye mosques achieved the most integrated performance, especially in emphasis, depth, contrast, and overall harmony, where the transition of light from southern to western façades created a dynamic, spiritually charged visual sequence. Al-Azhar combined strong rhythmic repetition and courtyard brightness to maintain unity and spiritual presence, while the Mustansiriya expressed a more restrained, academic aesthetic based on stable rhythm and balanced light–shadow distribution. Overall, the comparative analysis confirms that traditional Islamic architecture transformed natural illumination into an intentional design language in which light embodies meaning and shadow articulates structure—validating the hypothesis that "utility becomes the essence of beauty" in the Islamic architectural experience.

GENERAL CONCLUSION

This study demonstrates that light and shadow in Islamic architecture form an intentional aesthetic system rather than incidental visual effects. Across the four case studies, the temporal movement of sunlight revealed how illumination and shade shape visual hierarchy, depth, rhythm, and spiritual atmosphere. Using photographic documentation, digital simulations, and eight aesthetic indicators, the research confirms that Islamic architects transformed natural light into a perceptual and symbolic design language. Despite climatic and historical differences, all models shared a unified aesthetic logic in which light enhances meaning and shadow completes form. The findings validate the hypothesis that beauty in Islamic architecture emerges from the harmonious integration of purpose, perception, and spiritual expression.

RECOMMENDATIONS AND FUTURE WORK

1. Expand the analysis to include other Islamic architectural types (e.g., ribats, mausoleums, traditional houses).
2. Conduct multi-seasonal and higher-resolution light simulations to capture climatic variations.
3. Integrate user-perception methods, such as surveys or eye-tracking, to measure visual engagement with light–shadow patterns.
4. Compare historical case studies with contemporary architectural projects to develop design guidelines for modern applications.
5. Encourage future studies to explore how digital tools can reinterpret traditional light–shadow aesthetics in sustainable architecture.

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